Salt Marsh Framework

Understanding Current Conditions and Opportunities for Restoration and Migration



Photo by Molly Weiner

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- E. Heidi Ricci, Director of Policy and Advocacy

- June 25, 2026

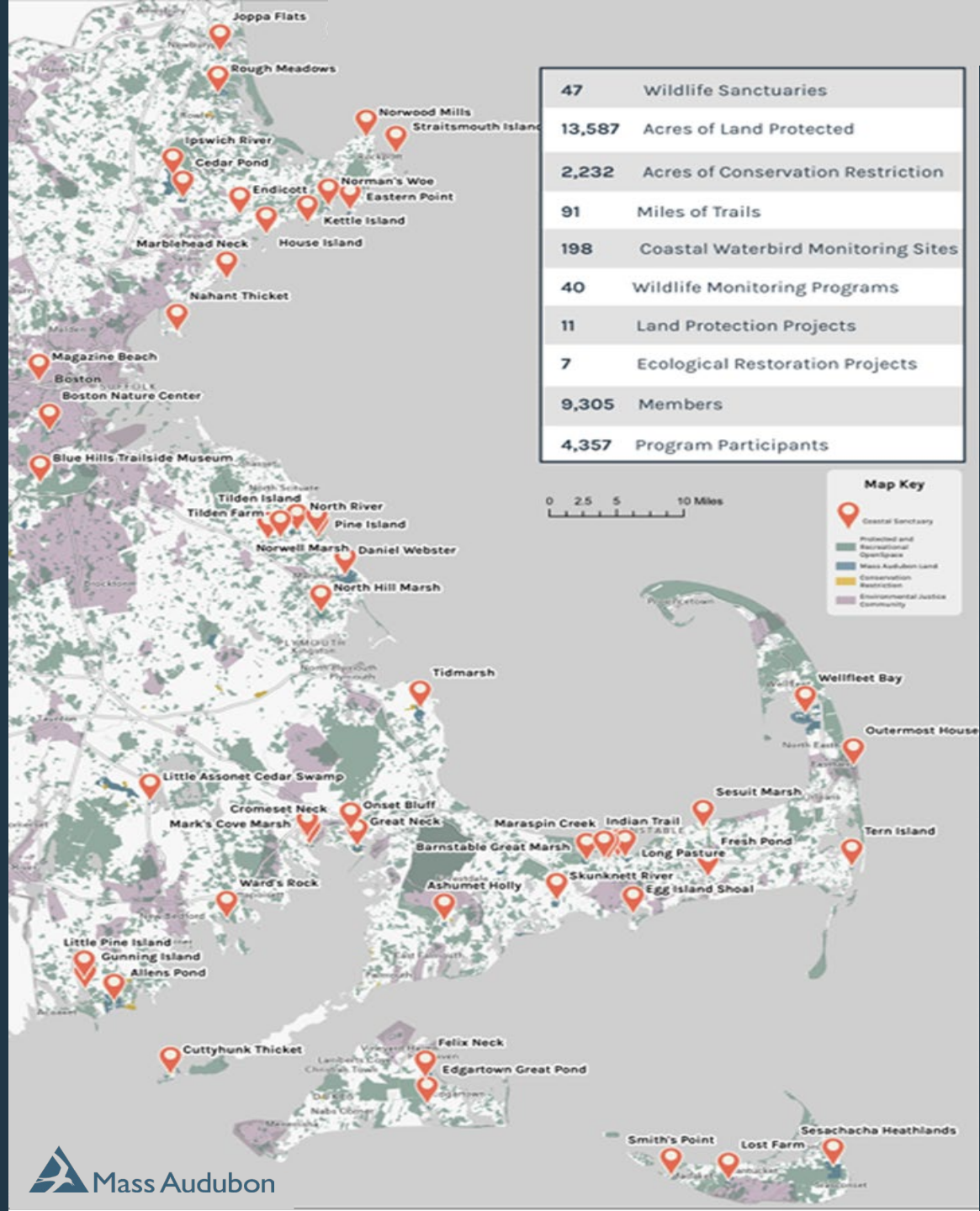
Mass Audubon

Hi! I’m Sara!

- Senior Coastal Ecologist
- Celebrating 3 years at Mass Audubon in September
- Working in salt marshes for ~25 years
- Working in restoration for ~20 years
- Part of Mass Audubon’s Ecological Restoration Program
- Based @ Tidmarsh Wildlife Sanctuary in Plymouth but travel from Newburyport to Wellfleet to **Westport**!



Mass Audubon on the Coast



47	Wildlife Sanctuaries
13,587	Acres of Land Protected
2,232	Acres of Conservation Restriction
91	Miles of Trails
198	Coastal Waterbird Monitoring Sites
40	Wildlife Monitoring Programs
11	Land Protection Projects
7	Ecological Restoration Projects
9,305	Members
4,357	Program Participants

Mass Audubon Action Agenda Goals

Goal 1



Protect and Steward Resilient Landscapes

Goal 2



Advance Inclusive and Equitable Access to Nature

Goal 3



Mobilize to Fight Climate Change

A restored landscape is **more resilient**, **more welcoming**, and **more prepared** for climate change

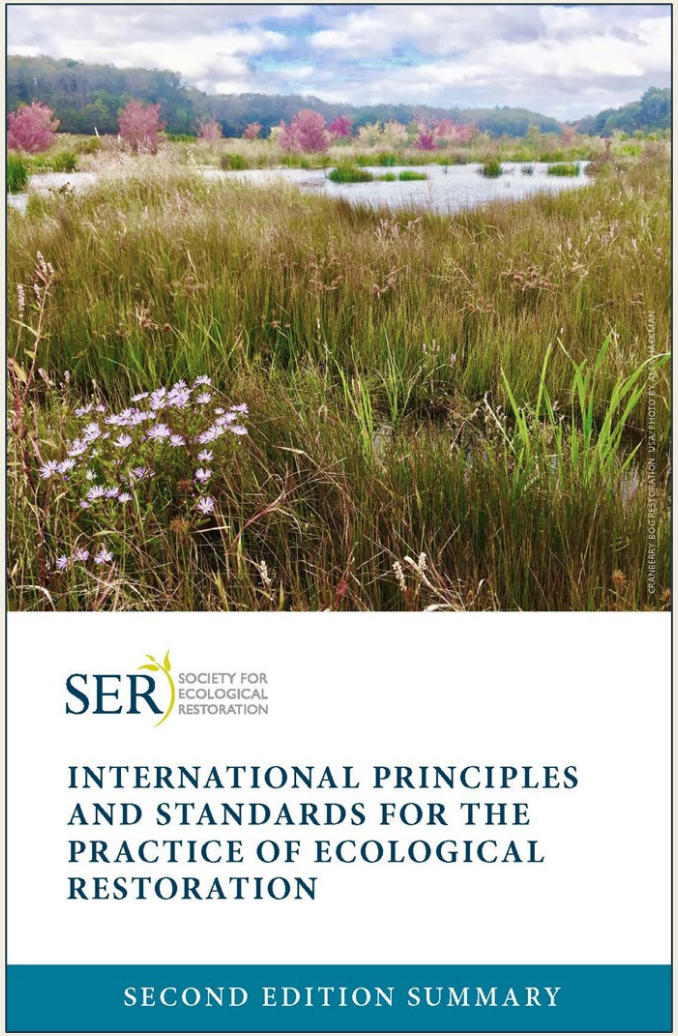
Ecological Restoration Program – started February 2023

Ecological Restoration

The process of assisting the recovery of an ecosystem that has been damaged, degraded, or destroyed

Why?

Increase biological diversity, capture and store carbon, improve water quality, store floodwater, purify air, and much more.



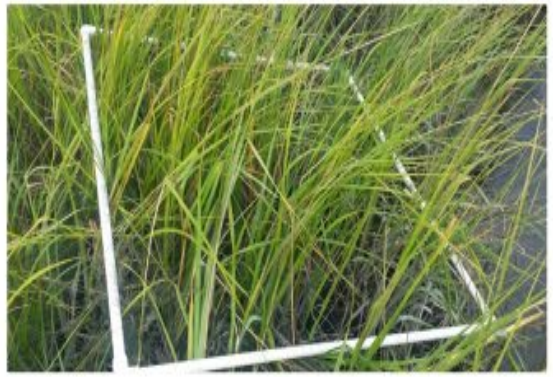
Salt marshes are in decline

- Massachusetts: 41% loss of salt marsh since ~1800
- Land use changes, altered sediment and nutrient regimes
- New England rates of sea level rise are 3-4x higher than global average

Salt Marsh – General Structure (not linear!)

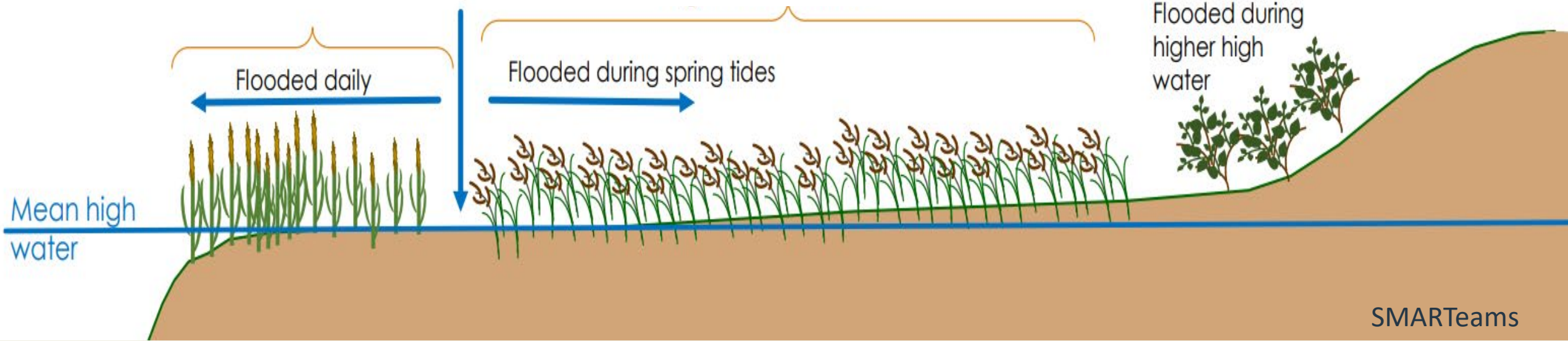


Spartina alterniflora (smooth cordgrass)

