

# Salt marsh sustainability in New England: progress and remaining challenges



Cathy Wigand & Stephen Balogh



Sachuest Pt.  
National Wildlife  
Refuge (RI), Thin  
Layer Placement  
(2016)

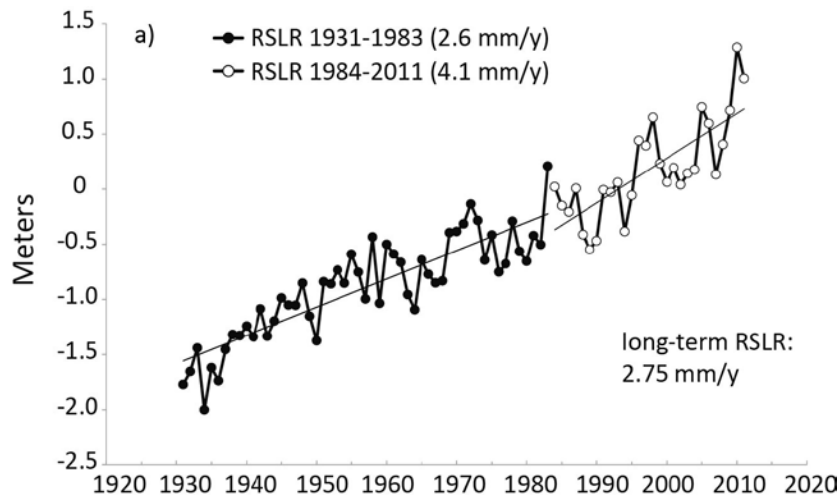
Project points-of-contact:  
- TLP ([Jennifer\\_White@fws.gov](mailto:Jennifer_White@fws.gov))  
- volunteers & plantings  
([wferguson@savebay.org](mailto:wferguson@savebay.org))

Photo credits: Wenley Ferguson

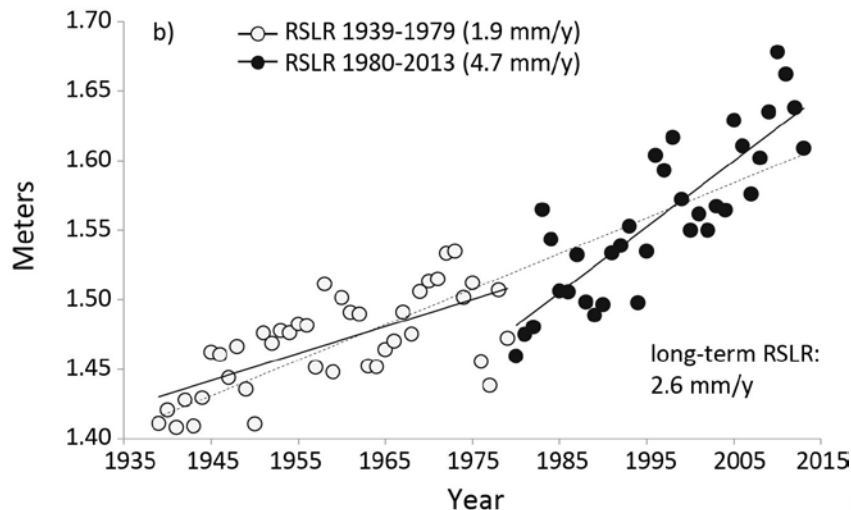
# Acceleration of RSLR in recent decades (beginning in 1980)

\*Relative sea level  
at Newport, RI

(\*Relative to the most recent MSL  
datum established by CO-OPS)

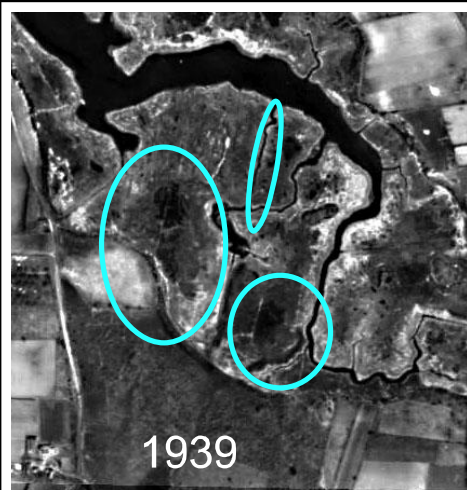


Mean annual sea level  
at New London, CT



Carey et al. 2017ab, *Estuaries and Coasts*, a) 40:626–639 b) 40:651–661.

