Overview of the John H. Chafee Sediment Placement Project and Ongoing Adaptive Management to Restore Salt Marsh

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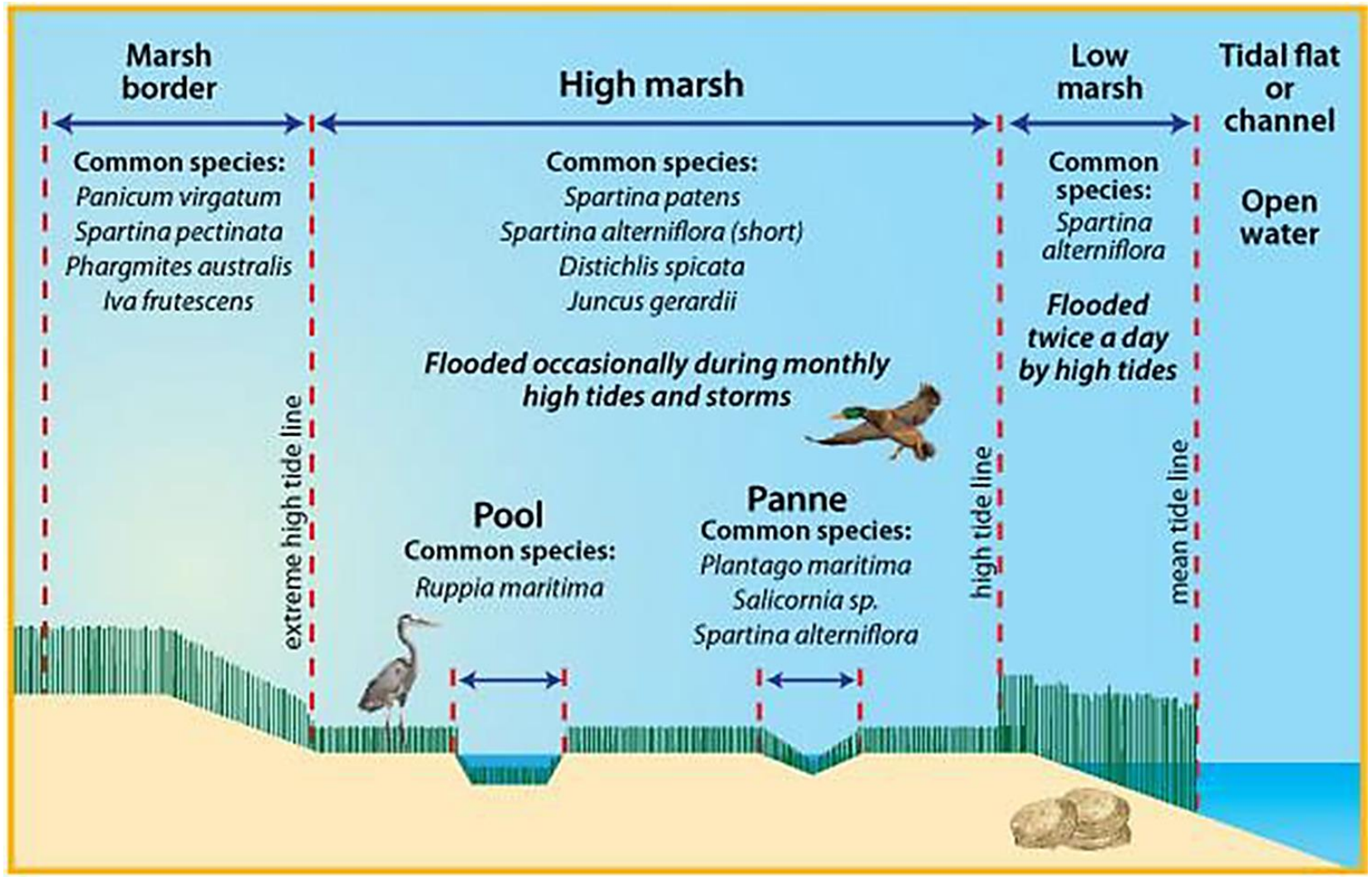
Save The Bay

Overview Salt Marsh Ecology and Threats

Ecosystem Services

- Wildlife
- Flood Control
- Filter water
- Nursery for important fish species
- Carbon sequestration (10-50x greater than forest)
- Recreational activities

Zones of the Salt Marsh

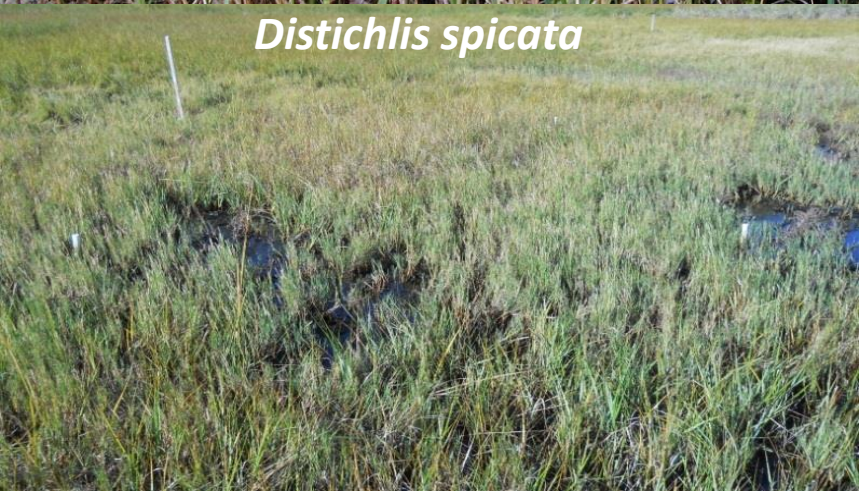


Low Marsh

Spartina alterniflora

Lower and Middle High Marsh

Distichlis spicata



Pools and Pannes

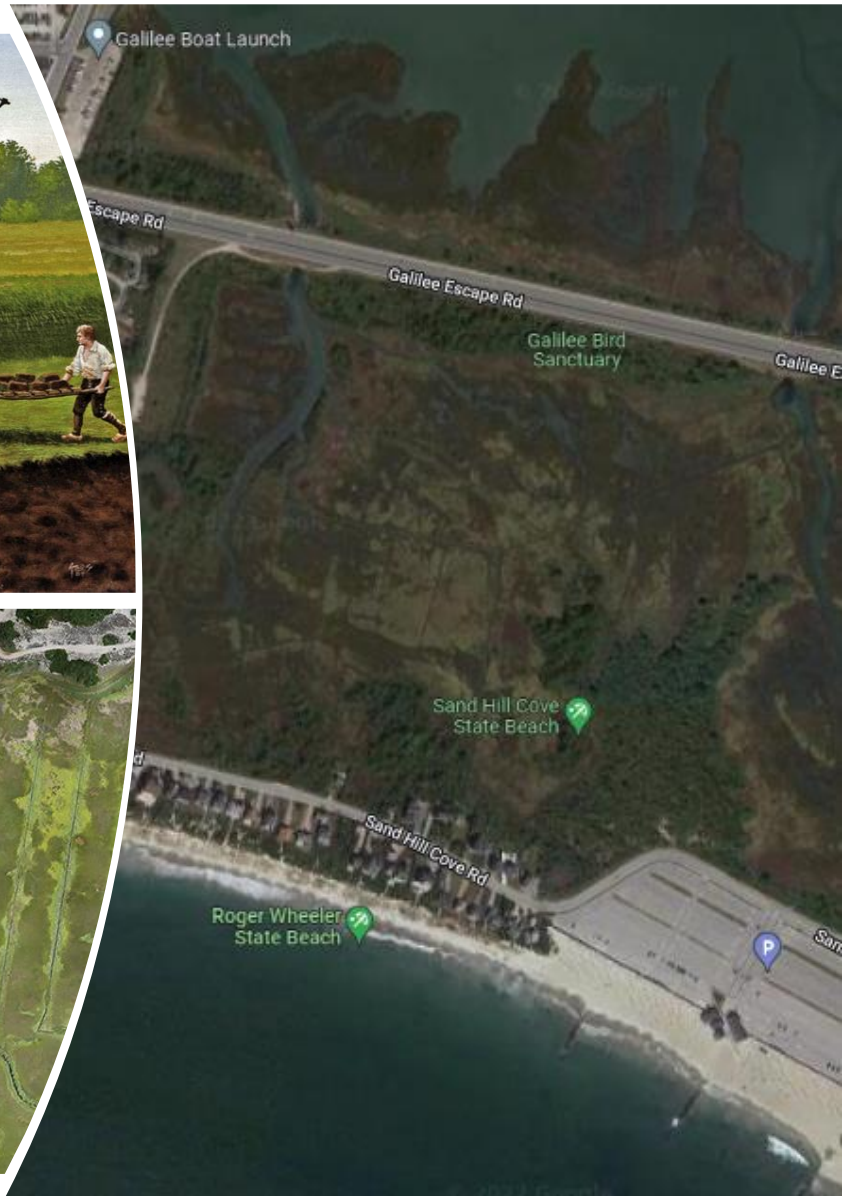
Salicornia spp.

Upper High Marsh

Upland Border

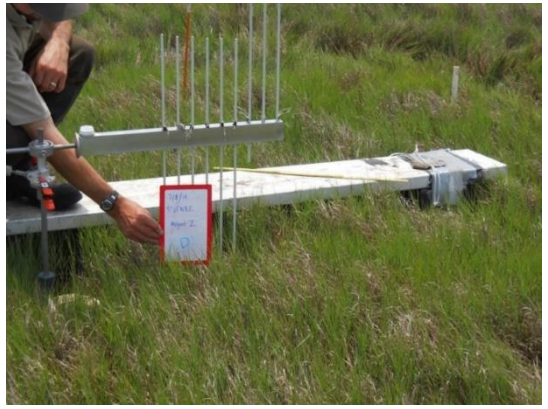
Threats: Historic Alterations to Marsh Hydrology