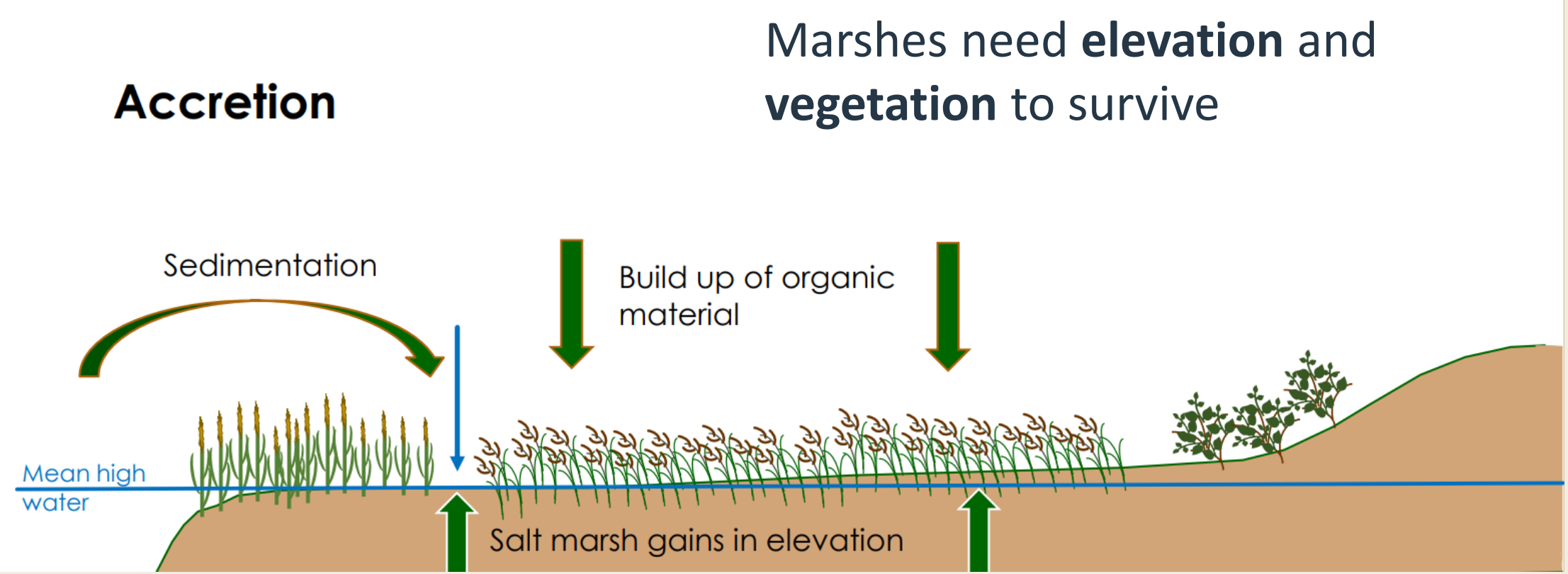


Spartina patens (salt hay)





Salt Marshes Naturally Adjust to Sea Level Rise



Wetlands need to be…wet!

- Low oxygen in wetland soil (especially peat) reduces decomposition
- Carbon is accumulated and stored





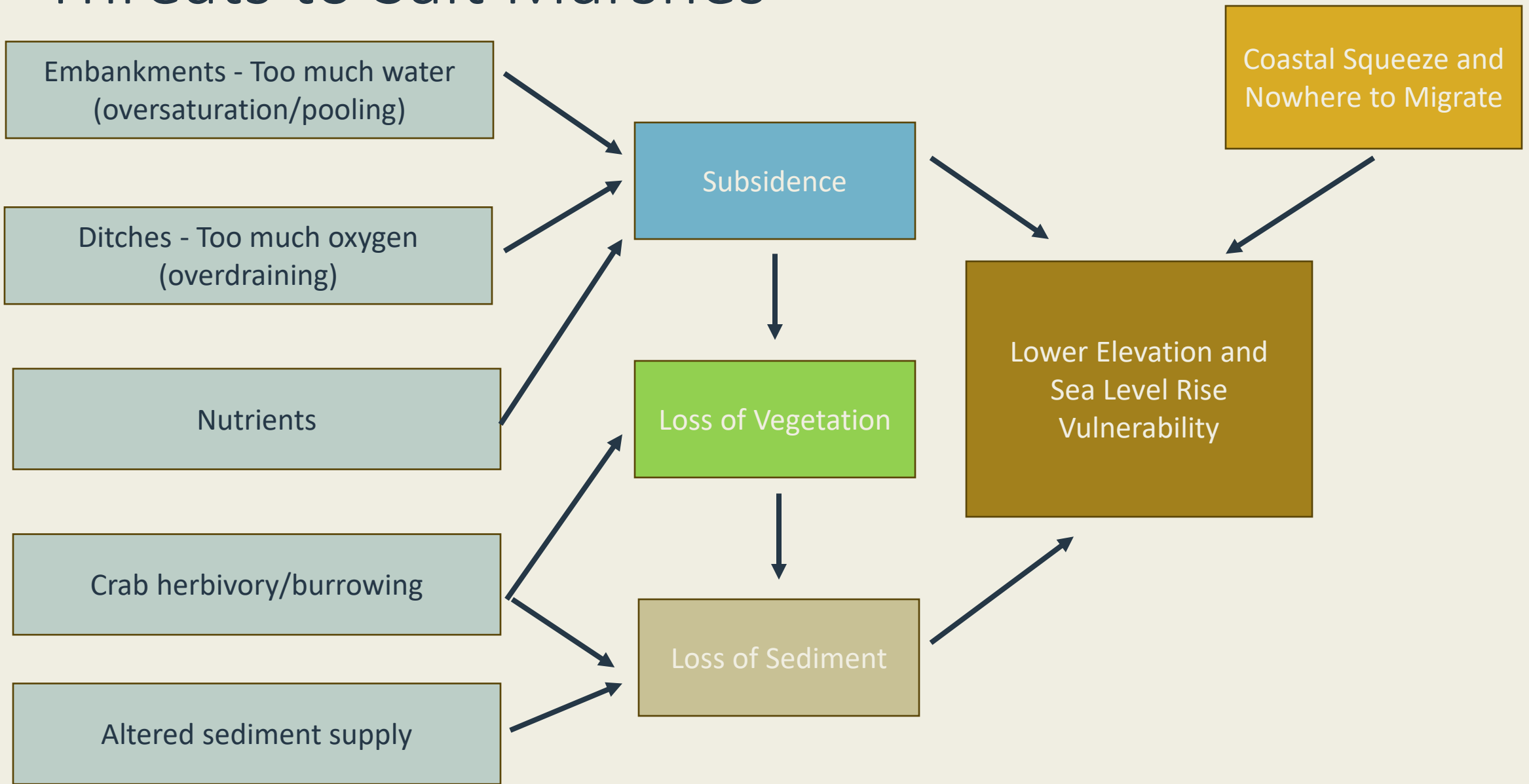


Legacy impacts of farming on the marsh

- *Spartina patens* (salt marsh hay) was harvested annually for livestock
- Ditching and embankments used to dry marsh to and enhance production
- Ditches later expanded for mosquito control purposes
- Almost ALL salt marshes in the U.S. northeast have these impacts



Threats to Salt Marshes




~42,000 acres of salt marsh in Massachusetts need restoration today.

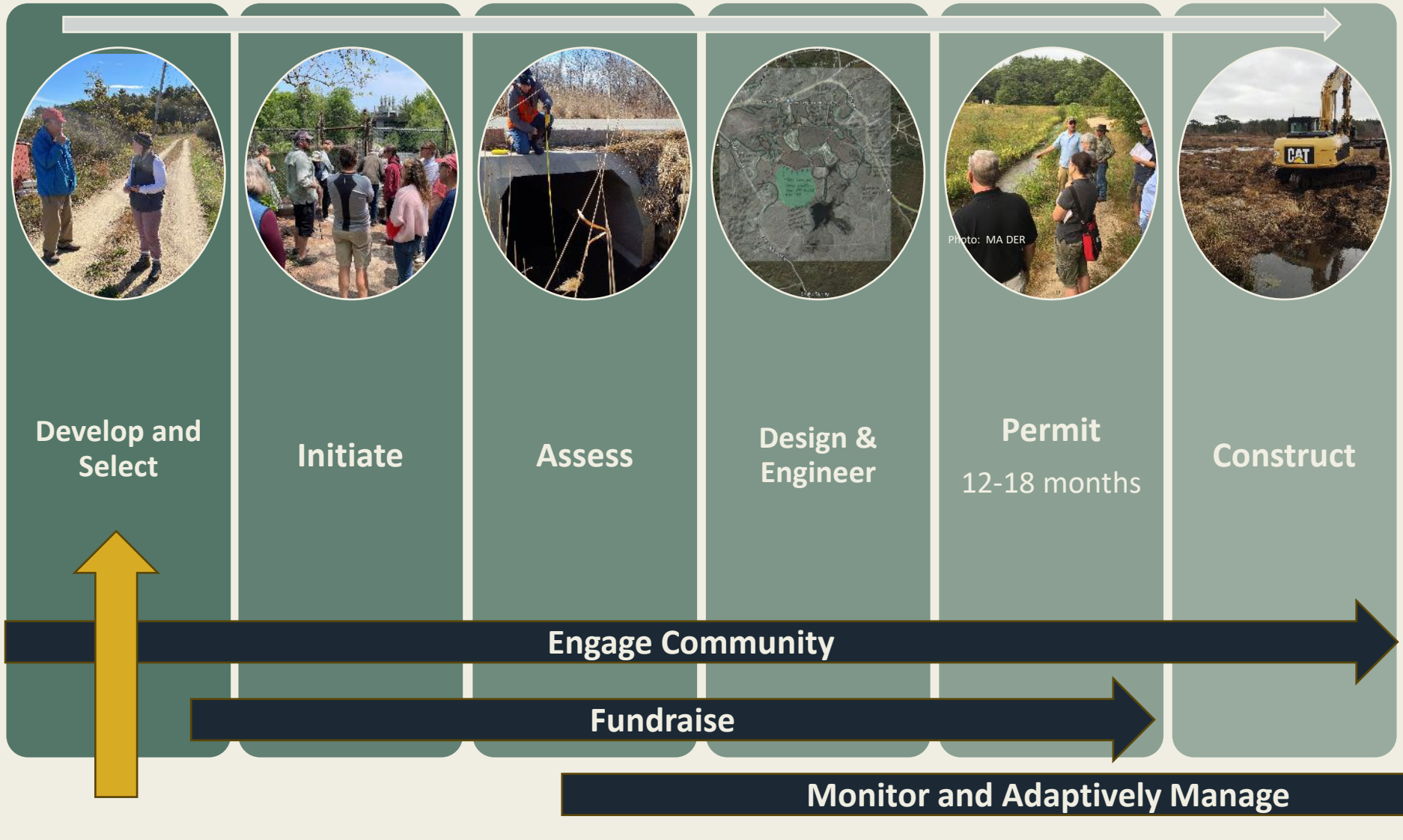
Great, but what now?





Projects happen in phases

Overlapping and iterative





The **Salt Marsh Framework** uses geospatial data to score salt marshes statewide by their current ***Condition***, future ***Trajectory***, and ***Migration*** potential.

☑ Right ***Places*** ☑ Right ***Time***

Condition, Trajectory and Migration scores are used to suggest ***Management Guidances***.

☑ Right ***Approach***

The Massachusetts Salt Marsh Framework

A Salt Marsh Restoration and Management Planning Tool

Each marsh complex gets a score based on:

- Condition – Is the marsh vegetated? Does it receive non-point source pollution?
- Trajectory – Where is the marsh relative to the tide? Is the marsh building elevation fast enough?
- Migration – Where can the marsh migrate? What is the land use in those areas?

