## Increasing Salt Marsh Resilience in the Face of SLR – Investigating Thin Layer Deposition (Sediment Augmentation) as a





# Coastal Wetlands on the Frontlines



Cape Cod National Seashore



## Hurricane Sandy Resilience Projects by USFWS









# Waquoit Bay NERR Research





# Has rapid demise of salt marshes gotten you down?





# Trying to pull yourself up by your own bootstraps?





http://maineoceanlover.blogspot.com/2014/10/mudflat-moon-snail-mania.html

# Trying new tools to get unstuck?





# Sometimes you are in too deep



# And you just want to DO something to help ailing marshes ......And yourself

http://farm1.staticflickr.com/163/432541049\_b232a8f755.jpg

# Examples



- RI- John H. Chafee NWR and Ninigret
   Pond (2016), Sachuest Point NWR (2015)
- NY- Big Egg (2003), Elders East (2006),
  Elders West (2010), Yellow Bar (2012),
  Black Wall and Rulers Bar (2013)
- NJ- Edwin B. Forsythe NWR
- DE- Pepper Creek Marsh (2013), Prime Hook NWR (2016)
- MD- Blackwater NWR (2003)

# Experimental Scale: Plum Island, MA pilot project





## Restoration scale: John H. Chafee NWR, Narrow River TLP test plot





May 8, 2015

Sept 10, 2015



Credit: Jennifer White, USFWS

# Sediment Augmentation Costs

- Cost per acre: max \$430k, min \$5,000
- Coastal RI
  - ~\$81,000 (Caitlin Chafee, RI CMRC)
- Jamaica Bay, NY projects
  - ~\$100-430,000 (J. Turek, NOAA Restoration Center)
- Seal Beach, CA 10 acre project
  - ~\$236,000
- Pepper Creek, DE, 25 acres
  - ~\$5,000
- Prime Hook NWR, DE, 4,000 acres
  - ~\$9,500



# **Design Process**

#### STEP 3: Specifying sediment containment measures

#### Criteria used:

- Topographic surveys
  - Existing elevation
  - Location of tidal creeks
- Target elevations

\*Wished we had modelled drainage pathways on the marsh within each area to know where to beef up containment and where not to

Avalon NJ Restoration, Source: Jackie Jahn, GreenVest





#### Using Technology and Emerging Practices to Build Tidal Marsh Habitat Resiliency

NE Regional Ocean Council and North Atlantic Landscape Conservation Cooperative Workshop

#### Thin Layer Placement Take Home Points

- Develop criteria to help coastal managers decide if/when thin layer deposition is an option

- Guidance re: appropriate thickness of sediment application across a restoration site

- Monitoring protocols are needed



#### Thin-layer sediment placement EVALUATING AN ADAPTION STRATEGY TO ENHANCE COASTAL MARSH RESILIENCE



A project funded by the National Estuarine Research Reserve Science Collaborative

### NEERS Thin Layer Project Leads

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Kenny Raposa Narragansett Bay NERR Rhode Island





## PROJECT OBJECTIVES

Determine conditions where sediment addition is an effective strategy to enhance marsh resilience

Consistent comparisons among 8 marshesCompare effect in high vs. low marsh

•Compare thinner vs. thicker addition layer



# **TWO MARSH ELEVATIONS**

•Most TLP focuses on saving lowest drowning marsh

•We are interested in TLP across the entire marsh landscape, including as a strategy for enhancing valued high marsh communities



### **FRAMES TO RETAIN SEDIMENT** •Use wooden frame to ensure sediment is not lost from plots





national estuarine research reserve system

#### Sage Lot Pond, Mashpee, MA



# **TWO SEDIMENT THICKNESSES**

•7 cm vs. 14 cm sediment addition

•Latter likely to kill vegetation present, but give opportunity for colonization to higher elevation appropriate for target community



### **HIGH MARSH SITE SELECTION**

- •Just below elevation where high marsh species dominate
- •Areas that have converted from valued or rare high marsh communities to low marsh communities
- •Goal of TLP here is to increase proportion of high vs. low marsh plant species



Experimental plot before



Experimental plot after

# Sage Lot Pond high marsh study site



# LOW MARSH SITE SELECTION

- •Near lower tolerance limit of marsh vegetation at each site
- •Areas with 0-50% cover, ideally with recent loss due to drowning
- •Goal of TLP here is to increase cover by low marsh vegetation





Experimental plot before

Experimental plot after



# Sage Lot Pond low marsh study site





# **GREENHOUSE EXPERIMENT**

•Complementary greenhouse experiment by Elizabeth Watson & students will shed light on plant growth differences across sediment types and biochar concentrations





### OUTCOMES..... Answers manager's questions: NE Regional Ocean Council and North Atlantic Landscape Conservation Cooperative Workshop

•Improved site selection for future sediment augmentation/TLP projects

•More accurate predictions about effectiveness of future TLP projects under different conditions (based on results from 8 sites)

•Standardized future monitoring across TLP projects

# Wave impacts on marsh edge