# Landscape spatial patterns linked with coastal marsh loss & SLR



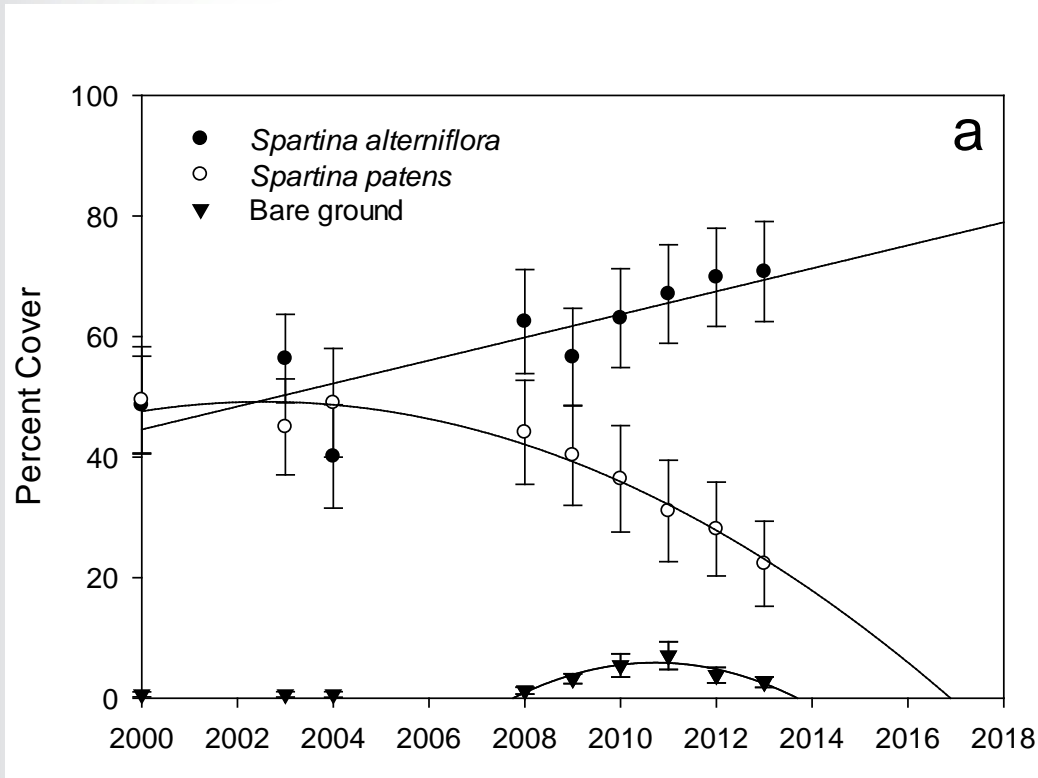
Sapowet



Colt State Park

Photo credit: Watson et al. 2017  
Estuaries and Coasts 40:662–681

Changes in the cover of *S. alterniflora*, *S. patens*, and bare ground over time in marshes at the RI NERR. Error bars are  $\pm 1$  SE



Raposa et al. 2017, Estuaries and Coasts 40:640–650

Advancement of the low marsh, *S. alterniflora* into the high marsh at Parker River NWR, MA