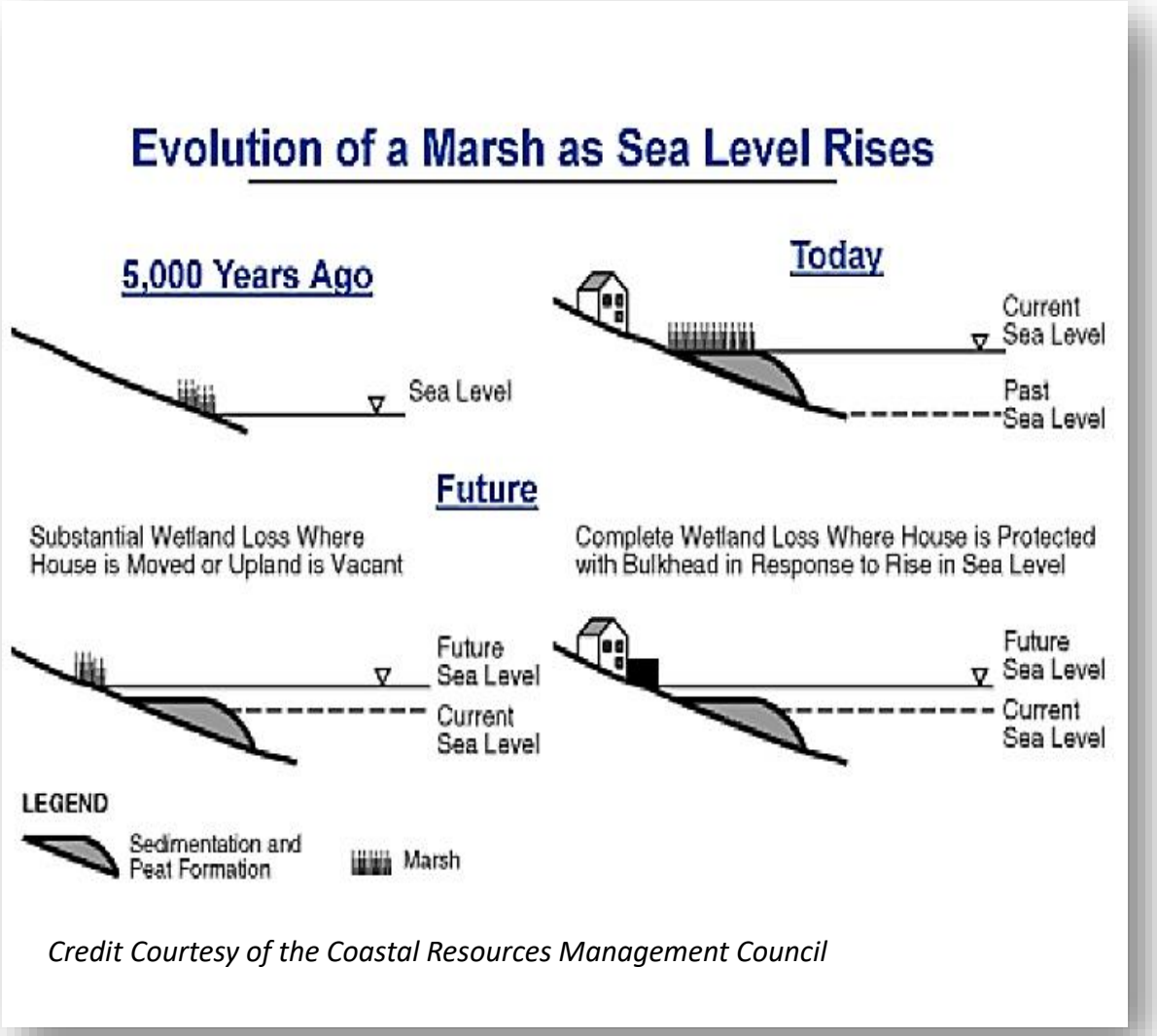
- Filled and drained salt marshes for agriculture and development
- Reduced tidal flow (transportation infrastructure)
- Grid ditching for mosquito control



Threats: Sea Level Rise (SLR)

- RI marshes have low elevation “capital”
- SLR rates 1999-2015: 5.26mm/year
- Accretion rates for refuge marshes 1.75-2mm/year (Raposa et al. 2016)





Credit Courtesy of the Coastal Resources Management Council

Additional Threats to Salt Marshes

Purple loosestrife
(*Lythrum salicaria*)

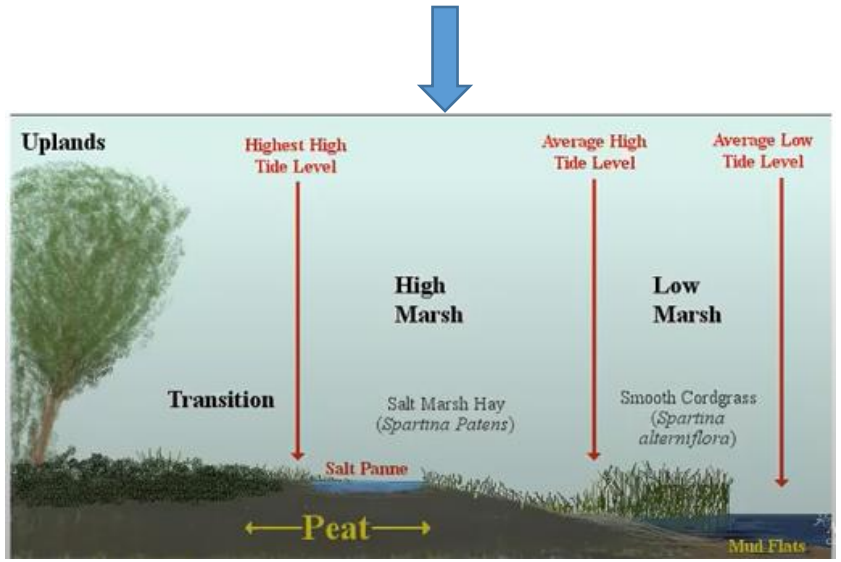
Common reed
(*Phragmites australis*)

- Invasive Species
- Nutrient inputs from urban runoff

Signs of Change

Saltmarsh Sparrow (*Ammospiza caudacuta*)

- Saltmarsh obligate
- Endemic to tidal marshes of eastern U.S.
- Generally, only nests in highest elevation portions of “high marsh”-the most imperiled marsh habitat



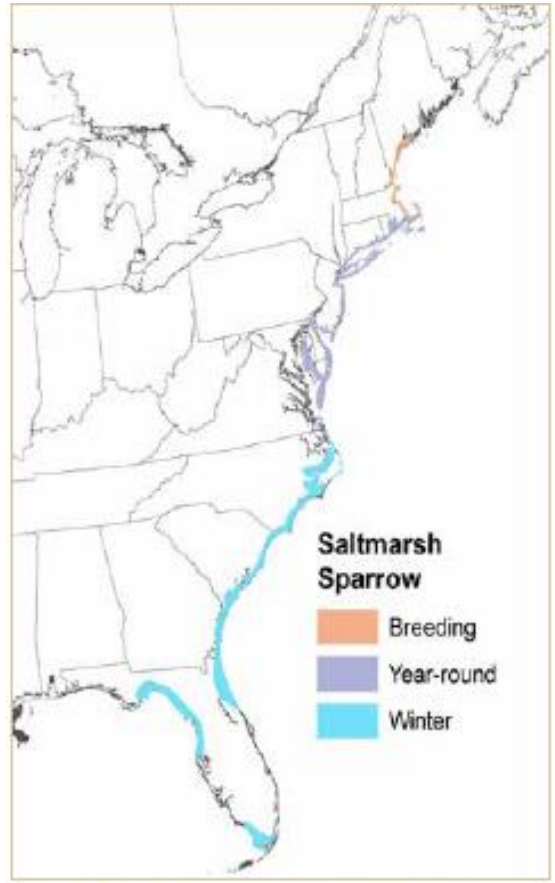


Figure 1. Breeding and non-breeding range of Saltmarsh Sparrow

Saltmarsh Sparrow Reproduction

Unique breeding system

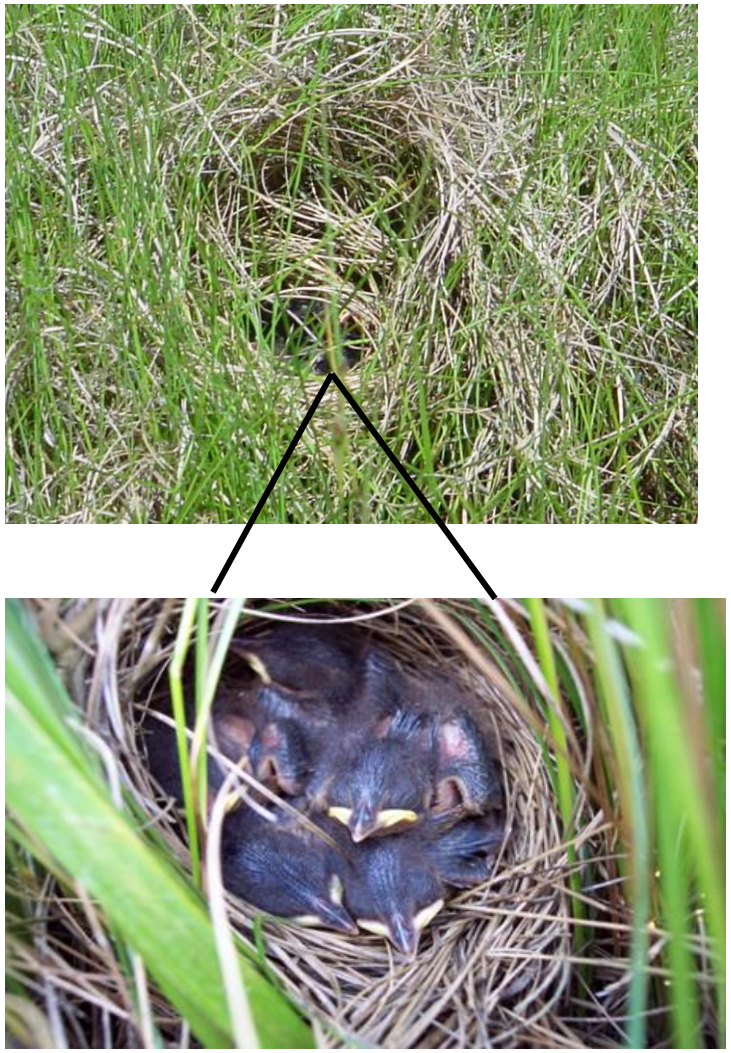
- non-territorial
- no pair bonds
- males highly promiscuous
- higher rate of female multiple mating than any other bird species
- females do all parental care of young

Synchronous nesting with lunar cycle

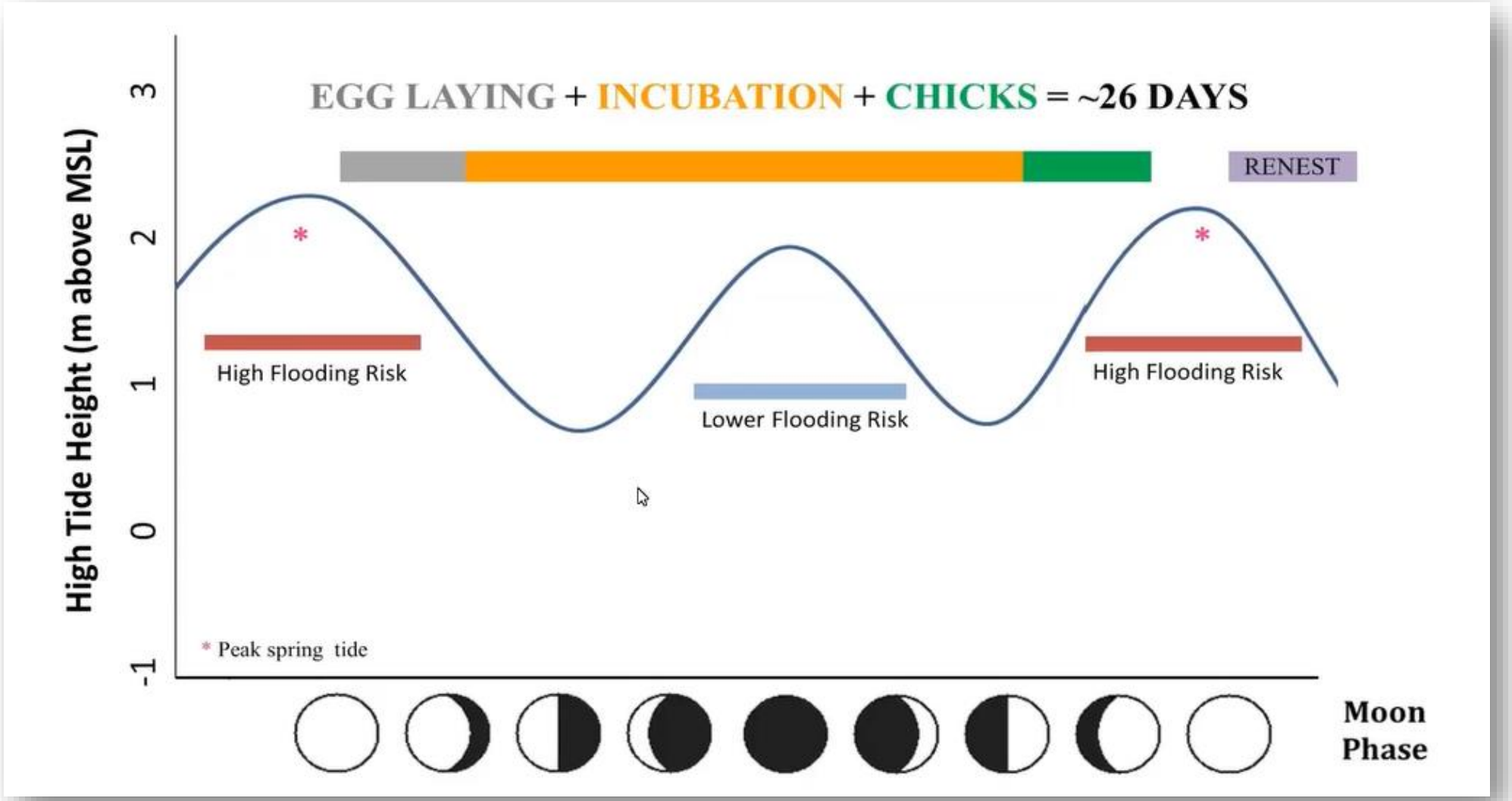
- 26-day nesting period (28-day tide cycle)