Combinations of scores provide guidance focused on protection, restoration, and migration

Can add in context – salt marsh sparrow, cranberry bogs, tidal restrictions



Condition, Trajectory and Migration inform ***Management Guidances***

☑ Right *Approach*

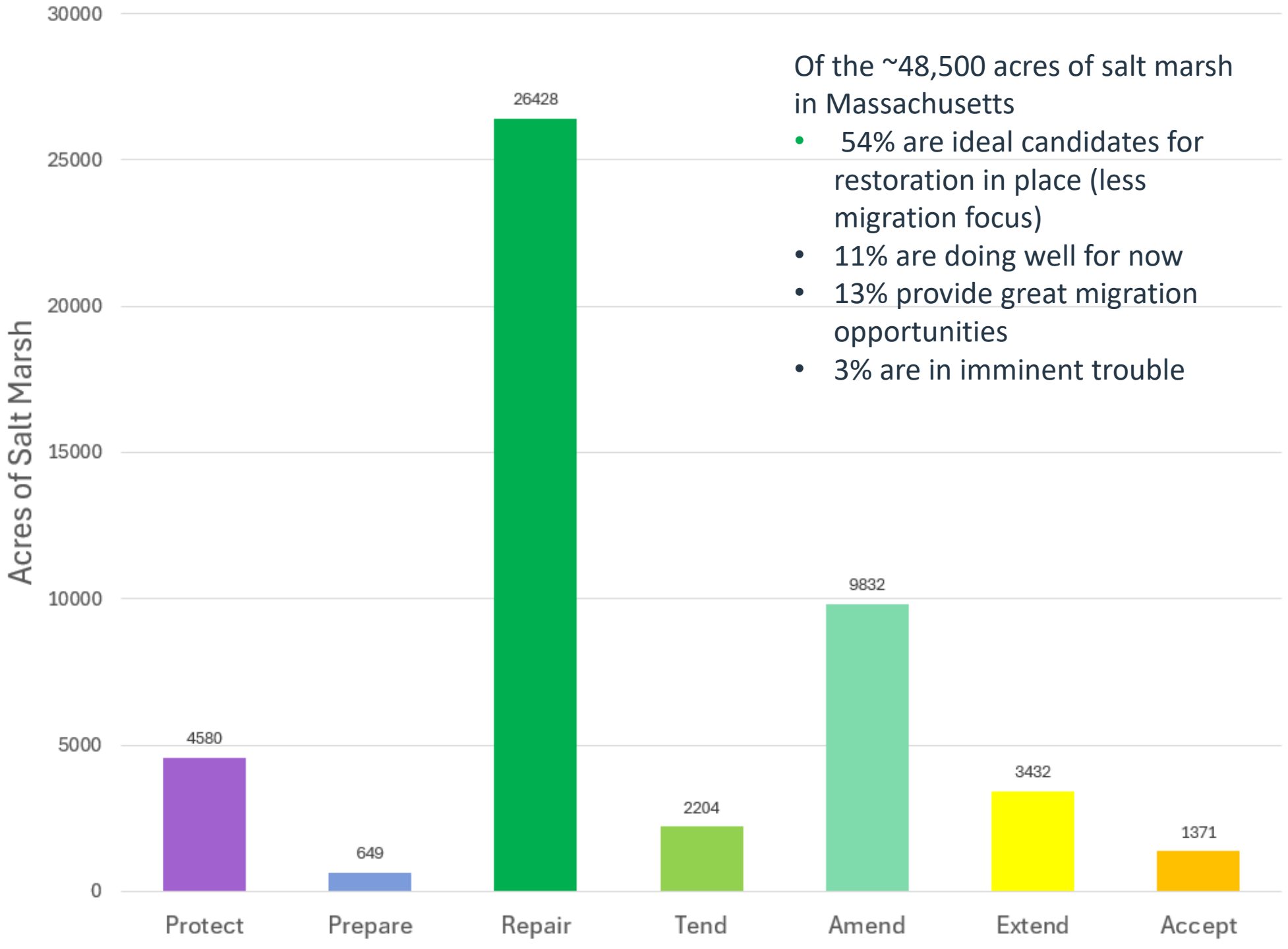


Greater Migration Potential

Better Condition and Trajectory, Gradient of Restoration Intensity



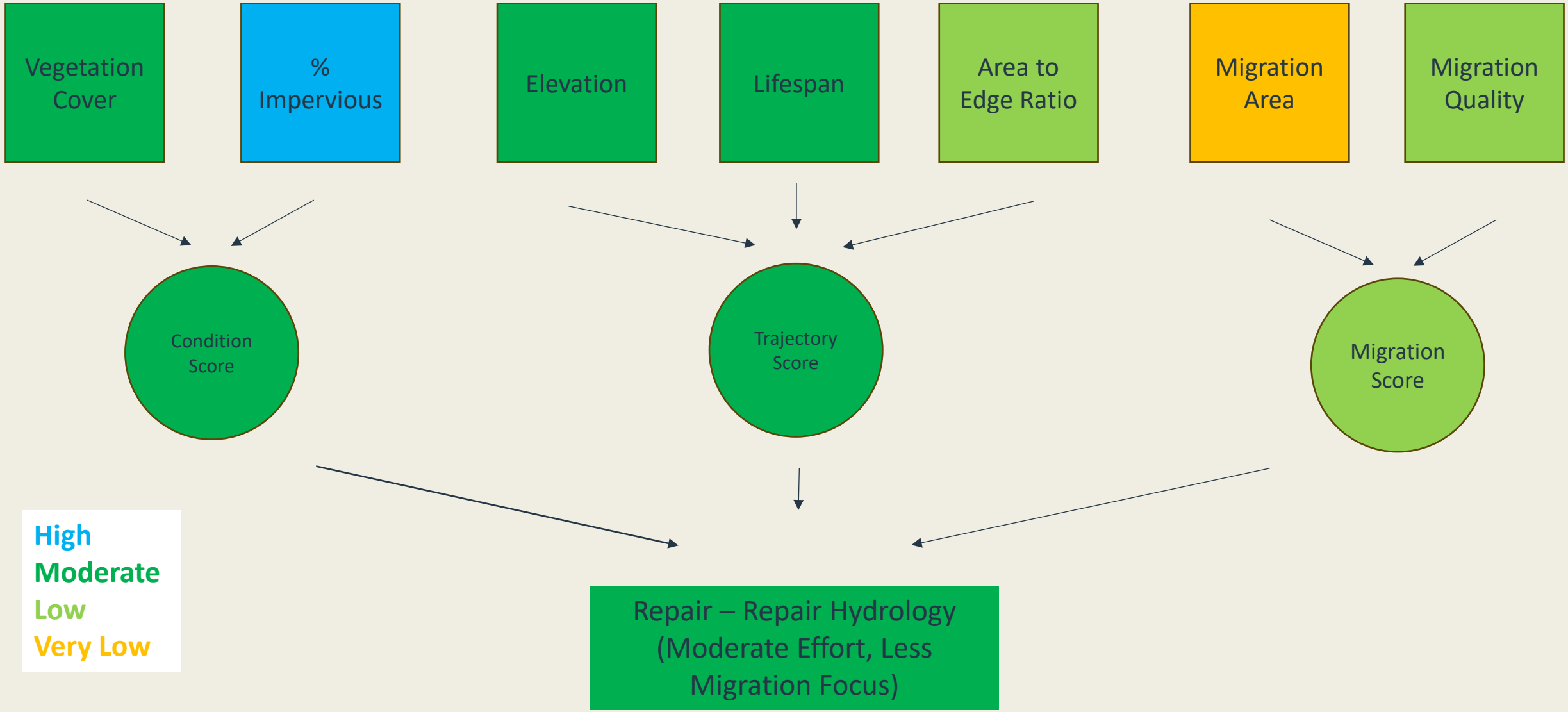
PROTECT Land protection and light touch restoration	***PREPARE*** Land protection and light restoration, prepare for migration
REPAIR Repair hydrology to improve trajectory	***TEND*** Repair hydrology to improve trajectory and prepare for migration
AMEND Large scale restoration to increase lifespan	***EXTEND*** Large scale restoration to allow for migration
ACCEPT Try experimental restoration or accept loss	



Of the ~48,500 acres of salt marsh in Massachusetts

- 54% are ideal candidates for restoration in place (less migration focus)
- 11% are doing well for now
- 13% provide great migration opportunities
- 3% are in imminent trouble

Barnstable Great Marsh - Salt Marsh Framework



Westport Marshes in Framework

East Branch ~768 acres
West Branch ~244 acres
Cockeast Pond ~ 8 acres
Richmond Pond ~ 17 acres

	Condition	Trajectory	Migration	Mgmt
East Branch	Low	Low	Low	Amend
West Branch	Low	Low	Low	Amend
Cockeast Pond	High	High	Moderate	Prepare
Richmond Pond	High	Moderate	High	Prepare

SNEP NETWORK

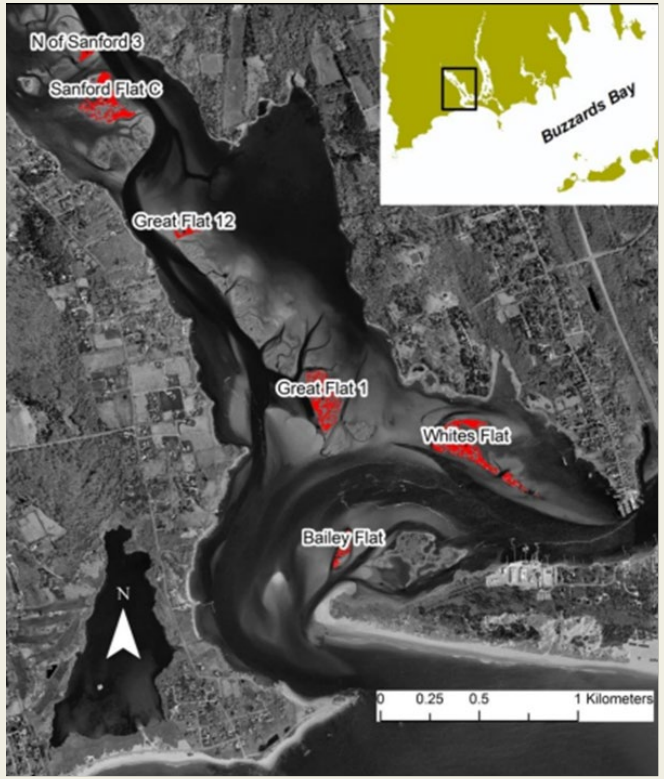


Previous Work

SUMMARY CONCLUSION

- The Westport Rivers are losing salt marsh islands at a troubling rate that has accelerated in recent years.
- At the six islands studied, marsh area has consistently declined in the last 80 years by an average of 48%.
- Both sea level rise and nitrogen pollution contribute to marsh loss in the Westport Rivers.
- Additional pressures that were not a focus of this study such as storms, dredging, and crabs may also add to marsh loss.

"Salt Marsh Loss in the Westport Rivers" Report, BBC et al.



Costa & Weiner 2017



Buzzards Bay Coalition Report – Westport Town Farm

MARSH-SPECIFIC METRICS

Stressors

Percent Low-Lying	2%
Nitrogen Pollution	0.8 mg/L estuary

Current Conditions

Percent Unvegetated	1%

Potential For Adaptation

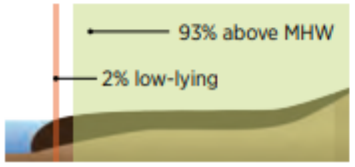
Plant Community	50% High Marsh 50% Low Marsh
Percent Above MHW	93%



Site map showing transects where on the ground measurements were made. Created with Google Earth.