Photo credit: David Burdick

# Development of assessment thresholds and metrics of marsh resilience to sea level rise

\*Resilience scaled from 1 - 5, with 1 red = lowest

resilience ranging to 5 green = highest resilience

Metric thresholds	> 80%	> 60%	> 40%	> 20%	≤ 20%
Percent of marsh below MHW	> 80%	> 60%	> 40%	> 20%	≤ 20%
Elevation change rate (mm yr <sup>-1</sup> )	≤ 2	> 2	> 3	> 4	> 5
Short-term accretion rate (mm yr <sup>-1</sup> )	≤ 2	> 2	> 3	> 4	> 5
Turbidity (NTU)/ TSS (mg l <sup>-1</sup> )	≤ 10	> 10	> 20	> 30	> 40
Tidal range (m)	≤ 0.6	> 0.6	> 1.2	> 1.8	> 2.4
Long-term rate of SLR (mm yr <sup>-1</sup> )	> 3.4	> 2.6	> 1.8	> 1	≤ 1

		NH	MA	RI	NY
		<i>Great Bay</i>	<i>Waquoit Bay</i>	<i>Narragansett</i>	<i>Hudson R</i>
Metrics	Percent of marsh below MHW	42	62	61	38
Elevation change (mm yr <sup>-1</sup> )	4.3	1.7	1.8	13.5	
Short-term accretion (mm yr <sup>-1</sup> )	2.7	n/a	1.8	12.7	
Turbidity (NTU)/ TSS (mg l <sup>-1</sup> )	34	1.8	4.5	23	
Tidal range (m)	2.7	0.55	0.53	1.4	
Long-term SLR rate (mm yr <sup>-1</sup> )	1.8	2.8	2.7	2.8	