cloacal protuberance

Saltmarsh Sparrow Nests



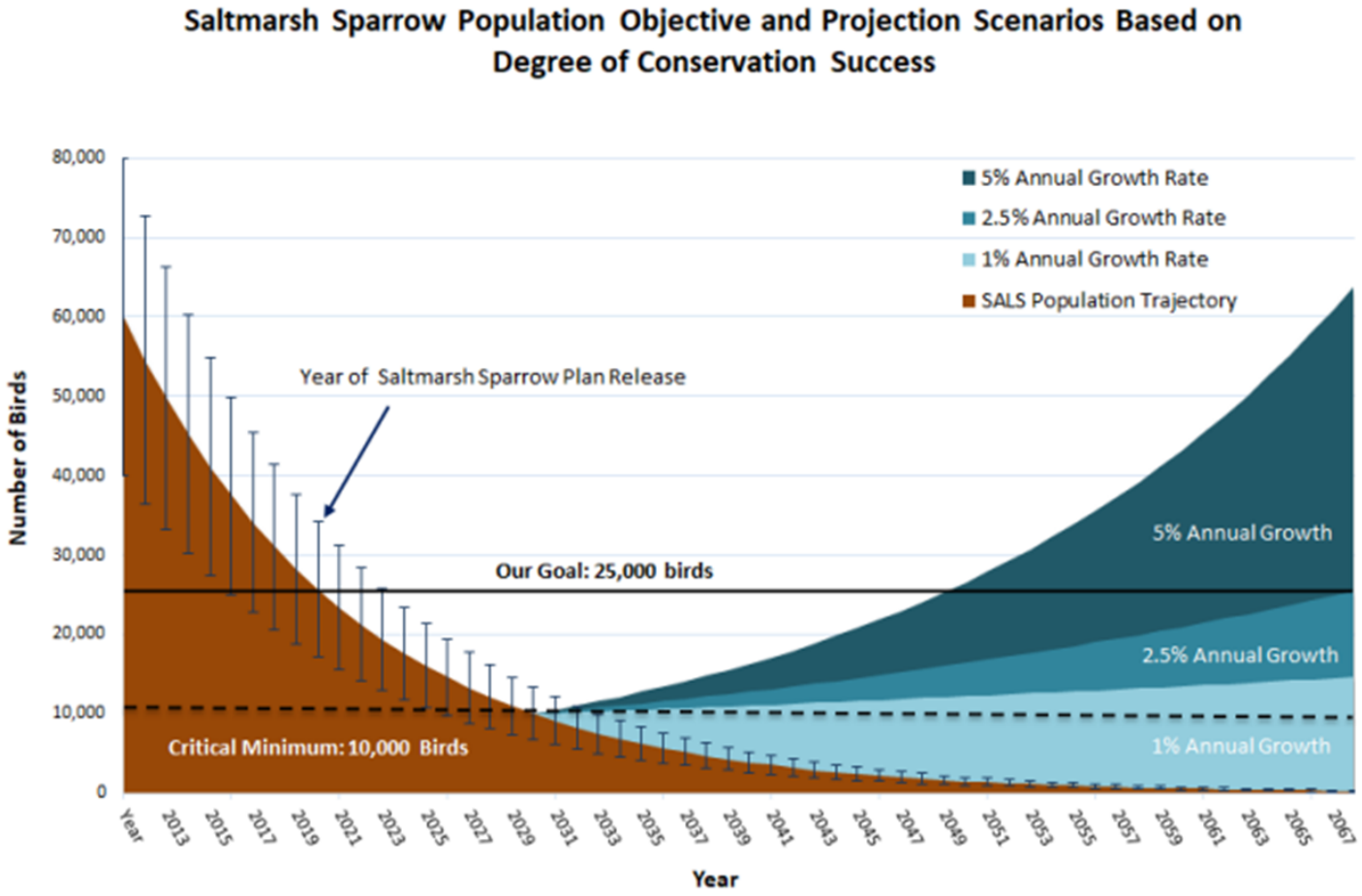
Nesting Adaptations – lunar synching

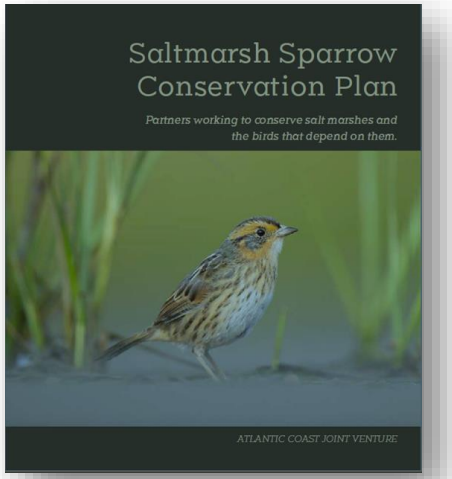


Saltmarsh Sparrow: Threats

- Nest flooding is driving population declines
- Sea level rising 2-4x the global average in the Northeast
- More frequent storms
- 87% population decline since 1998 (-9%/year)
- International Union for the Conservation of Nature (IUCN): endangered
- Under review for listing under the Endangered Species Act (decision 2023)

Saltmarsh Sparrow: Population Trend





Population Goals

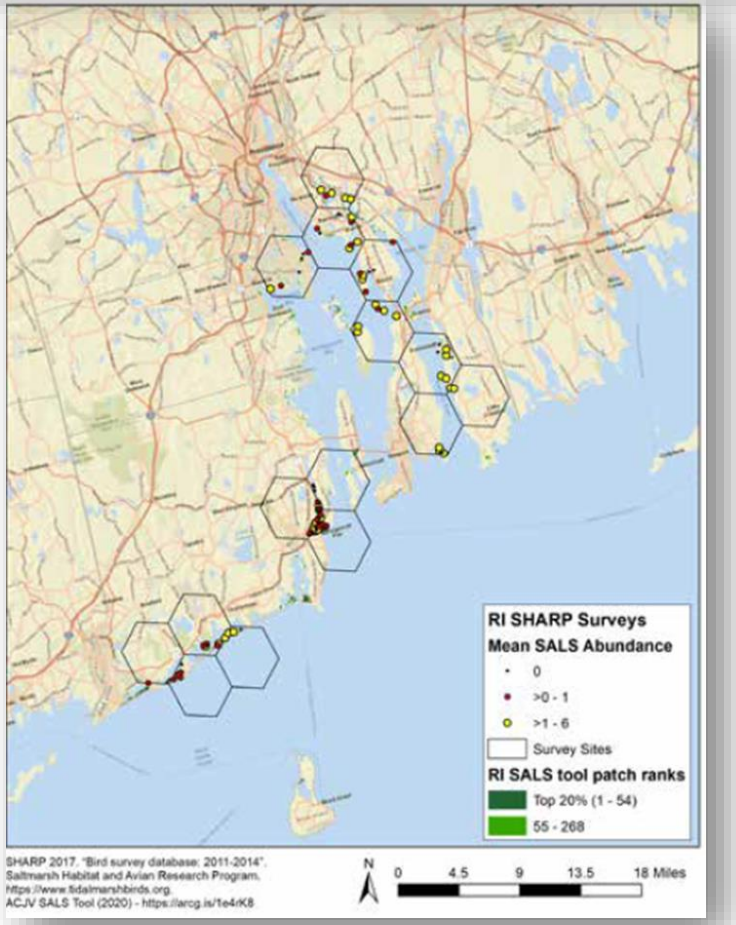
- Stabilize population at **10,000** birds (2031)
- Restore population to a minimum of **25,000** birds

Habitat Goals

- 2030: **23,000** acres of high-quality high marsh breeding habitat
- 2069: **80,000** acres of high-quality nesting habitat

Saltmarsh Sparrow Status and Distribution: Rhode Island

State	Population Estimate	±95% Confidence Interval	State % of Total	Population Goal	Minimum Acreage Needed to Meet Population Goal
Rhode Island	900	(± 300)	1.5%	376	583



Flagship Species

- The saltmarsh sparrow serves as an indicator species of healthy saltmarsh habitat.
- By focusing on, and conserving the saltmarsh sparrow, we can benefit other species that depend on functioning saltmarsh habitat/