VULNERABILITY TO SEA LEVEL RISE

2% Low-Lying



CURRENT CONDITIONS

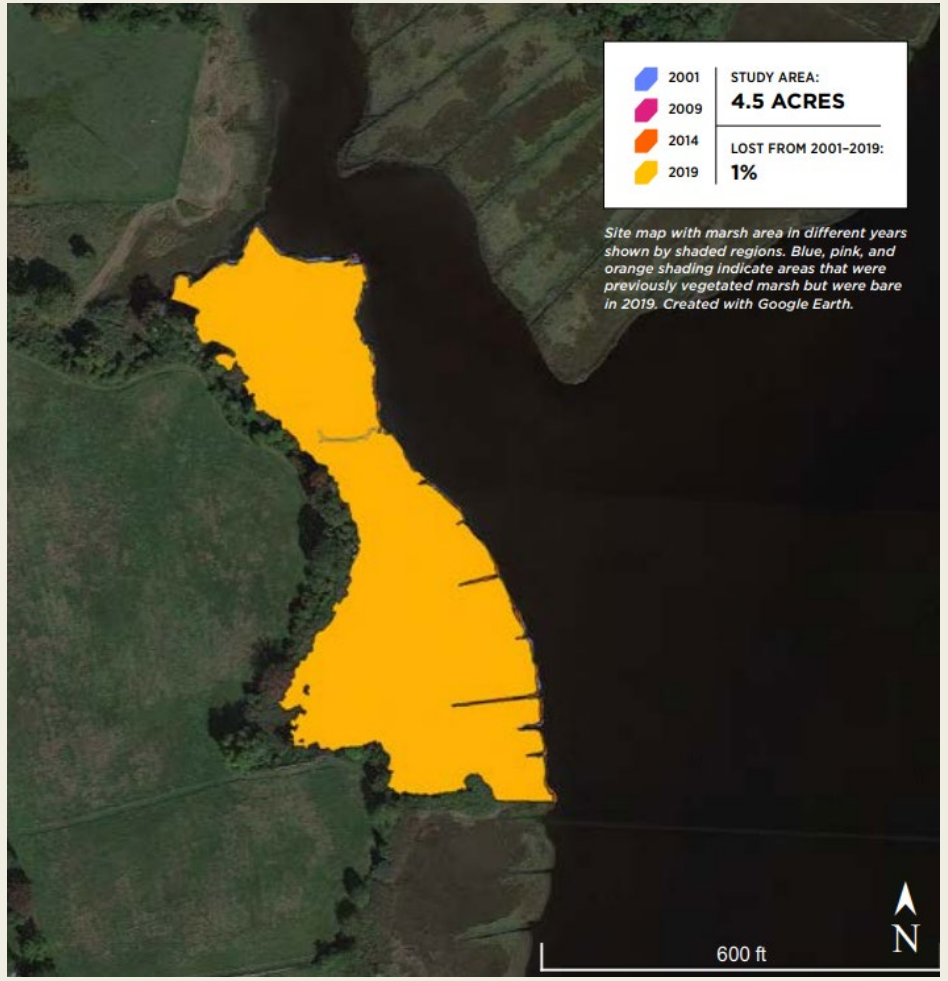
1% Unvegetated



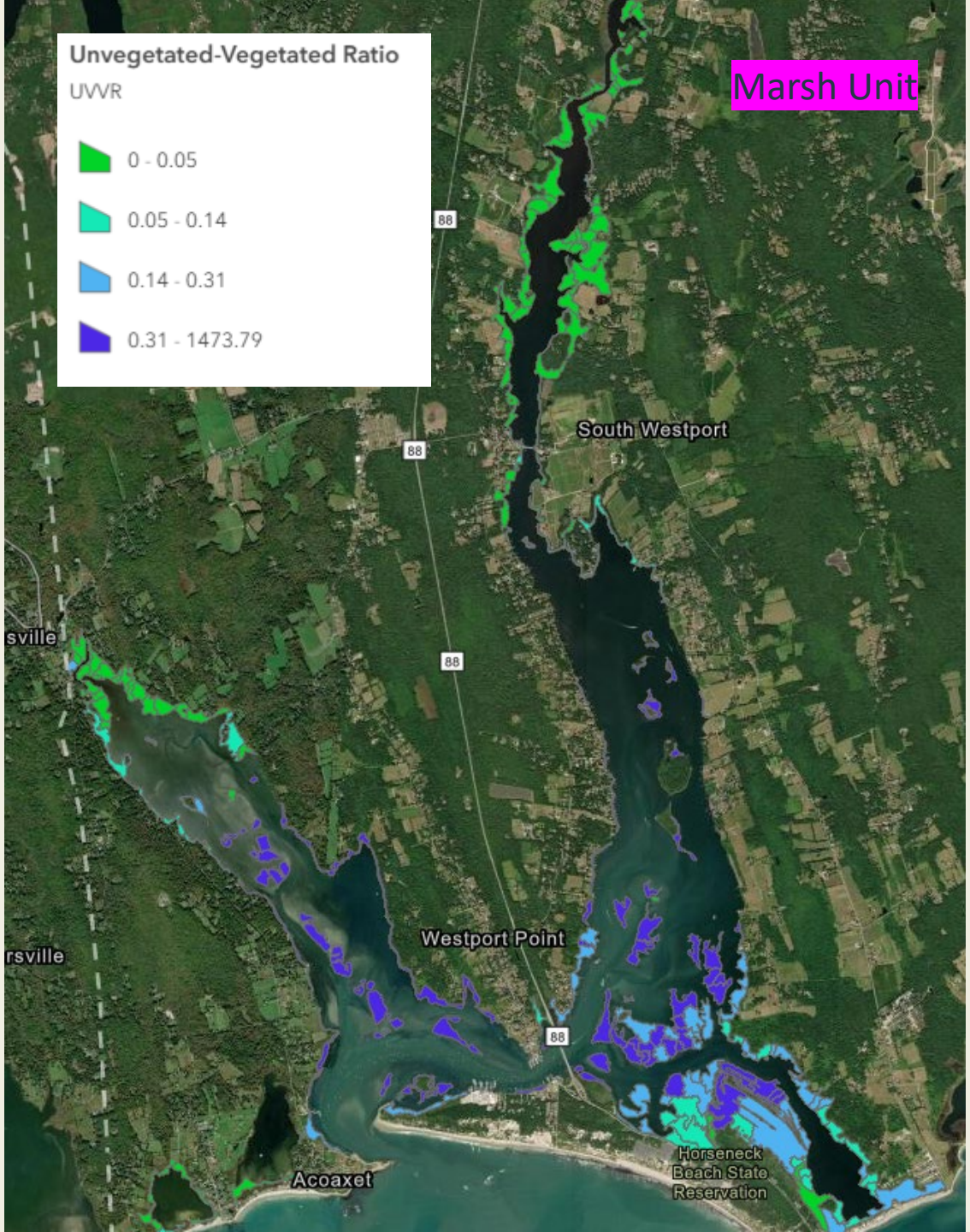
POTENTIAL FOR ADAPTATION

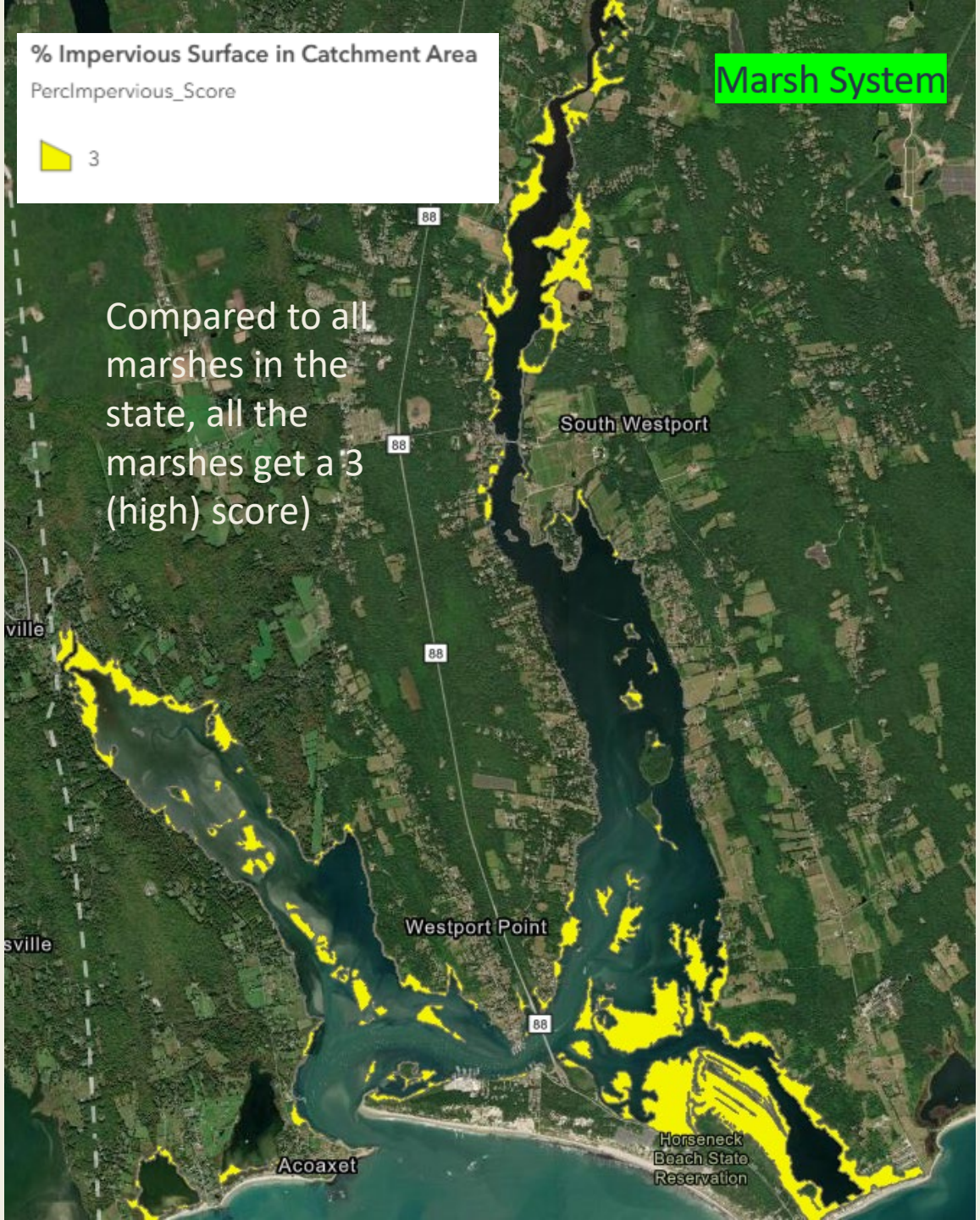
50% High Marsh

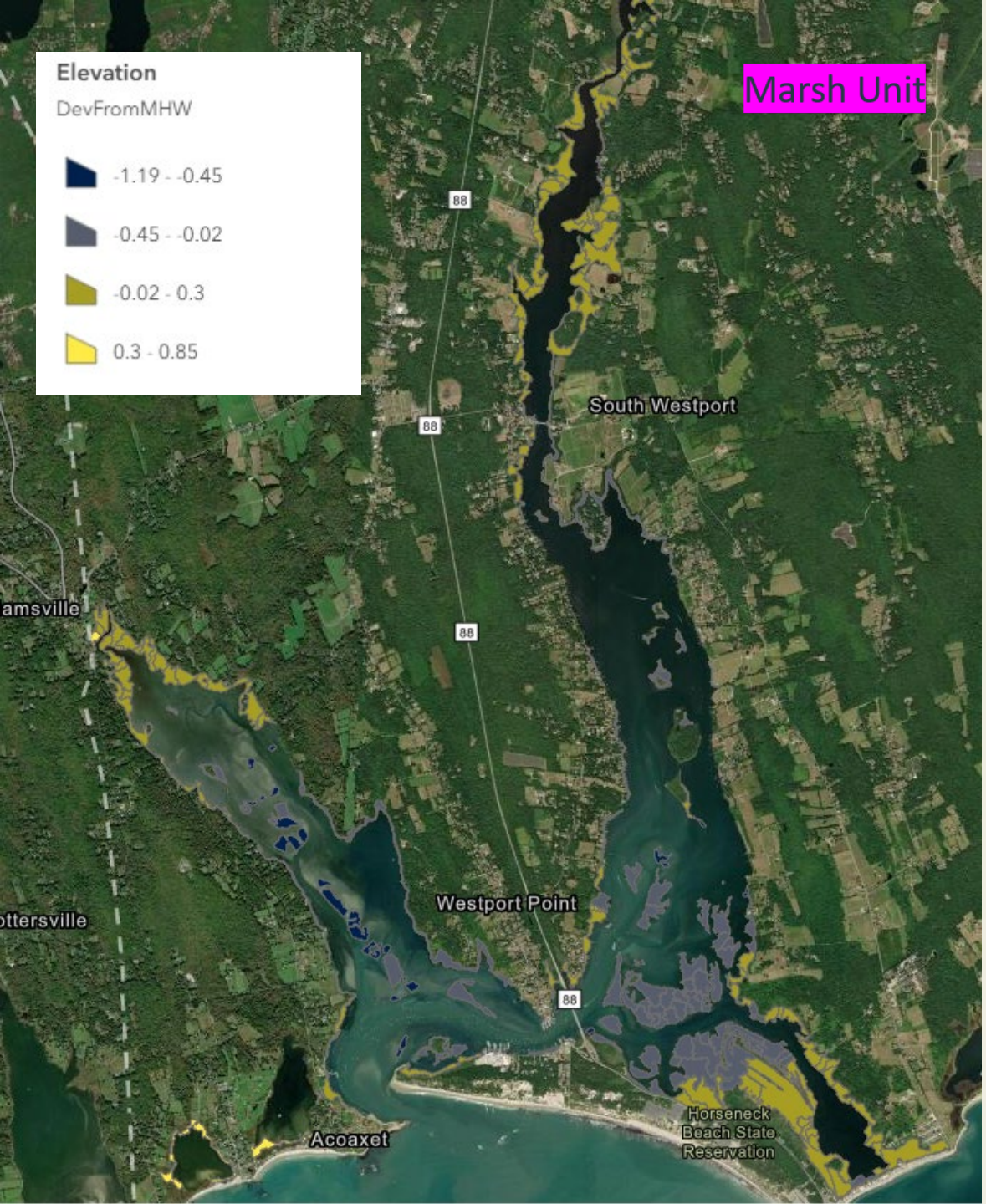