Modified from Raposa et al. 2016, Biol. Conservation 204:263–275

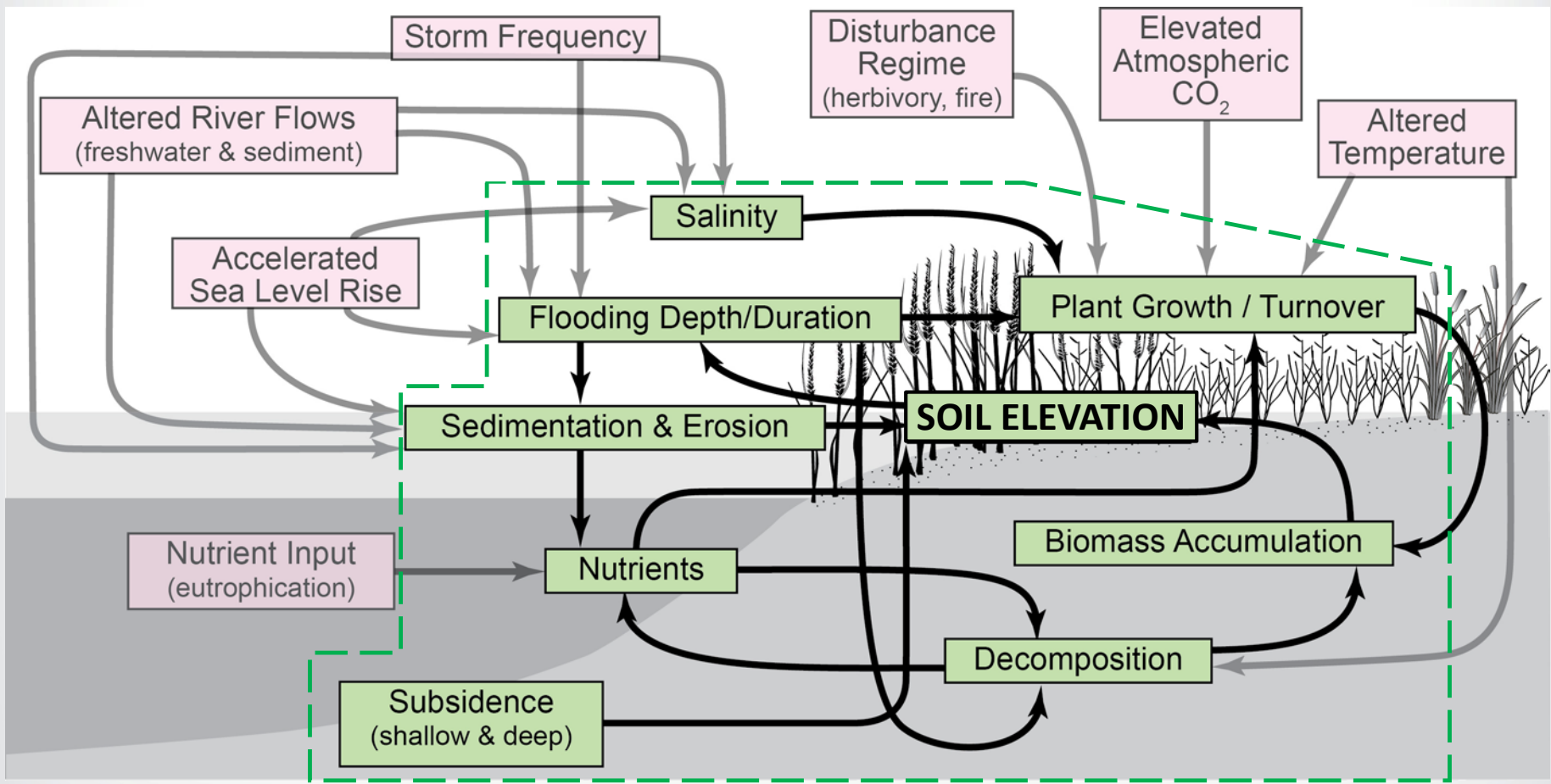
# Restoration and adaptation actions

- Land conservation / Land use planning
- Removal of barriers to future migration
- Tidal restoration and hydrologic modifications
- Elevation enhancement with sediment
- Living shorelines