Willet

Seaside sparrow

Clapper rail

Restoration- Climate adaptation strategies

Management Tools

Restoring hydrology on marsh platform

-Ditch remediation

- Runnels

Elevation Enhancement

-Sediment Placement

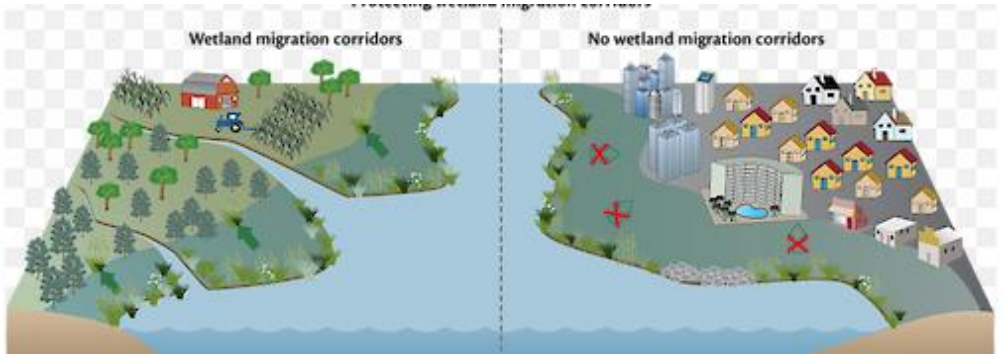
Erosion control

-Living shorelines

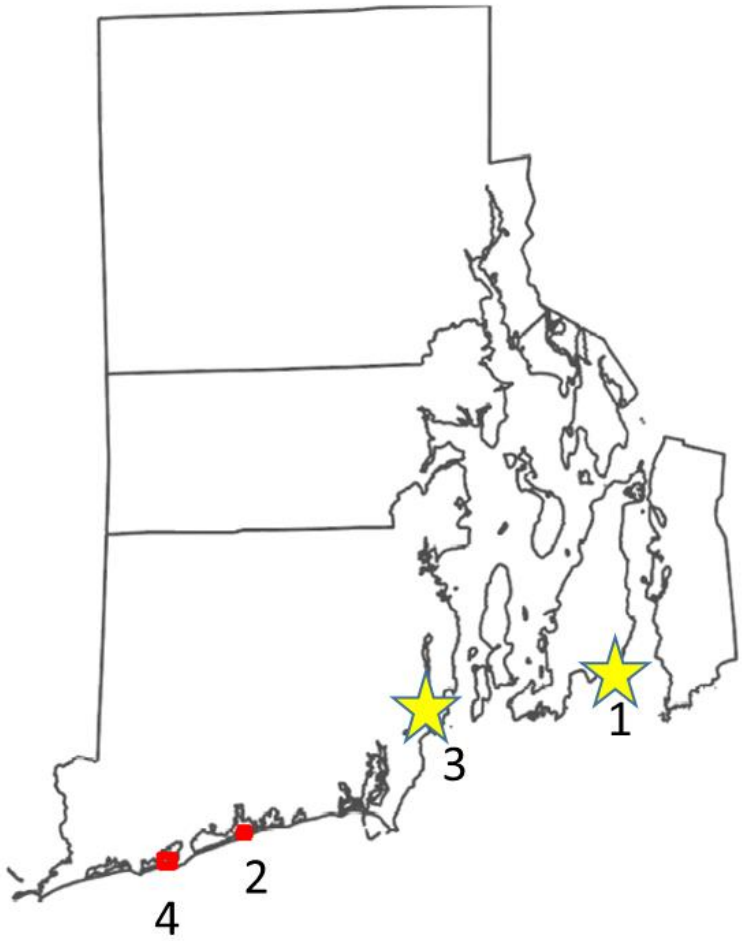
Removing tidal restrictions

-Culvert replacement

Conserving Migration Corridors



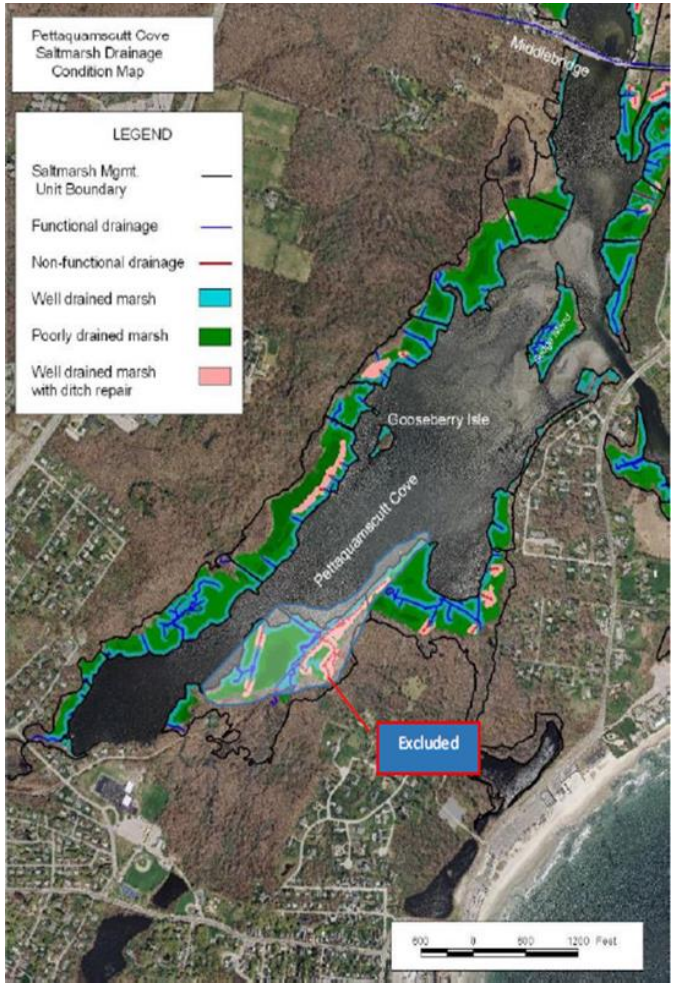
Overview of Sediment Placement Projects in RI



1. **Sachuest Point NWR (2016)**
2. Ninigret Pond (2017)
3. **John H. Chaffee NWR (2017)**
4. Quonochontaug Pond (2019)

John H. Chafee NWR Marsh Restoration

- ~39% of marsh impacted by poor drainage/waterlogging
- Conversion of high marsh to degraded low marsh or mudflat
- Unstable peat/bog like conditions
- ~40% increase in pools and pans since 1939
- Limited marsh migration corridors
- Shoreline erosion



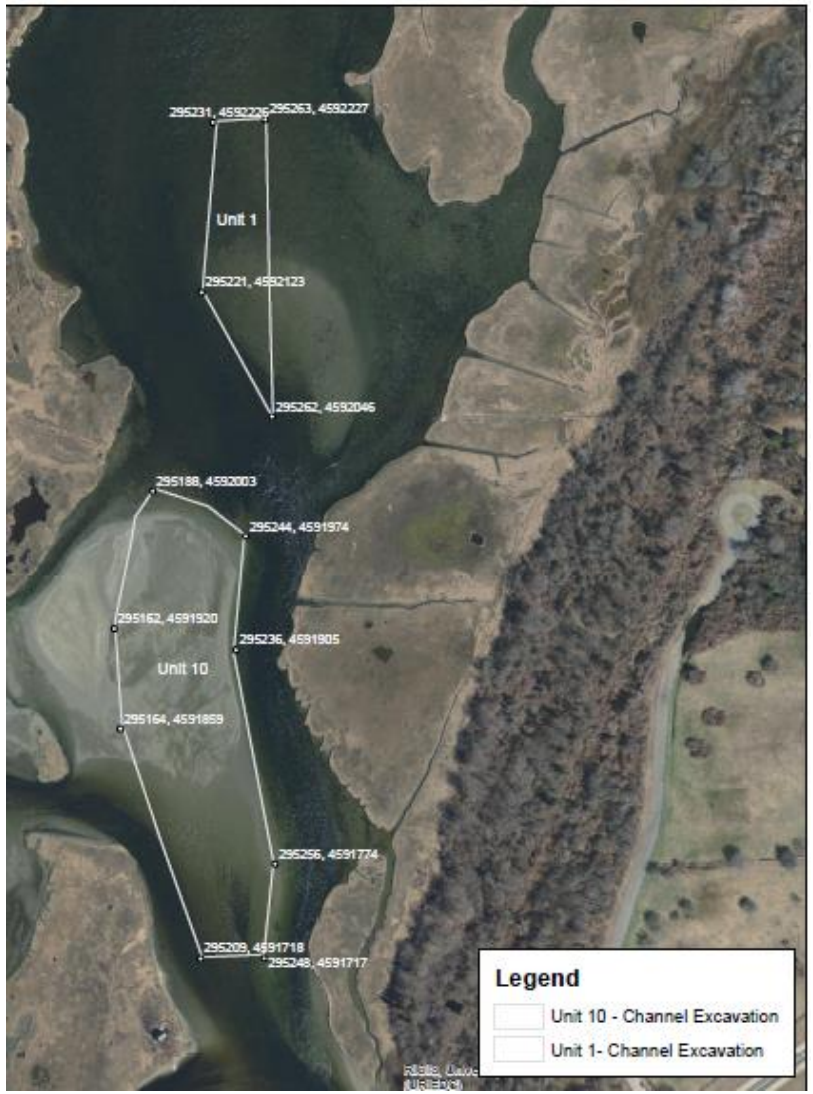
Sediment Enhancement Design

Dredge areas

- Create central channel for boats
- Dredge depth, -4 ft (eelgrass)

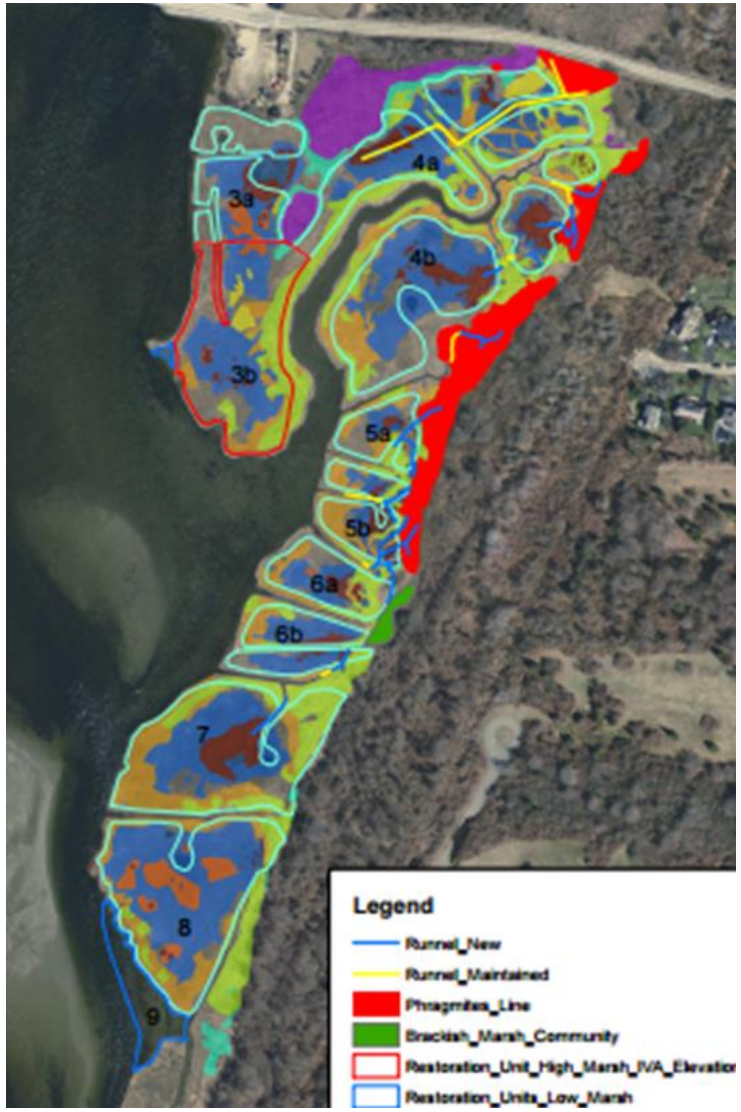
Sediment use

- Raise marsh
- Erosion control



Sediment Enhancement Design

- Mapped vegetation communities
- Target elevations – *S. alterniflora, S. patens., Iva frutescens*



Preparation of Dredge Work

Vertical dredge

- Operating in shallow water
- Delivers higher percent solids

Before dredge prep, coir fiber roll to protect pool & SET, South Middlebridge.

Before dredge, Straw wattle to protect fish pools, Sedge Island.

Before dredge, South Middlebridge.

After dredge, South Middlebridge.