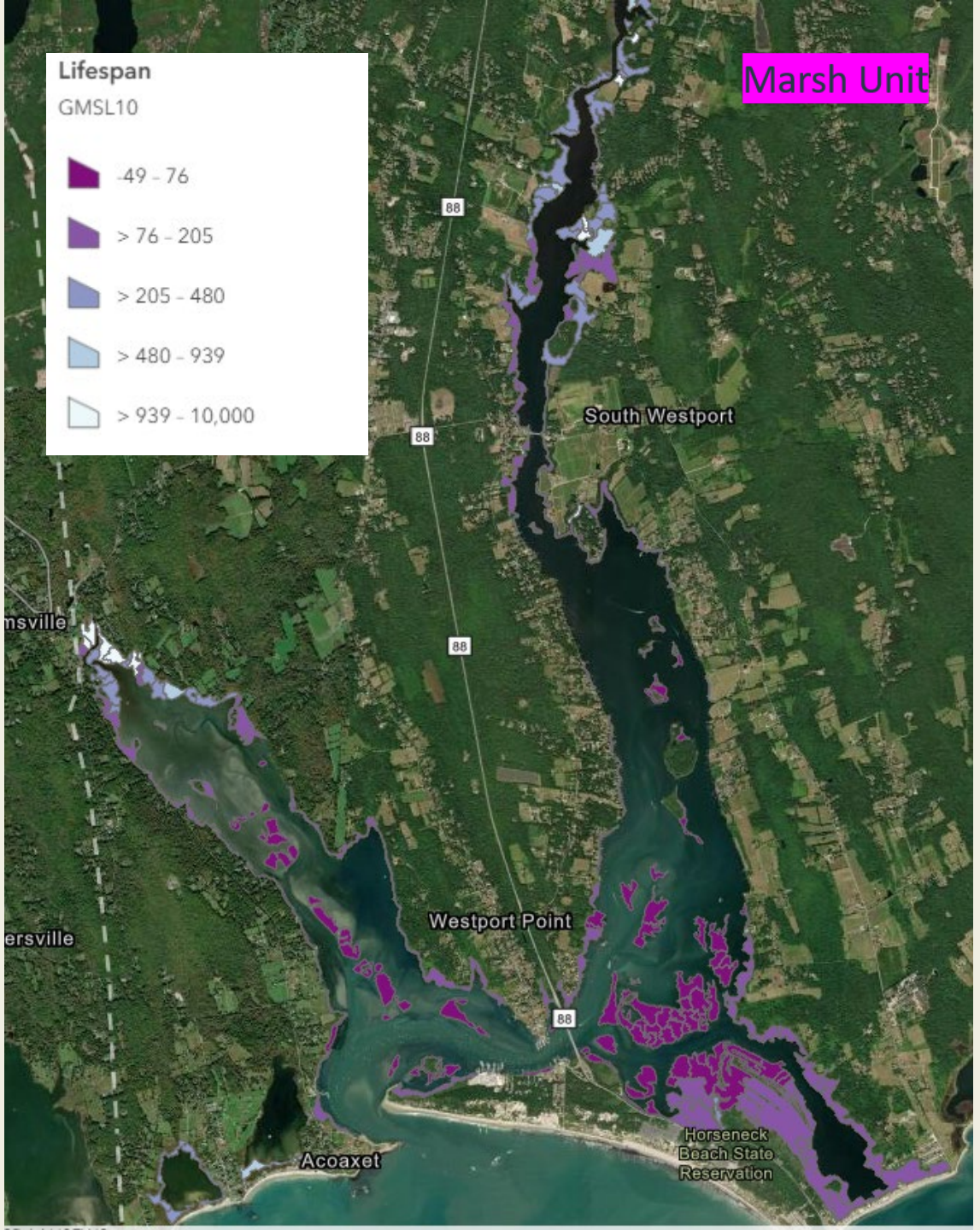


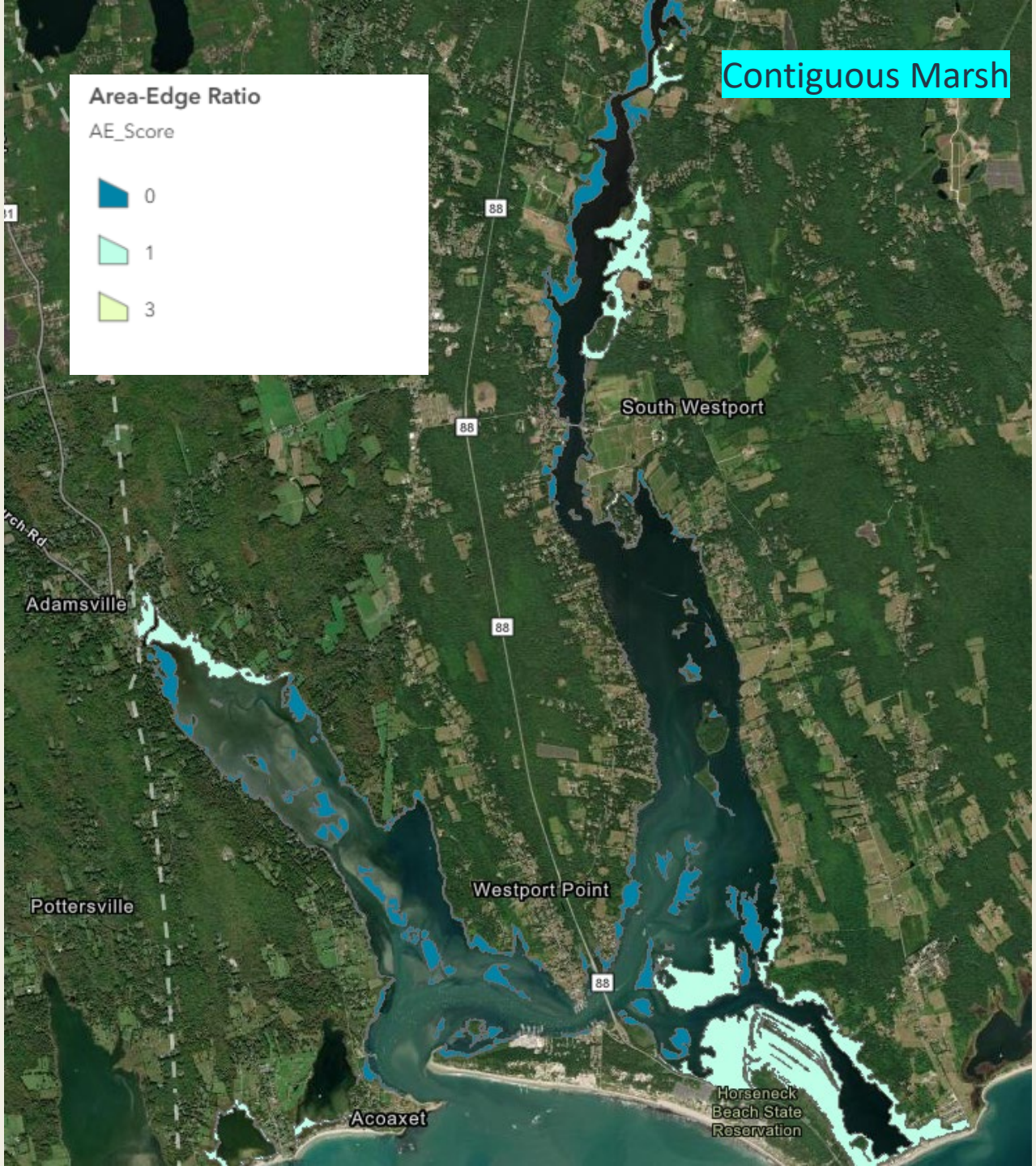
Site map with marsh area in different years shown by shaded regions. Blue, pink, and orange shading indicate areas that were previously vegetated marsh but were bare in 2019. Created with Google Earth.