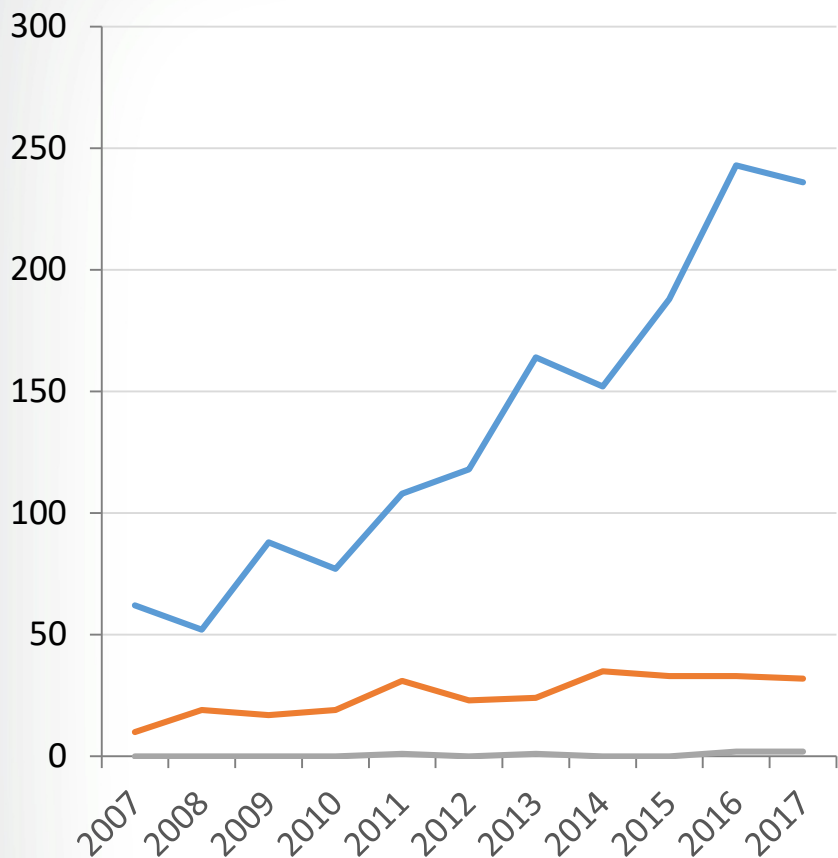


# Ecological advancements in our understanding of marsh processes linked with sustainability

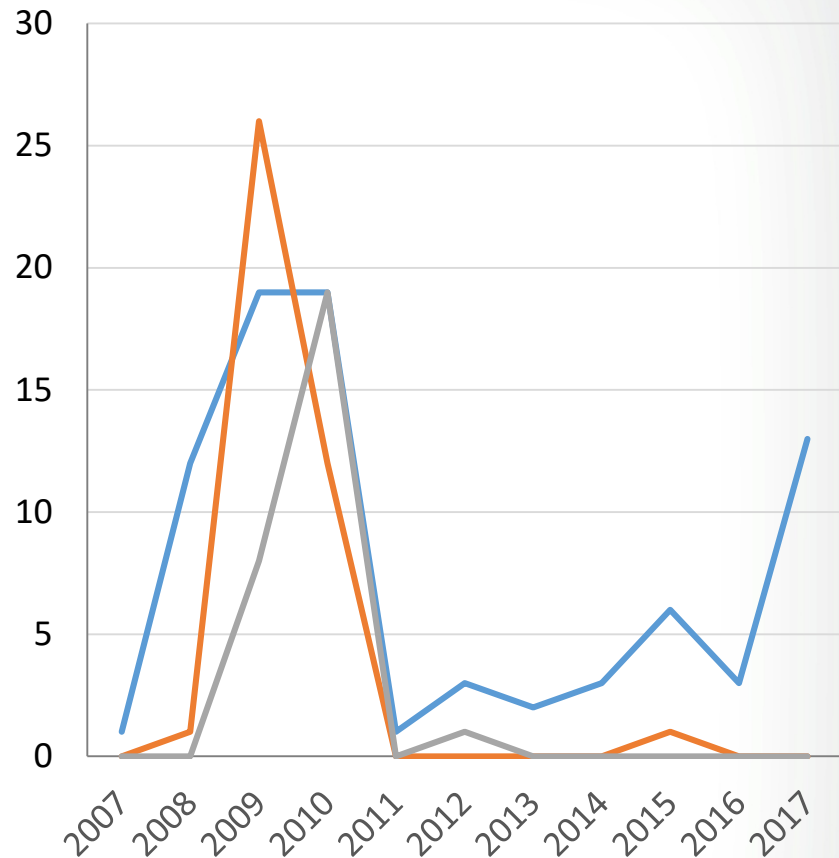
## MARSH ECOLOGY



## # of articles in Web of Science Database

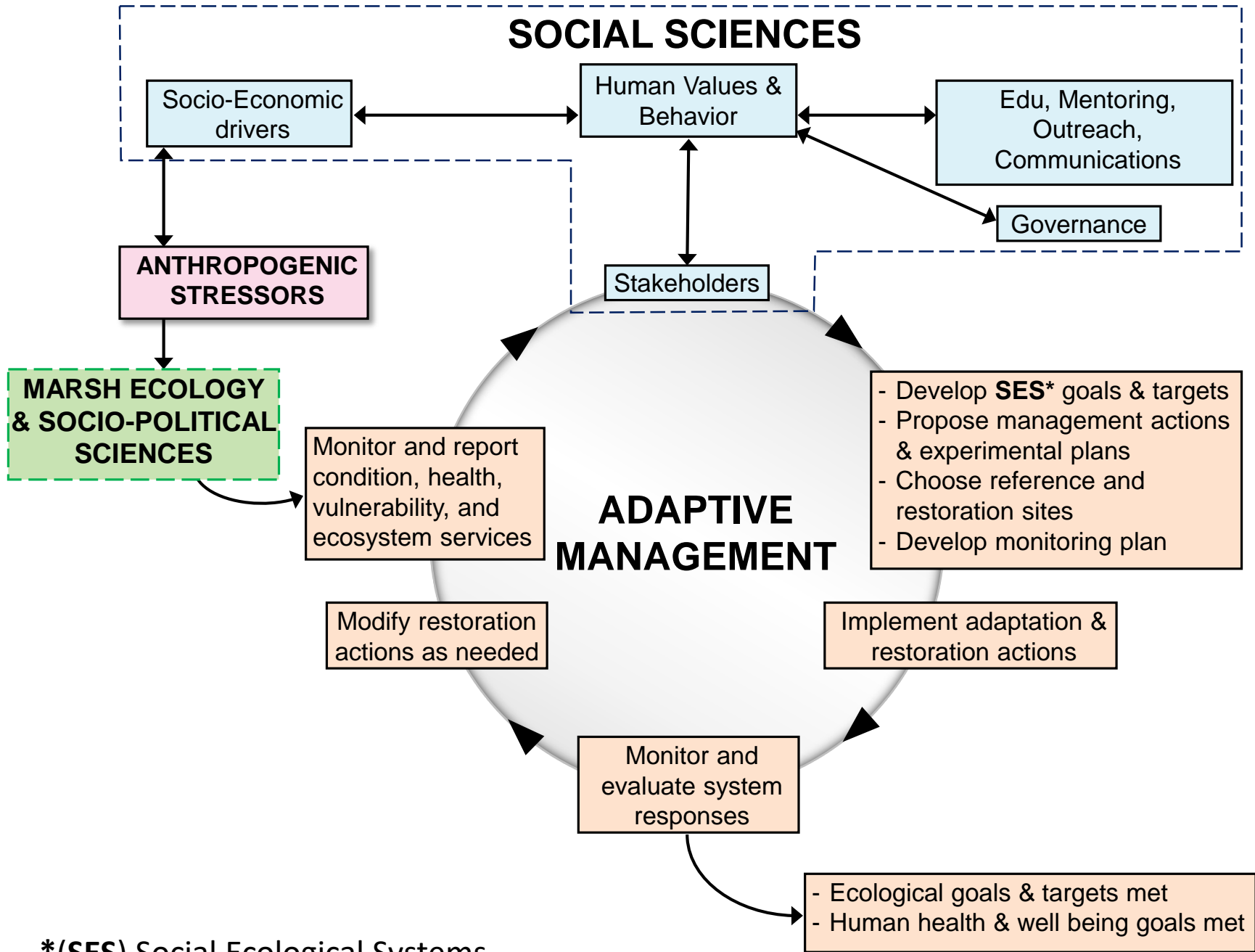


## # of news items in NewsBank Database



- SLR&marsh
- SLR&human health
- SLR&human health&marsh





\*(SES) Social Ecological Systems

# Mastic Beach, Long Island, NY: Buyout & undevelopment of repeat loss houses in marshes and marsh migration zones



- Flood Hazard Areas (DFIRM)**
- 0.2 % Annual Chance Flood Hazard
  - A Zone (1% Annual Chance, Elev. Not Determined)
  - AE Zone (1% Annual Chance, Elev. Determined)
  - VE Zone (1% Annual Chance + Wave Action)
- Limit of Moderate Wave Action
- Village of Mastic Beach
- The Nature Conservancy  
Long Island

- Village of Mastic Beach
  - Current Tidal Marsh Extent (2012)
- Future SLAMM projection (RIM MIN - 2085)**
- Flooded Developed Dry Land
  - Tidal Marsh
- The Nature Conservancy  
Long Island

Coastal storm vulnerability

Marsh migration potential

Photo credits and point-of-contact: Nicole Maher: nmaher@TNC.ORG



Photo credits and point-of-contact: Nicole Maher: [nmaher@TNC.ORG](mailto:nmaher@TNC.ORG)

# Bride Brook restoration project in CT



Photo credits and points-of-contact:  
[Roger.Wolfe@ct.gov](mailto:Roger.Wolfe@ct.gov) and [Harry.Yamalis@ct.gov](mailto:Harry.Yamalis@ct.gov)

# Project Site - Ninigret Pond, RI: thin layer placement marsh restoration

- Back-barrier marsh adjacent to manmade breachway, state-owned public access point, beach and campground
- Microtidal salt marsh habitat exhibiting areas of prolonged flooding, vegetative die-off, subsidence and marsh edge erosion