Sediment Application

- Pipe, material stockpiled
- Rough spread (dewater)
- Rough contour in March

Low Marsh Creation

- Low Marsh creation, northwest Sedge Island (January 2017)
- Sediment pumped into shallow water at edge of marsh
- Containment via shell bags and turbidity fence

Low Marsh Creation

- Low marsh creation, southern end of Sedge Island (December 2018)

Southern End of Sedge Island 2021

- Raised elevation on approximately 14 acres
- Raised elevations 1-6 inches
- Created elevations to support low and high marsh habitat

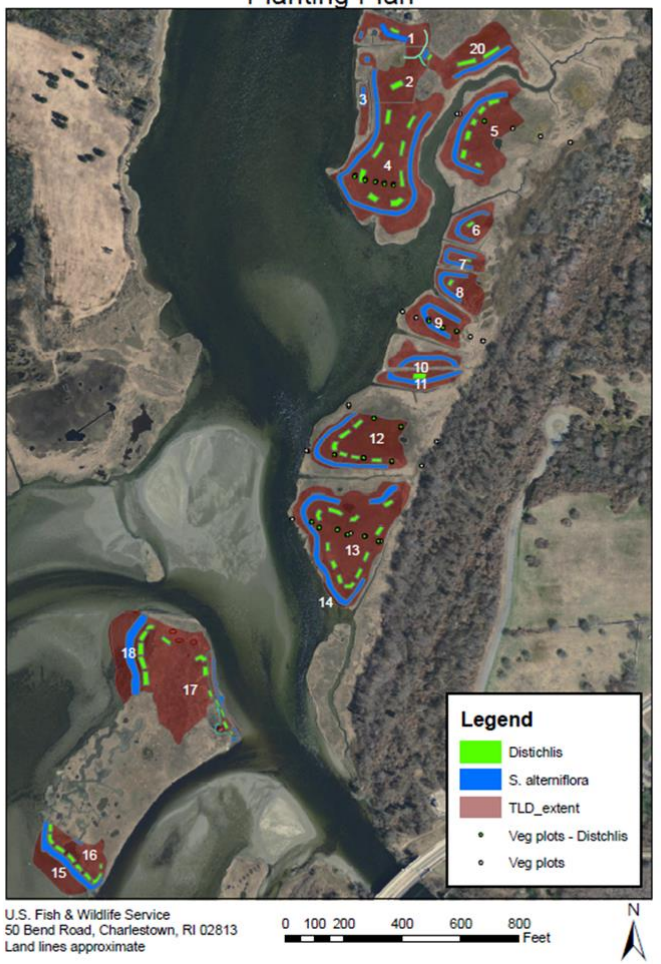
Pre-Restoration

Post-Restoration

Planting Post Sediment Placement

- Planted >50,000 salt marsh grasses
- *Spartina alterniflora*, *Distichlis spicata*, *spartina patens*
- Fencing to protect plants from goose browsing

John H. Chafee NWR Narrow River Resiliency Project:
Planting Plan



U.S. Fish & Wildlife Service
50 Bend Road, Charlestown, RI 02813
Land lines approximate

0 100 200 400 600 800
Feet

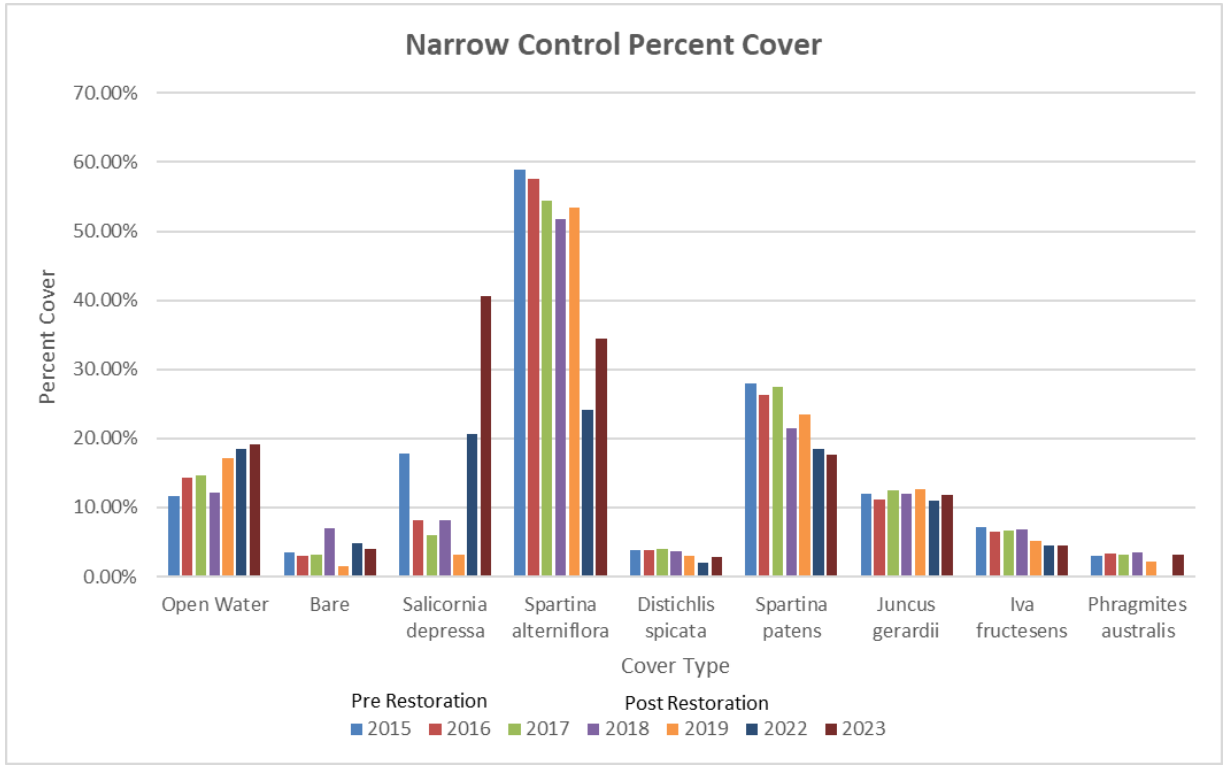
N

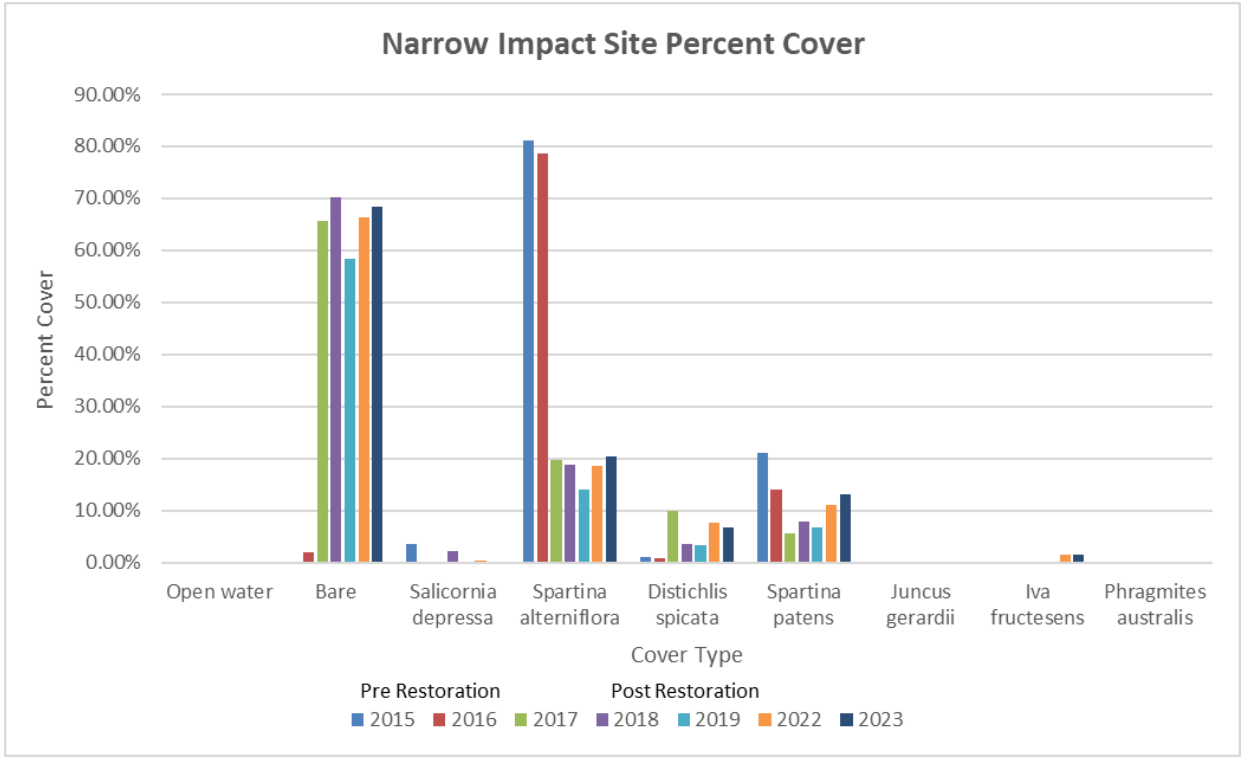
Monitoring: BACI Design

Category	Method	Parameter(s)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Elevation	RTK entire marsh	Marsh elevation		X									
	RTK veg plots	plot elevations			X		X			X			X
	SETs	Net elevation change		X	X	X	X	X	X		X		X
	Marker horizons	Accretion, subsidence		X	X	X	X	X	X				
Hydrology	HOBO logger in estuary	Tidal datums		X	X		X						
	HOBO loggers in marsh	Marsh surface inundation and drainage	X										
	Salinity mapper	Marsh-wide salinity									X	X	
	Porewater in veg plots	soil salinity		X	X	X	X	X	X			X	X
Soils	Shear vane	Shear strength			X		X					X	X
Vegetation	Plots	Community composition, cover, height, stem density		X	X	X	X	X	X			X	X
	Covertype	Vegetation communities mapping		X									
Nekton	Throw traps	Community composition, density	X		X		X						
Birds	SHARP surveys	Community composition, density			X	X	X	X	X	X	X	X	X
	Area search surveys	USFWS - 20 min early am						X	X				X
	SALS monitoring	USFWS - Nest searching effort, banding	X	X	X	X	X	X	X				X
	Eelgrass survey/mapping	Pre & post boat surveys		X	X	X	X	X					