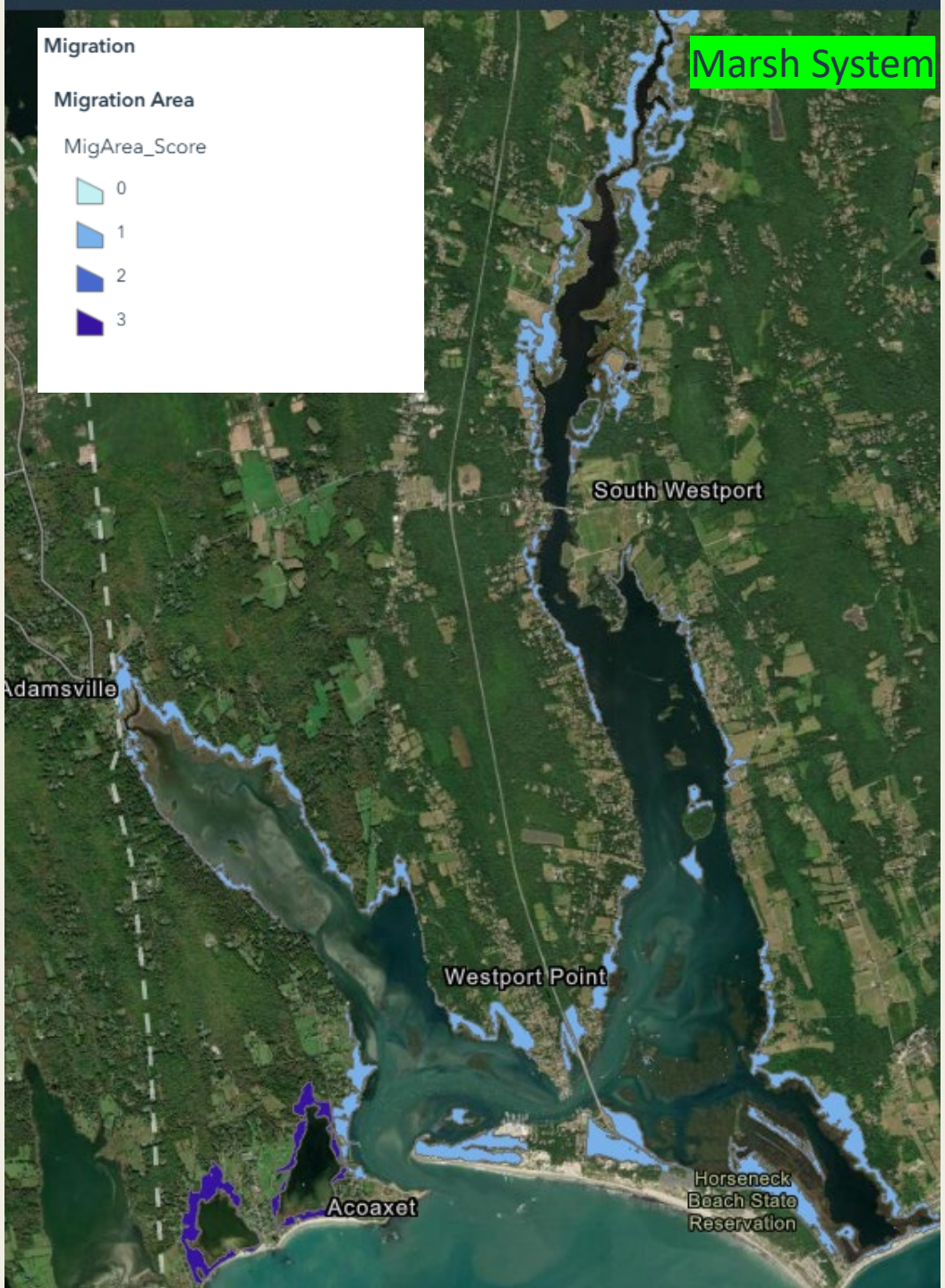

Unvegetated-Vegetated Ratio
UVVR
0 - 0.05
0.05 - 0.14
0.14 - 0.31
0.31 - 1473.79
Marsh Unit
South Westport
Westport Point
Acoaxet
Horseneck Beach State Reservation
88

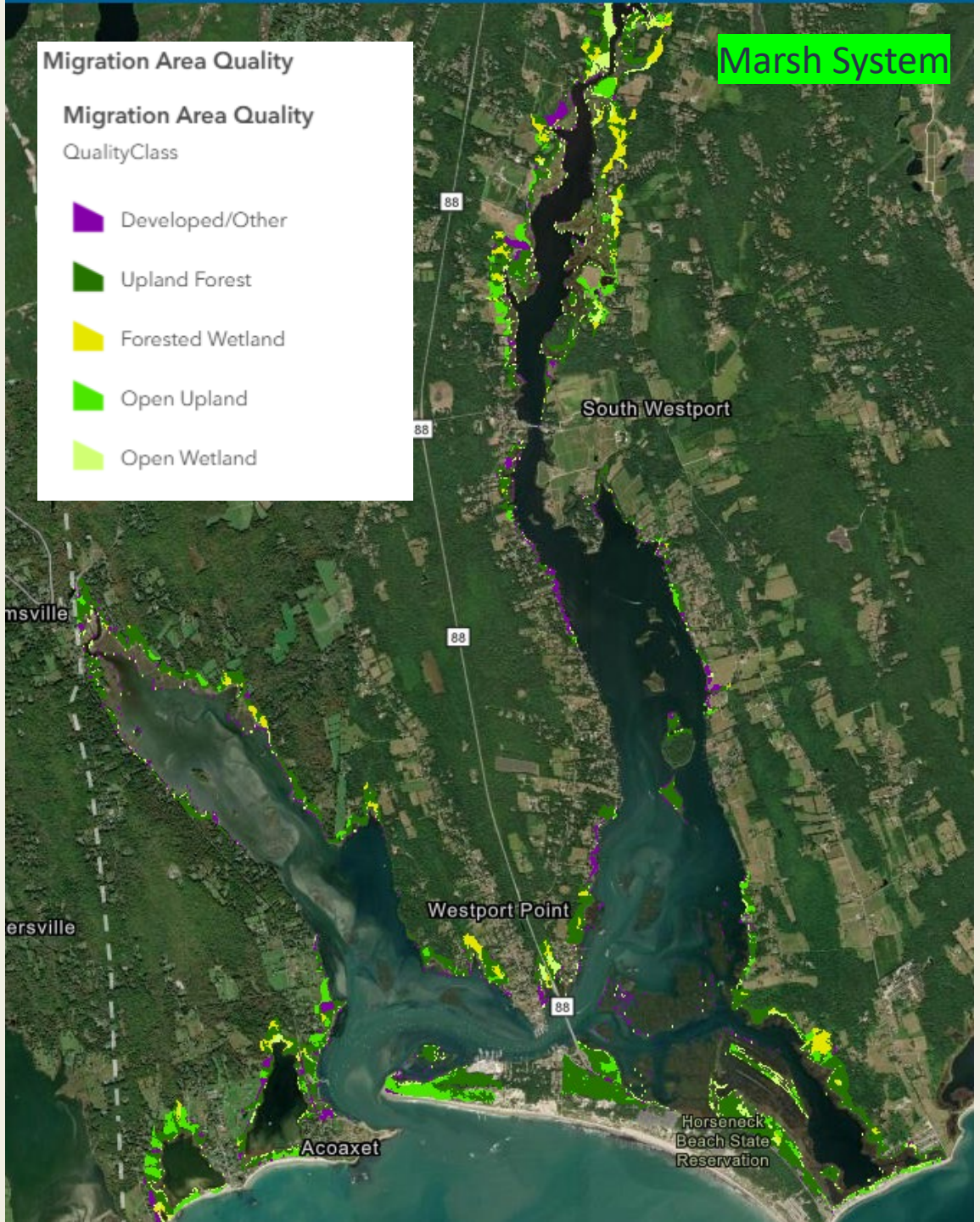

% Impervious Surface in Catchment Area
PercImpervious_Score
3
Marsh System
Compared to all marshes in the state, all the marshes get a 3 (high) score)
South Westport
Westport Point
Acoaxet
Horseneck Beach State Reservation
88


Elevation
DevFromMHW
-1.19 - -0.45
-0.45 - -0.02
-0.02 - 0.3
0.3 - 0.85
Marsh Unit
South Westport
Westport Point
Acoaxet
Horseneck Beach State Reservation
88


Lifespan
GMSL10
-49 - 76
> 76 - 205
> 205 - 480
> 480 - 939
> 939 - 10,000
Marsh Unit
South Westport
Westport Point
Acoaxet
Horseneck Beach State Reservation
88

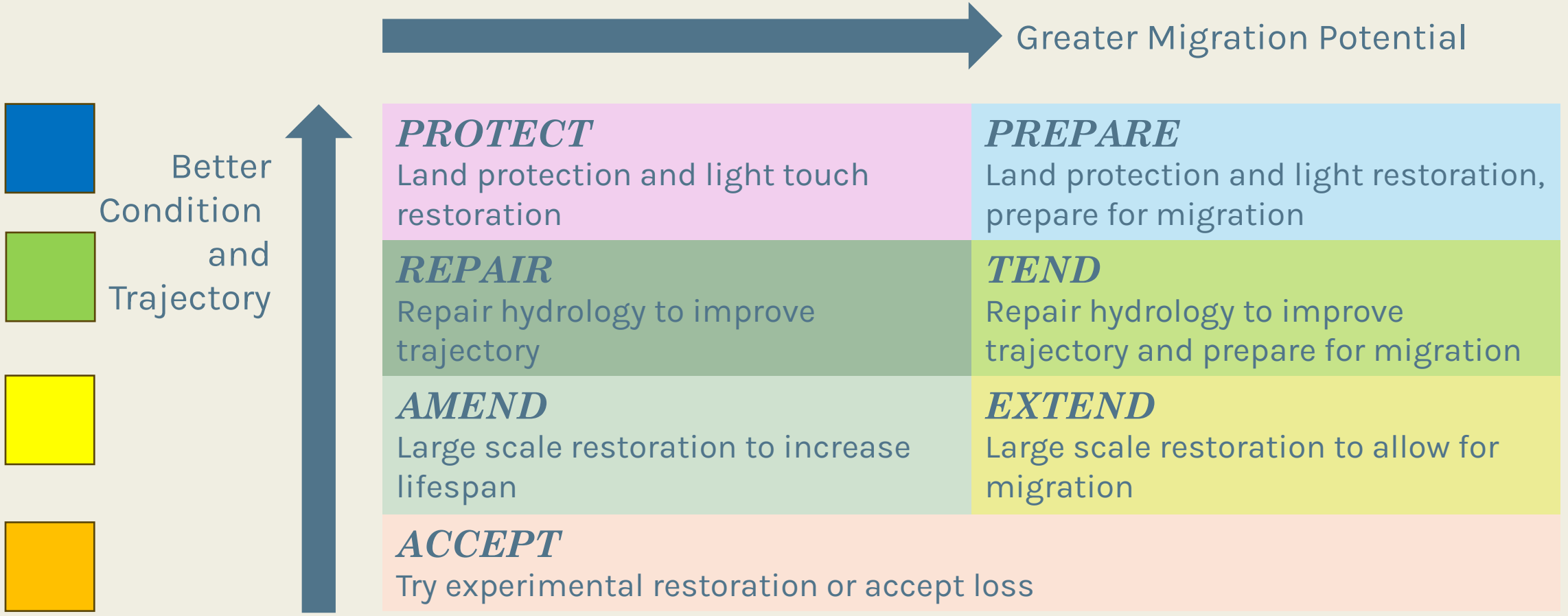

Contiguous Marsh
Area-Edge Ratio
AE_Score
0
1
3
South Westport
Adamsville
Pottersville
Westport Point
Acoaxet
Horseneck Beach State Reservation
88