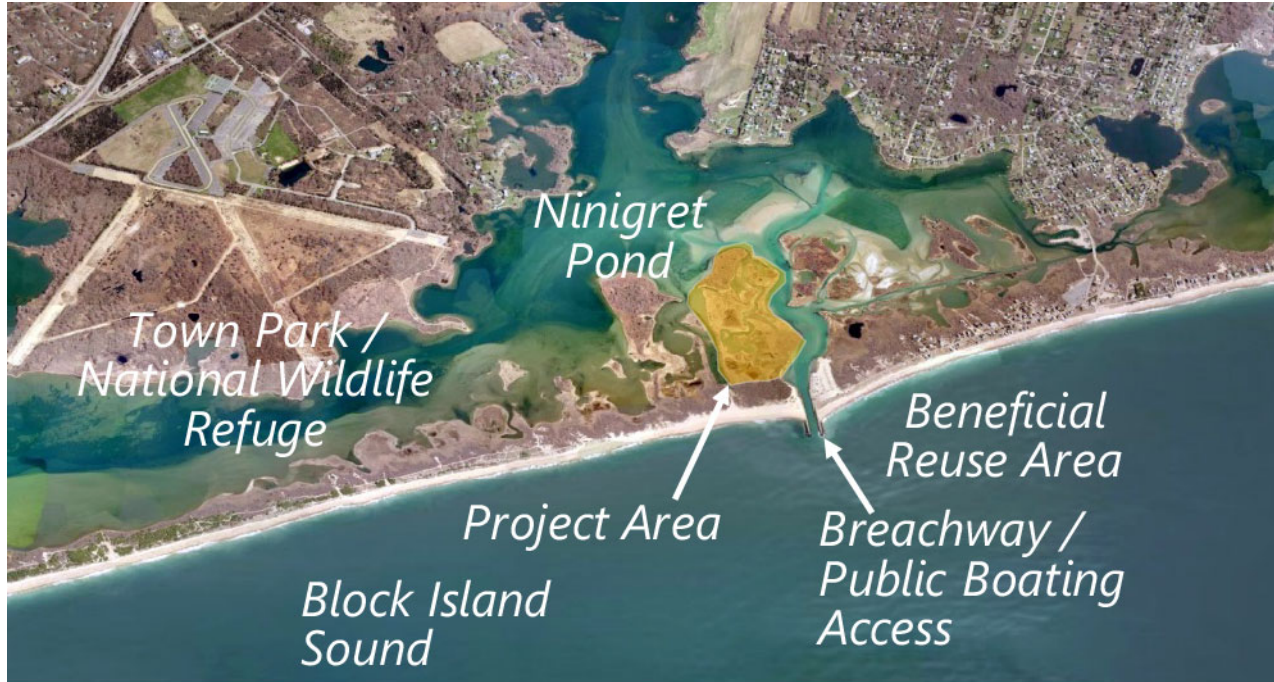


Photo credit and point-of-contact: Caitlin Chaffee: [cchaffee@crmc.ri.gov](mailto:cchaffee@crmc.ri.gov)

# Governance: Permitting and Regulatory Compliance

- NEPA EA /Section 106 (USFWS lead federal agency)
- USACE Section 404 Permit (includes sign-off by EPA, NOAA Nat. Marine Fisheries Service)
- State Section 401 Water Quality Certification
- CRMC Assent



US Army Corps  
of Engineers®



Rhode Island  
Department of  
Environmental  
Management



NOAA  
FISHERIES



# Project Costs

Approx. 68,000 cy dredged material to restore approx. 20 acres of marsh

- Design, Engineering and Permitting: \$110,453
- Construction
  - Mobilization/Demobilization: \$334,400
  - Dredging, spreading & grading of material: \$543,900
  - Alternate dredging: \$530,812
- Planting: \$100,000
- TOTAL: \$1,619,565
- (about 81K per acre restored)



Photo credits and point-of-contact:  
cchaffee@crmc.ri.gov

# Post thin layer placement at Ninigret, RI



## Citizen Volunteers and Outreach Tours

Photo credits:  
[cchaffee@crmc.ri.gov](mailto:cchaffee@crmc.ri.gov)







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