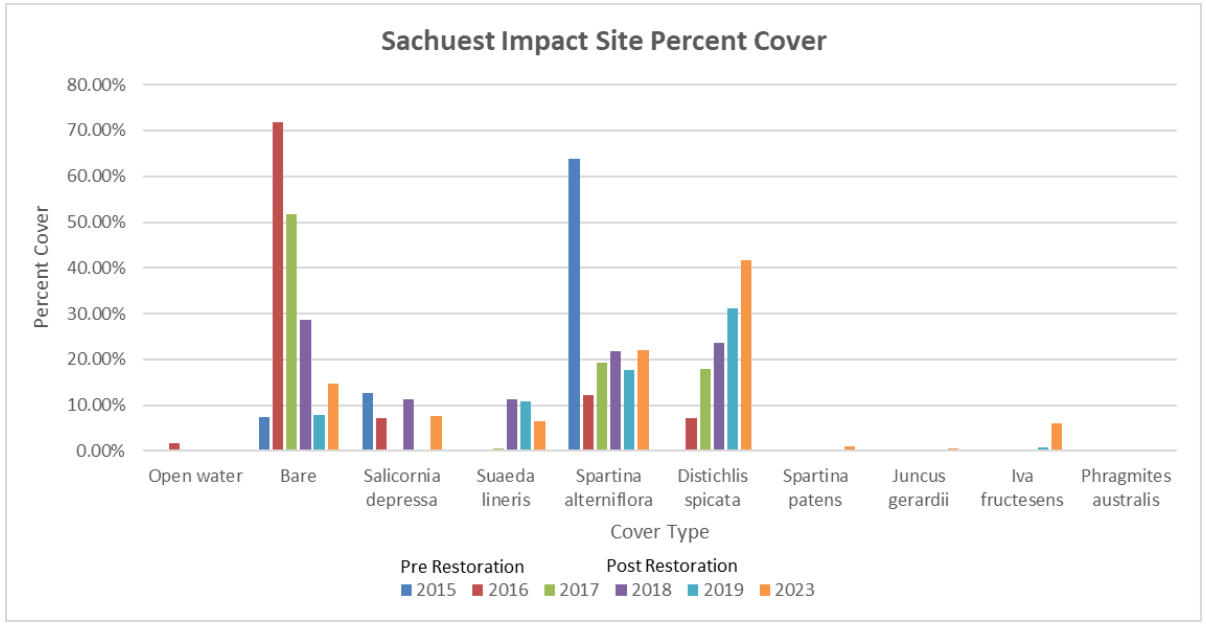
Challenges

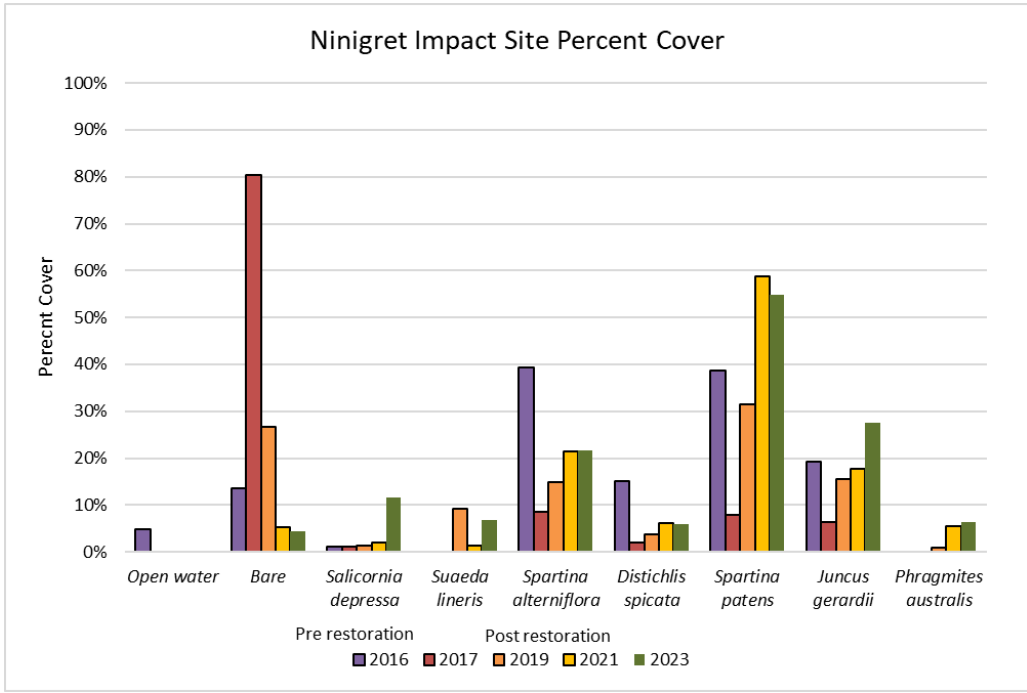
Monitoring: Narrow Vegetation Percent Cover

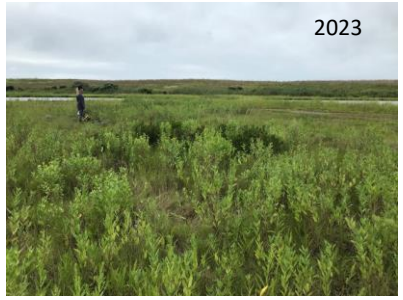




Monitoring: Sachuest & Ninigret Impact Sites

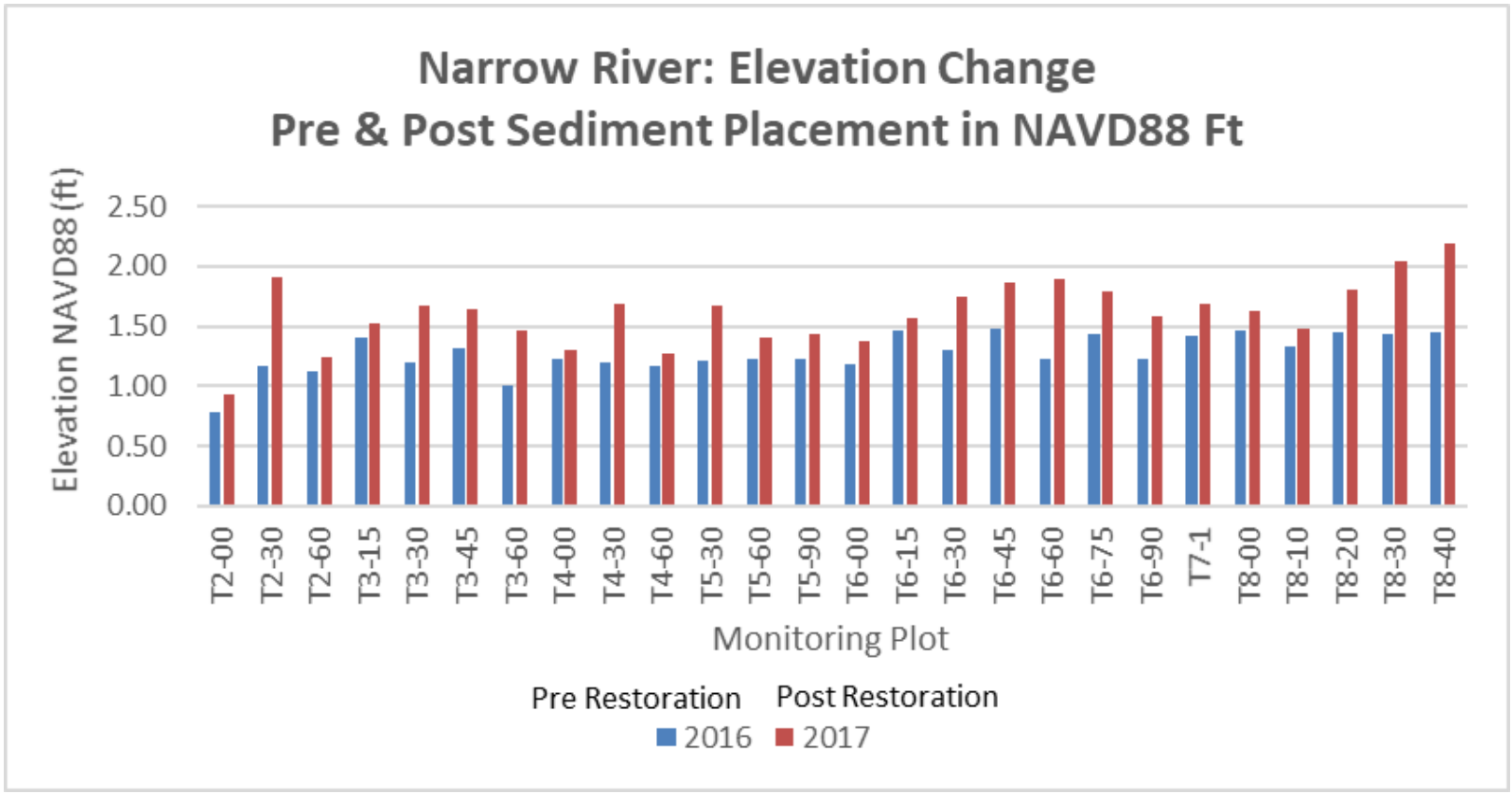






Ninigret photo credit: Wenley ferguson

Monitoring: Elevation (Vegetation Plots)



Monitoring Plot	Change in Elevation (inches)
T2-00	1.86
T2-30	8.78
T2-60	1.36
T3-15	1.38
T3-30	5.82
T3-45	3.92
T3-60	5.45
T4-00	0.87
T4-30	5.89
T4-60	1.17
T5-30	5.46
T5-60	2.05
T5-90	2.43
T6-00	2.28
T6-15	1.36
T6-30	5.41
T6-45	4.66
T6-60	7.89
T6-75	4.15
T6-90	4.24
T7-1	3.32
T8-00	2.02
T8-10	1.75
T8-20	4.32
T8-30	7.21
T8-40	8.84

Adaptive Management: Facilitating Vegetation Recovery

Issues / Challenges	Adaptive Management Technique	Outcome
1. Impounded water on the sediment placement	Tidal marsh hydrology restoration using runnels	Reduction of standing water on the marsh platform to improve growing conditions
2. Hyper saline soil conditions	Runnels / compaction reduction / microtopography	Reduction in soil salinities in close proximity to runnels, increase hydraulic conductivity, offer well drained growing opportunities
3. Anoxic conditions	Runnels / compaction reduction / microtopography	Decrease perched water table, allow flushing and oxygenation of the root zone, offer well drained growing opportunities
4. Compacted fine grain soils	Compaction reduction	Foster better drainage & allow plants to miore easily colonize via edge growth or self colinization
5. Lower plant survivorship and slower natural recovery	Alternative planting techniques, watering, salt water acclimation	Increase plug survival & creation of lower salinity planting opportunities

Low, medium, & high elevation areas that require different techniques.

What is the tide telling us?

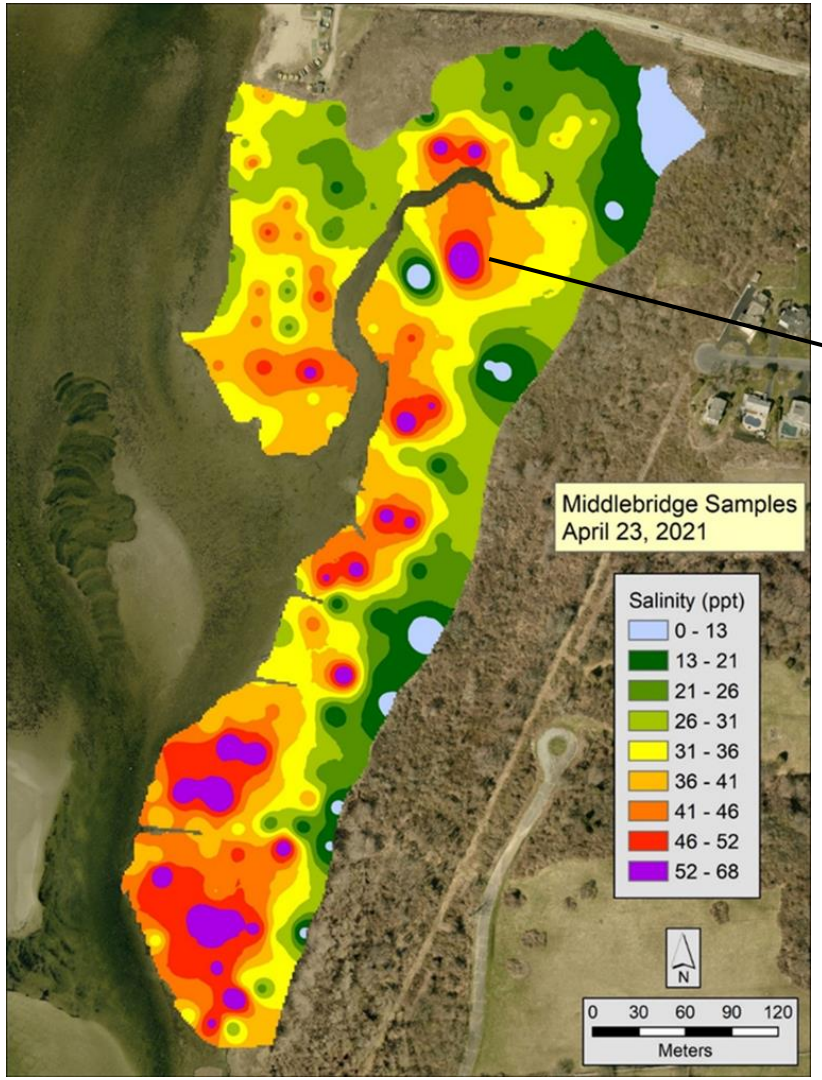
What is the vegetation telling us?