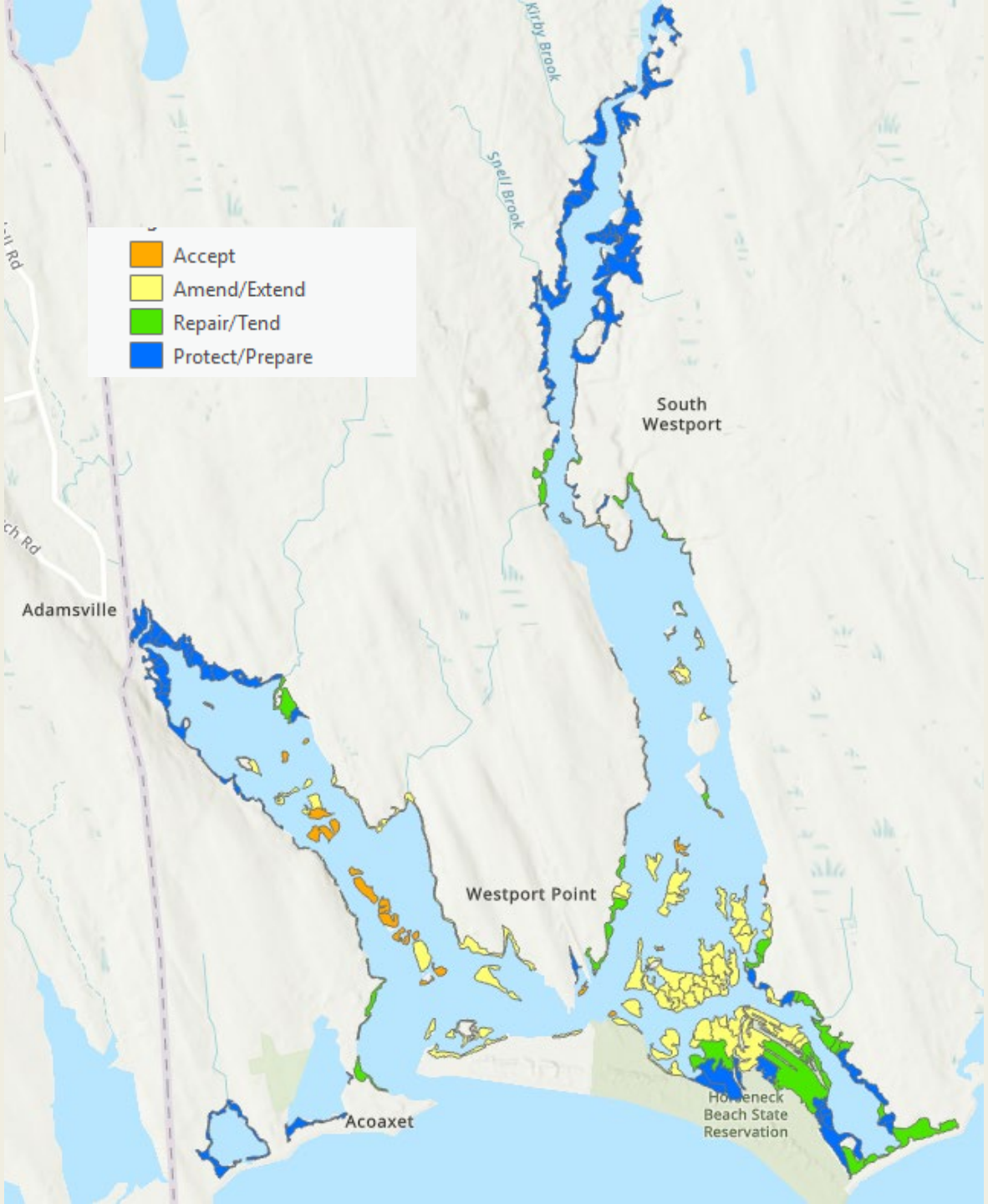

Migration
Migration Area
MigArea_Score
0
1
2
3
Marsh System
South Westport
Adamsville
Westport Point
Acoaxet
Horseneck
Beach State
Reservation


Migration Area Quality
Migration Area Quality
QualityClass
Developed/Other
Upland Forest
Forested Wetland
Open Upland
Open Wetland
Marsh System
88
South Westport
Westport Point
Acoaxet
Horseneck
Beach State
Reservation

Condition, Trajectory and Migration inform ***Management Guidances***

☑ Right *Approach*




Accept
Amend/Extend
Repair/Tend
Protect/Prepare
Kirby Brook
Snell Brook
South Westport
Adamsville
Westport Point
Acoaxet
Horseneck Beach State Reservation

Community Input

- TONS of local knowledge
- Erosion of vulnerable islands due to currents
- Issues with Phragmites and water quality in ponds (outlet opening protocol)
- Strong interest and enthusiasm for continuing to work together!



Massachusetts Oyster Restoration Suitability Index Model

Massachusetts Division of Marine Fisheries and The Nature Conservancy

Data Filters

Region
No category selected

- Cape Cod
- Islands
- Mount Hope Bay
- North Shore
- South Shore
- State Waters

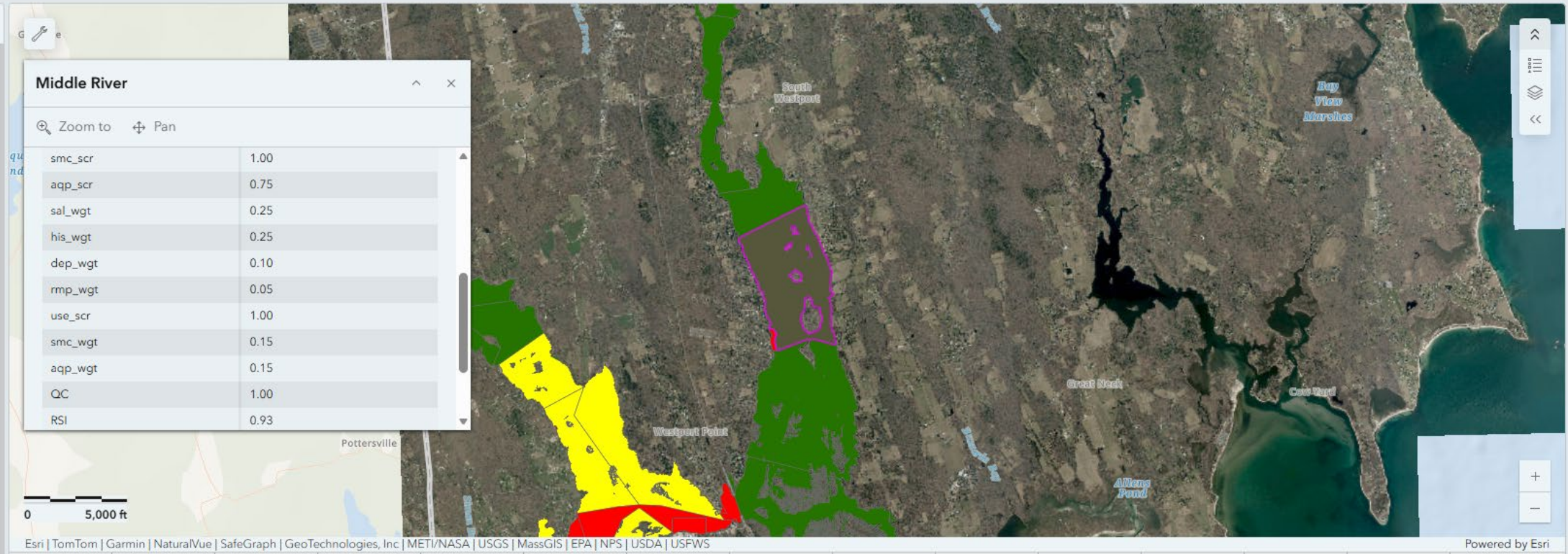
Reset | Select all

Municipality
WESTPORT

Search...

- WELLFLEET
- WEST TISBURY
- WESTPORT
- WEYMOUTH
- WINTHROP
- YARMOUTH

click the three lines in the top right corner of the dashboard to see the model criteria