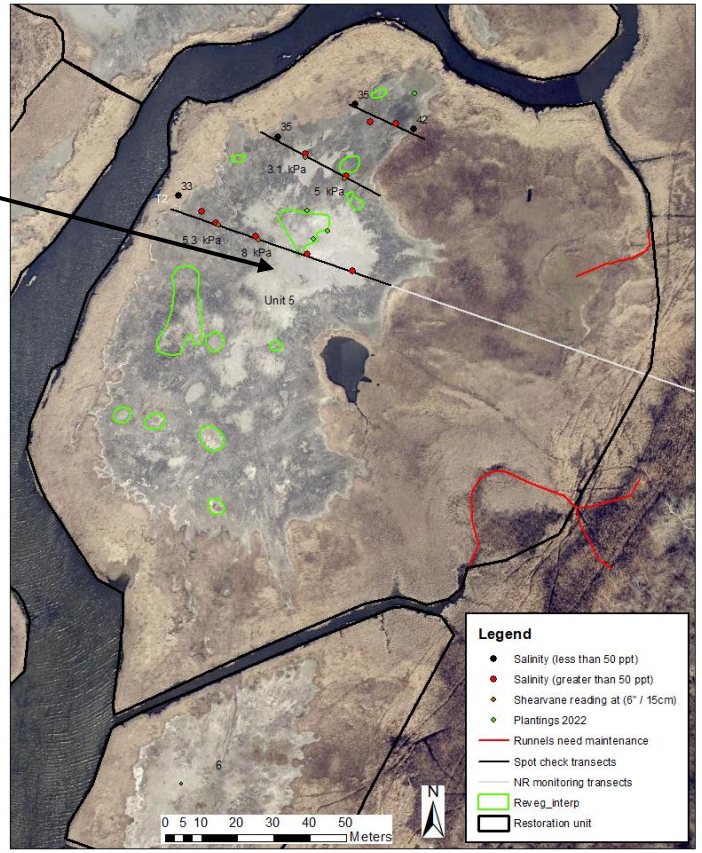
Challenge: Impounded water

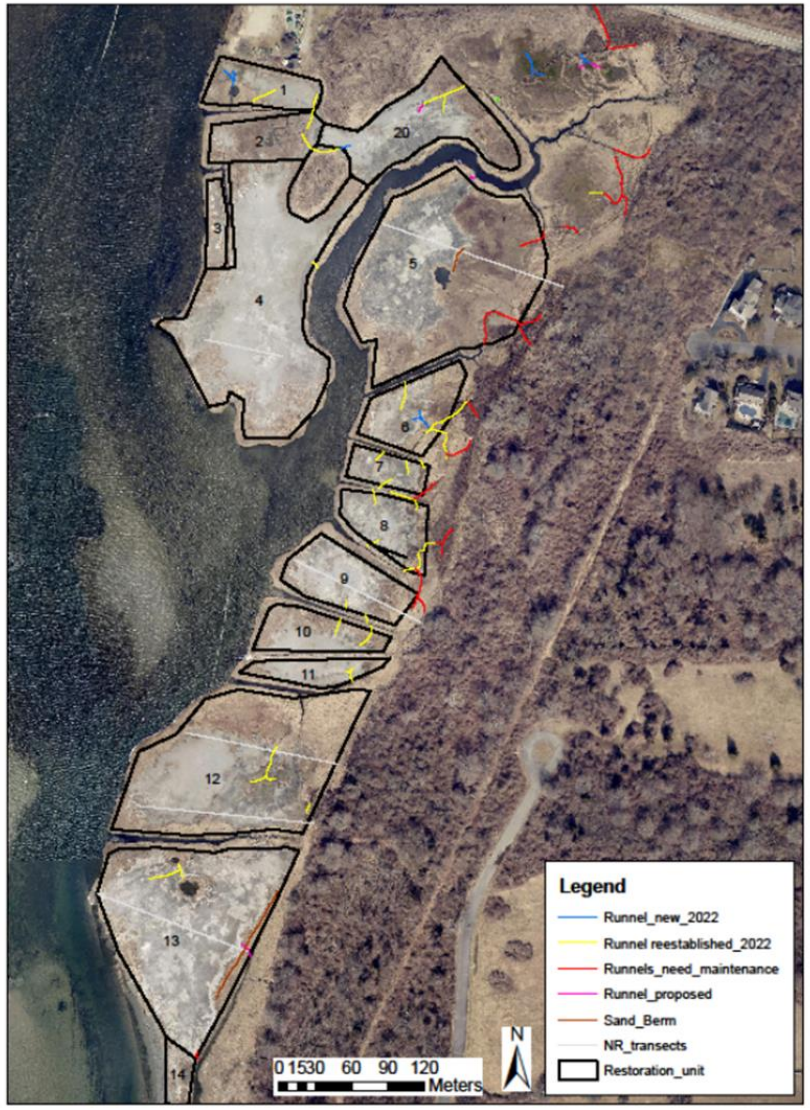
Algal mat formation from impounded water

Drainage and microtopography installed

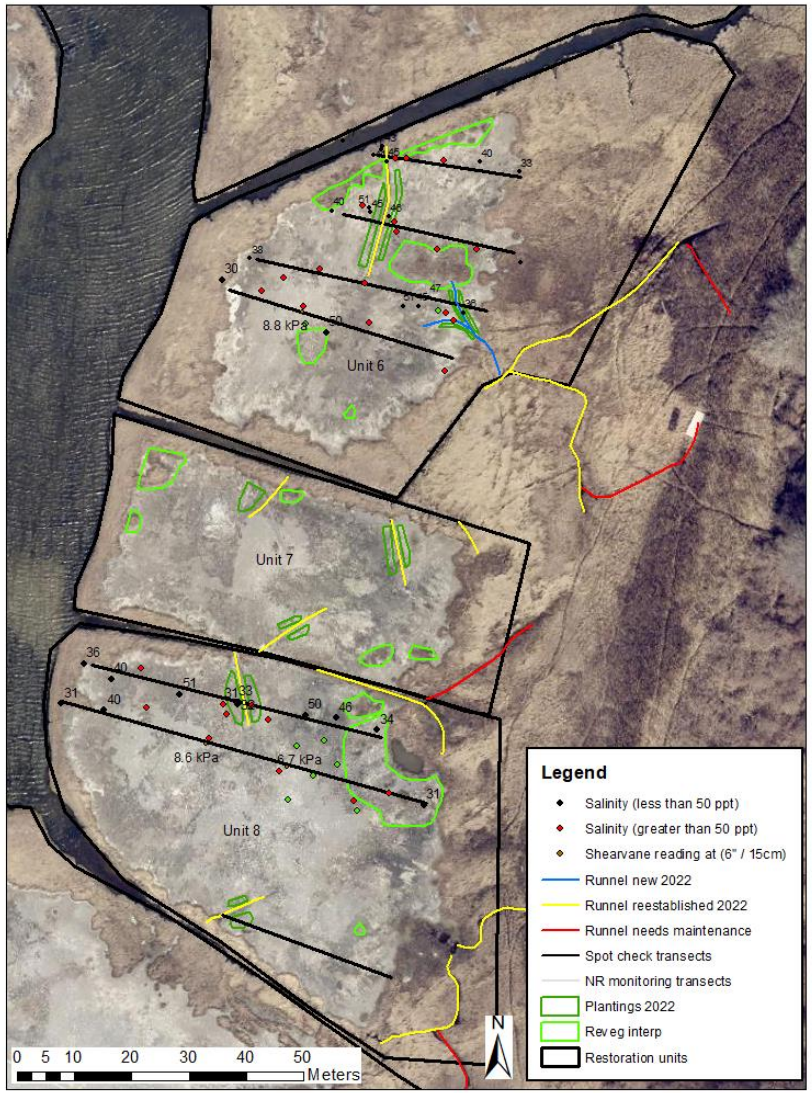
Challenge: Hyper Saline Conditions

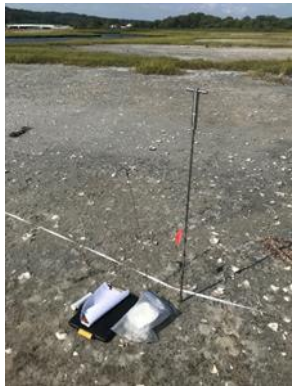






Salinity Spot Mapping





	Pre-TLP		TLP Applied			
	2015	2016	2017	2018	2019	2022
	n=6/7	n=6	n=8	n=7	n=7	n=2*
T6-60	51	52	37	53	67	100
T3-30	38	45	47	69	88*	100
T7-01		46	47	61	72	61
	No TLP Applied					
T5-00	37	37		38	34	38

Technique: Runnel (shallow drainage) to allow flushing

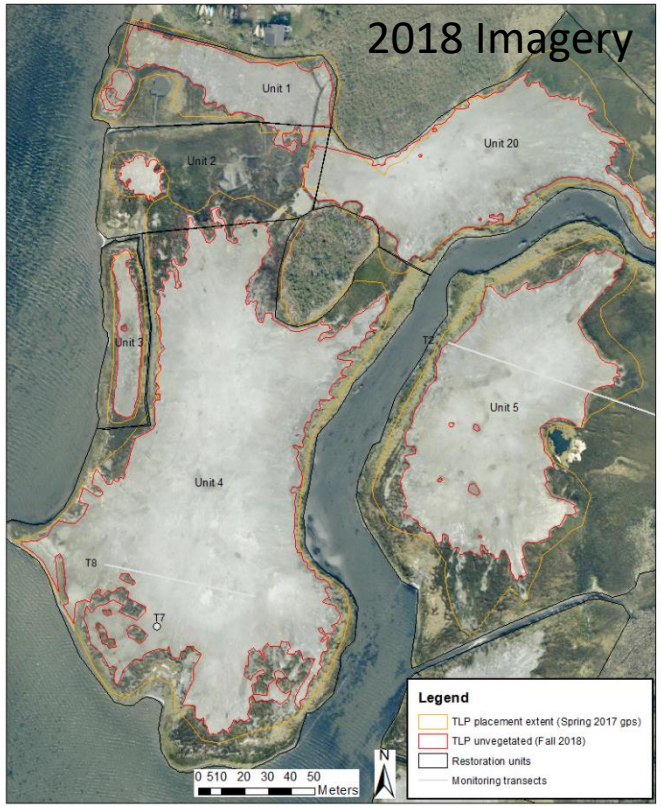
- Create lower salinity planting opportunities
- Reduce impounded water in sediment causing anoxic conditions
- Reduce soil salinities

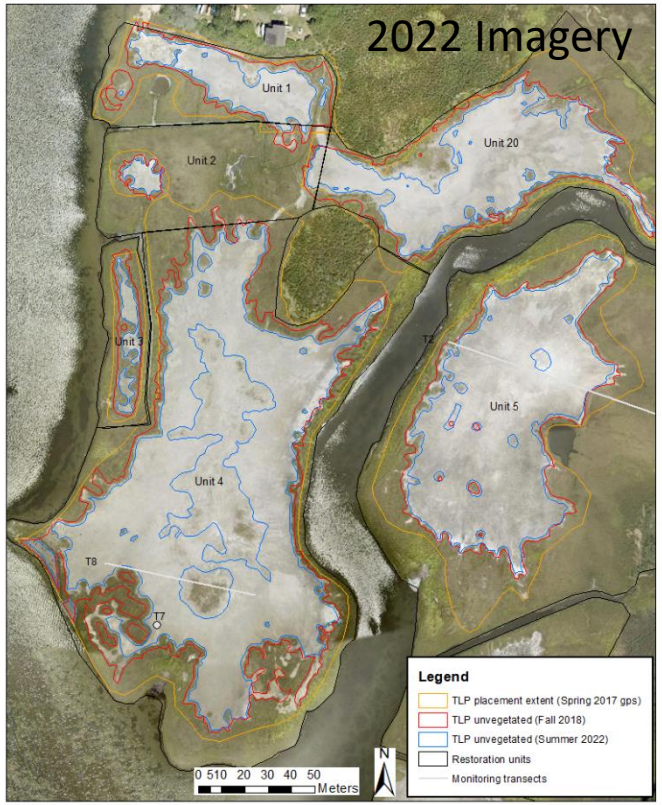
Challenge: Compacted Soils

Nursery plugs colonized by Salicornia

Technique: Compaction reduction

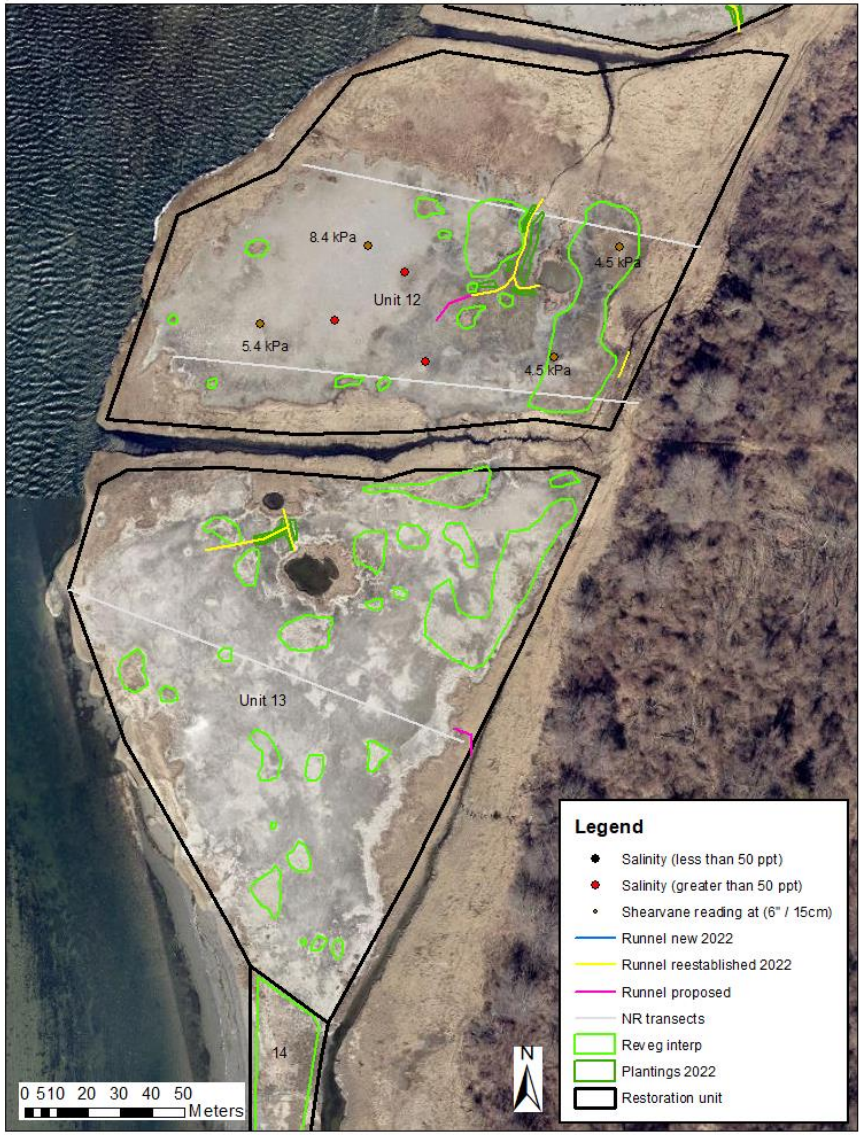
Challenge: Slow Vegetation Recovery





Unit	TLP total area Spring 2017 (sq ft)	TLP total area unvegetated 2018 (sq ft)	TLP total area unvegetated 2022 (sq ft)	TLP total area revegetated* 2018 to 2022 (sq ft)	% Change of TLP total area revegetated from 2018 to 2022	% Change of TLP area vegetated* from 2017 to 2022*	% TLP area estimated revegated from existing marsh edge 2018 to 2022
1	32,031	22,960	12,539	10,421	45.4%	60.9%	39.0%
2	4,593	2,464	1,622	842	34.2%	64.7%	34.2%
3	9,880	6,705	1,288	5,417	80.8%	87.0%	70.0%
4	216,886	163,240	103,516	59,724	36.6%	52.3%	18.6%
20	70,111	57,123	35,169	21,954	38.4%	49.8%	21.1%
5	114,618	77,885	66,258	11,627	14.9%	42.2%	12.5%

Leverage what is working



Edge growth

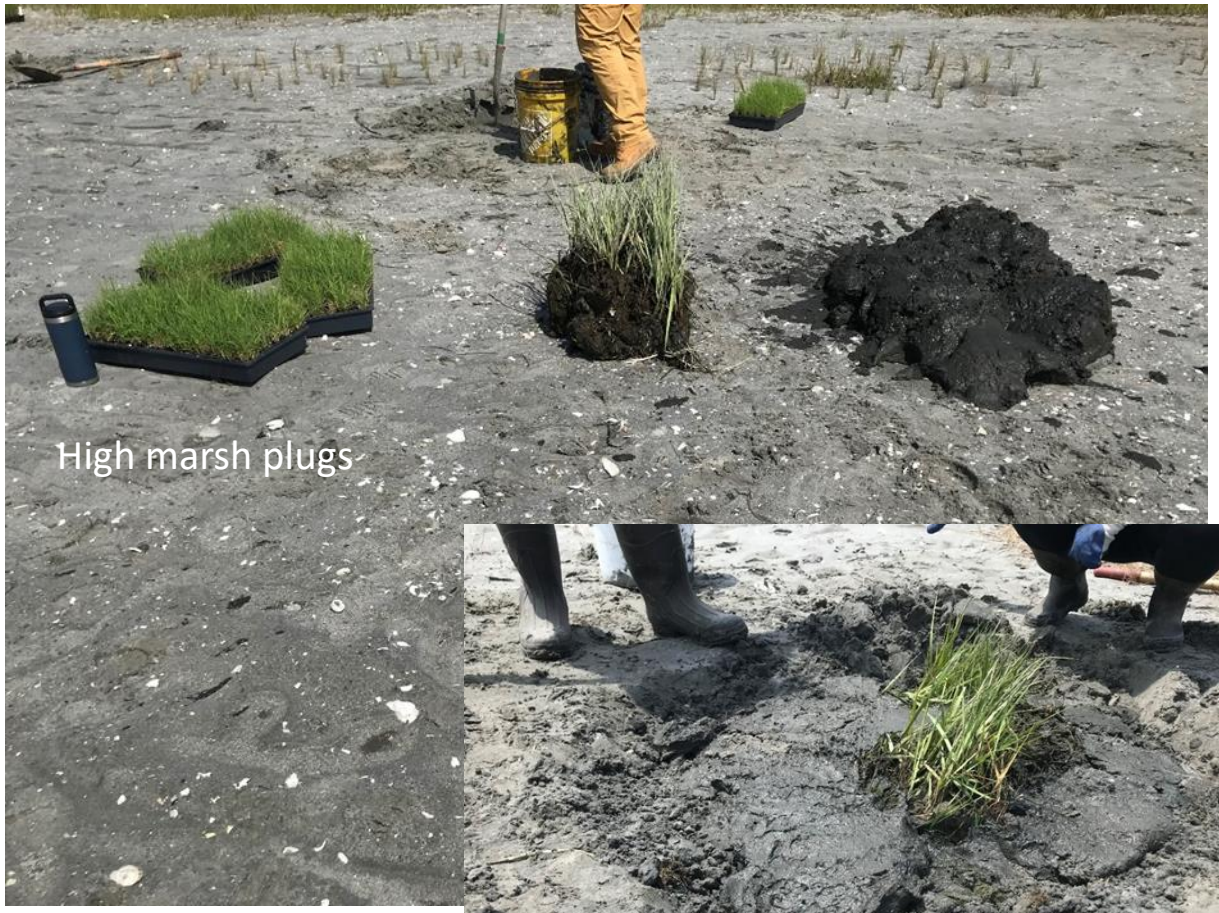
Salicornia colonizing the edges

Distichlis spicata rhizomes

Technique: Microtopography

- Works the best when applied in low elevation areas
- Excellent drainage
- Uncompacted planting option

Technique: Buffered Plantings



Technique: Acclimated Plugs / Watering

- Increases plug survivorship
- Watering with a brackish mix
- Labor intensive

Next Steps: Encouraging Signs

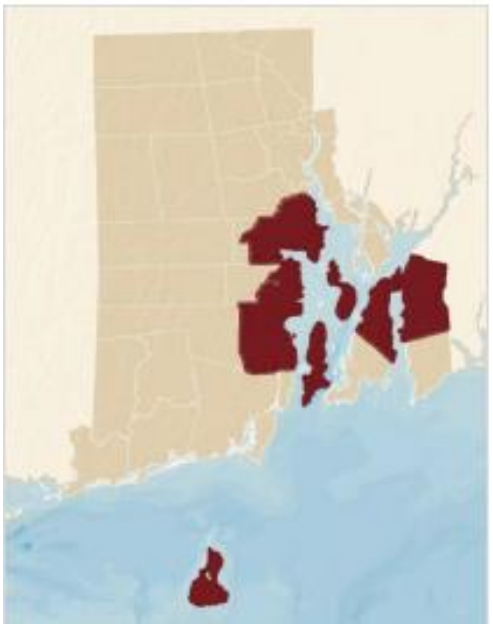
Numerous SALS nesting successfully on the RIDEM Ninigret sediment placement site

JHC2024_SALS_001

SALS nesting on the edge of the Narrow River sediment placement in 2023

Marsh Creation Areas:

Margined Tiger Beetle (*Cicindela marginata*)



THANK YOU!


UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY


SHARP
Saltmarsh Habitat
& Avian Research Program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RHODE ISLAND


NARROW RIVER PRESERVATION ASSOCIATION


THE
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US DEPARTMENT OF COMMERCE


U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849