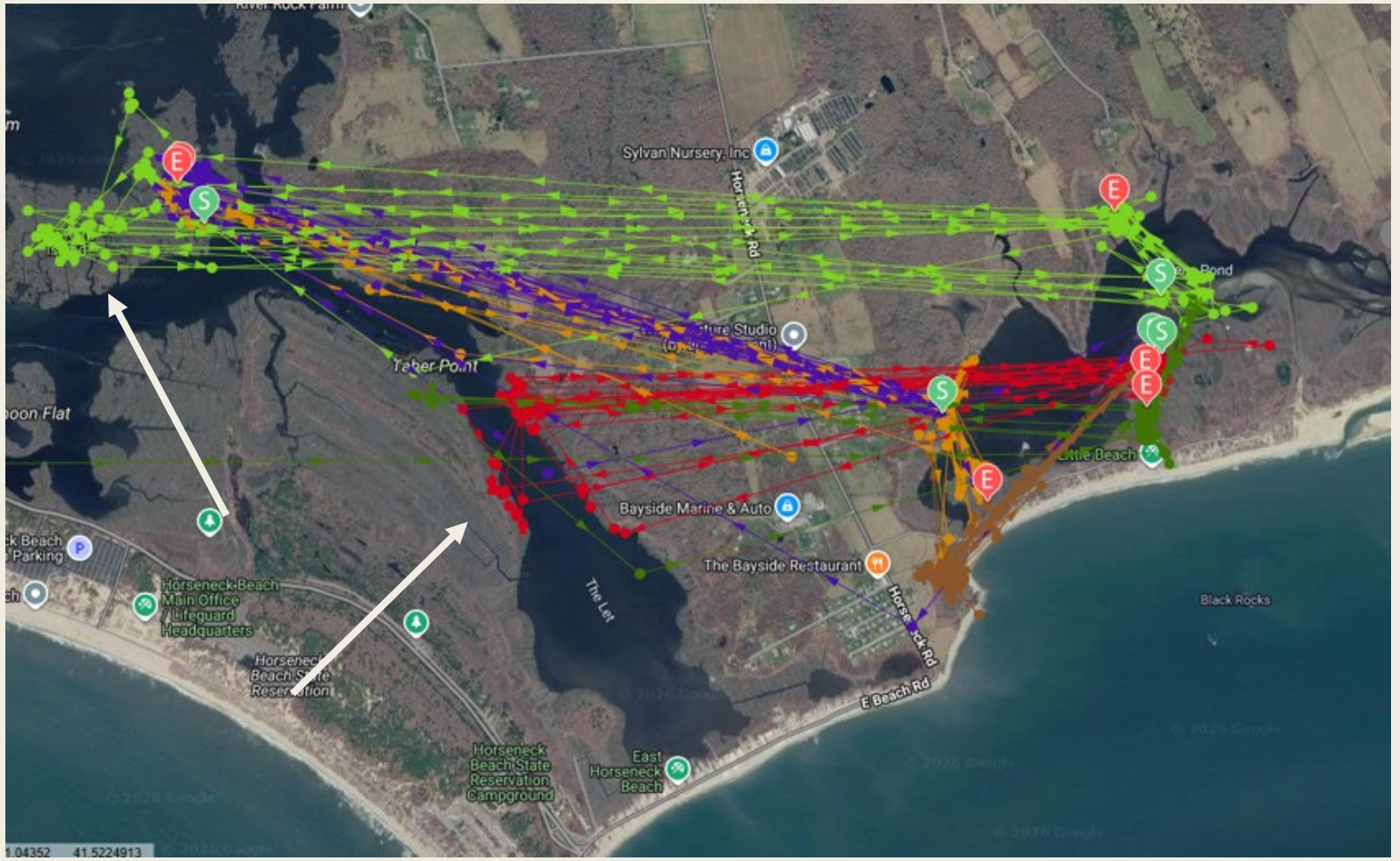


Region	Town	SGA	SCA	Desc.	Class.	Salinity	Hist. Suit.	Depth	Ramp Prox.	Excl. Uses	Mgmt. Cap.	Aquac.	QC	RSI
Buzzards Bay	WESTPORT	BB4	BB4.15	Lakes Island	Conditiona…	1.00	1.00	1.00	0.75	0.99	1.00	0.75	1.00	0.95
Buzzards Bay	WESTPORT	BB4	BB4.8	Middle River	Conditiona…	1.00	1.00	1.00	0.25	1.00	1.00	0.75	1.00	**0.93**
Buzzards Bay	WESTPORT	BB3	BB3.3	West Branc…	Prohibited	1.00	1.00	1.00	0.25	1.00	1.00	0.75	1.00	**0.93**
Buzzards Bay	WESTPORT	BB4	BB4.11	Cadman C…	Prohibited		1.00		0.75	1.00	1.00	0.75	1.00	**0.92**
Buzzards Bay	WESTPORT	BB4	BB4.26	Snell Creek	Prohibited		1.00	1.00	0.50	1.00	1.00	0.75	1.00	**0.92**
Buzzards Bay	WESTPORT	BB4	BB4.25	Wings Brook	Prohibited		1.00		0.50	1.00	1.00	0.75	1.00	**0.90**
Buzzards Bay	WESTPORT	BB4	BB4.6	Lees Brook	Prohibited		1.00		0.25	1.00	1.00	0.75	1.00	**0.88**

Mass Audubon Willet Data

5 GPS tags



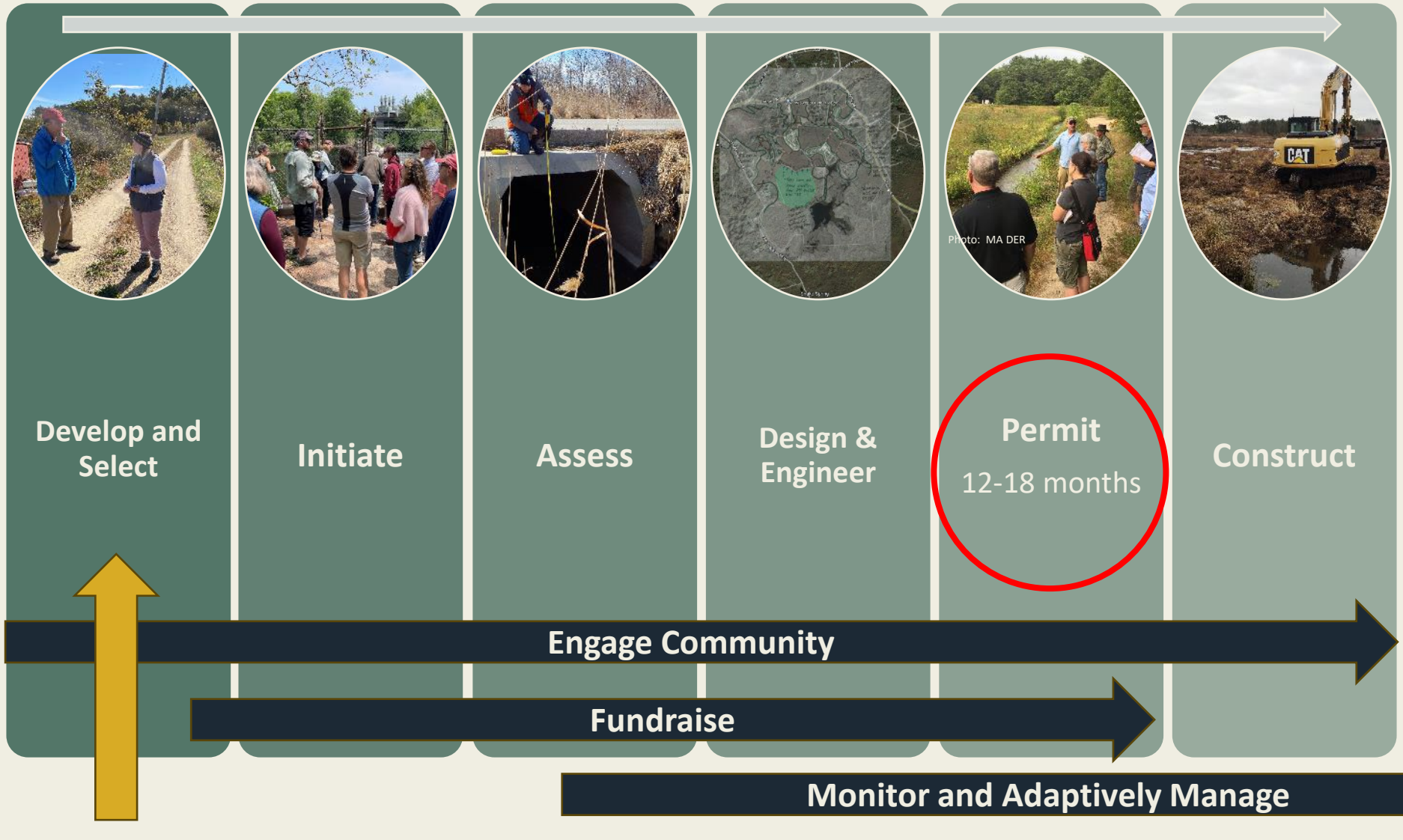


Recommendations

- Lower River Fringing Marshes and Horseneck – restore hydrology (moderate effort), ensure continued foraging habitat
- Upper River Fringing Marshes – restore hydrology (light effort), seek migration opportunities
- Ponds – protect marshes and carefully evaluate outlet opening, manage invasives, seek migration opportunities (phased)
- Lower Islands East Branch – Sediment placement and erosion protection (oysters with TNC?)
- Upper Islands East Branch – Consider cost/benefit, sediment placement, erosion protection (oysters with TNC?)

Projects happen in phases

Overlapping and iterative



Funding and Permitting to Support Restoration Projects

Heidi Ricci
Director of Policy and Advocacy
Mass Audubon
hricci@massaudubon.org

State Policy & Planning Context

Restoration helps achieve many of our broader state goals.

- ★ Climate adaptation and resilience
- ★ Climate change mitigation
- ★ Enhancing biodiversity
- ★ Ensuring environmental justice

…"the Department [of Fish and Game] recognizes a need to collaborate with municipal, state, and federal agencies to improve and streamline permitting pathways and guidelines to accelerate the pace of ecological restoration, climate mitigation, and climate adaptation projects."

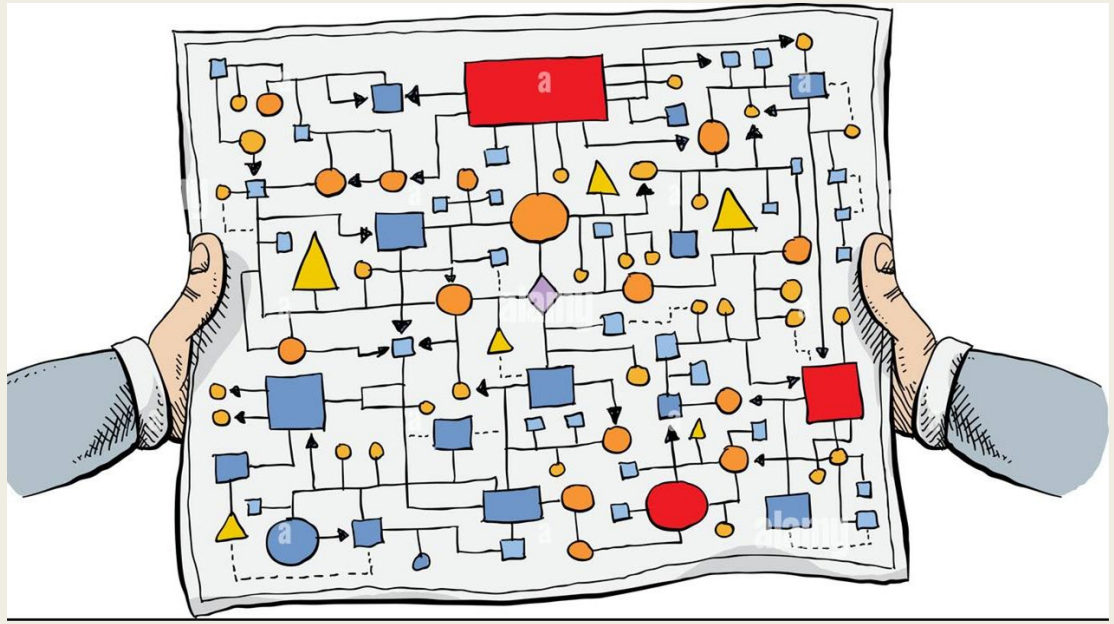
DFG Strategic Plan, 2024



Complex Regulatory Framework

Designed for development, not restoration

- Wetlands Protection Act and local bylaws
- DEP 401 Dredging and WQ Certification
- DEP Ch. 91 Tidelands licensing
- Coastal Zone Management
  federal consistency review
- Areas of Critical Environmental Concern
- MA Endangered Species Act
- Massachusetts Environmental Policy Act
- Army Corps of Engineers – General Permit



And more….

Unless we greatly accelerate the pace of restoration now, we will lose critical ecosystem services and will require more expensive and invasive restoration techniques

Funding and Streamlining Restoration

Mass Ready Act – $3.5 billion Environmental Bond bill

H.5518/S.3064, *An Act to build resilience for Massachusetts Communities*

- Funding land and water conservation and restoration projects
- Permit streamlining for Restoration & Nature-based Solutions

Regulatory Streamlining and Improved Coordination

- Supported by more than 60 organizations/municipalities
- Working with state and federal agencies





www.massaudubon.org/wetlandrestoration

Sign up today!

Mass Audubon



Wetlands Workforce Model

The power of people to implement restoration at pace and at scale:

- 23 techs and coordinators
- 1,000 acres
- 500 ditches
- 2 ½ months

Resources

Data/Decisionmaking

Salt Marsh Framework Web App https://arcg.is/08i9bH
massaudubon.org/our-work/resilient-lands/coastal-resilience/salt-marsh-framework

MassMarsh Remote Sensing Portal
umass.edu/gloucester-marine-station/mass-marsh/remote-sensing-portal

UMass Blue Carbon map https://www.umass.edu/geological-survey/blue-carbon

Funding/Grants

EEA Climate One-Stop grants mass.gov/environment-climate-one-stop

NEEFC Environmental Funding Navigator neefc.org/environmental-funding-navigator/

SNEP Network Tools and Resources snepnetwork.org

Southeast New England Program (SNEP) Network

a program of the **new england environmental finance center**

Empowering communities to achieve healthy watersheds, sustainable financing, and long-term climate resilience.

Who We Are

The SNEP Network, created in 2019, consists of over a dozen partner organizations who collaborate to address the region's stormwater and watershed management, ecological restoration, and sustainable financing challenges.

What We Do

We offer **free training, tools, and technical/financial assistance** to municipalities, organizations, and Tribes, working collaboratively with communities to **build local capacity** and advance community projects from planning to financing and implementation.

Thank you!

Mass Audubon