Salt Marsh Restoration: Planning and Implementation

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Tatia Bauer, Regional Stewardship Manager

December 21, 2023

Overview

I. Introduction (Jeremy)

II. Restoration at Old Pond Marsh (Tatia)

III. Restoration opportunities in York (Jeremy)

IV. Questions (We've got a lot. I hope you do, too!)

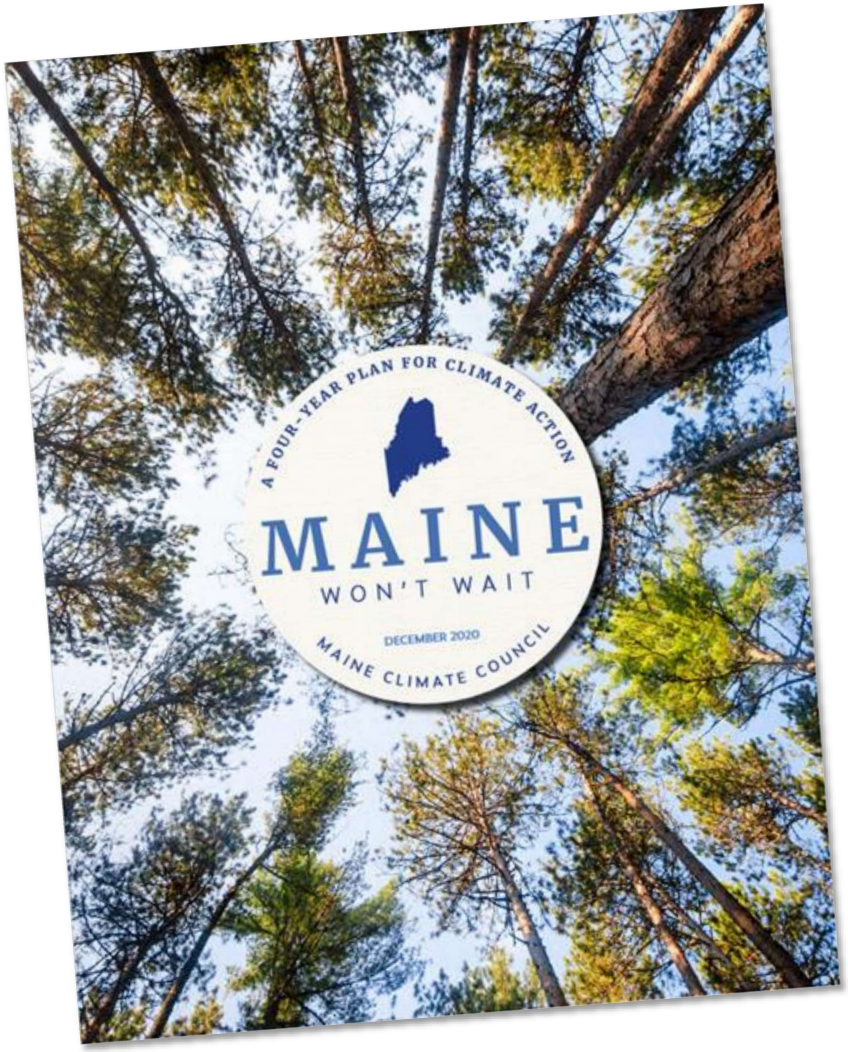
Maine Coast Heritage Trust

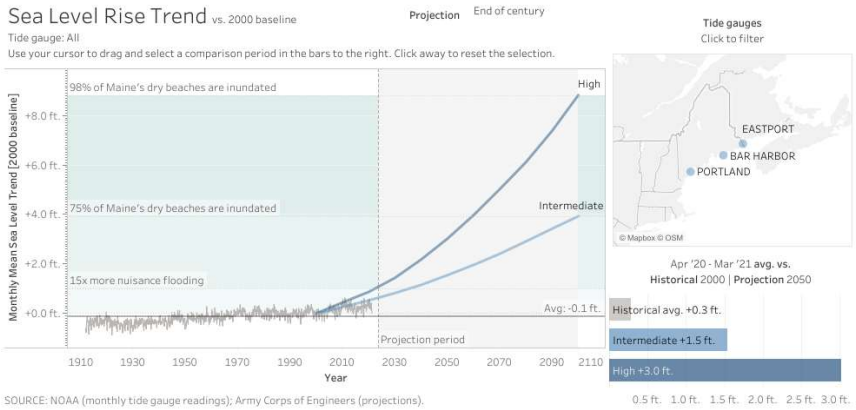
Maine Coast Heritage Trust (MCHT) conserves and stewards Maine's coastal lands and islands for their renowned scenic beauty, ecological value, outdoor recreational opportunities, and contribution to community well-being. MCHT provides statewide conservation leadership through its work with land trusts, coastal communities and other partners.


Old Pond Preserve, Hancock

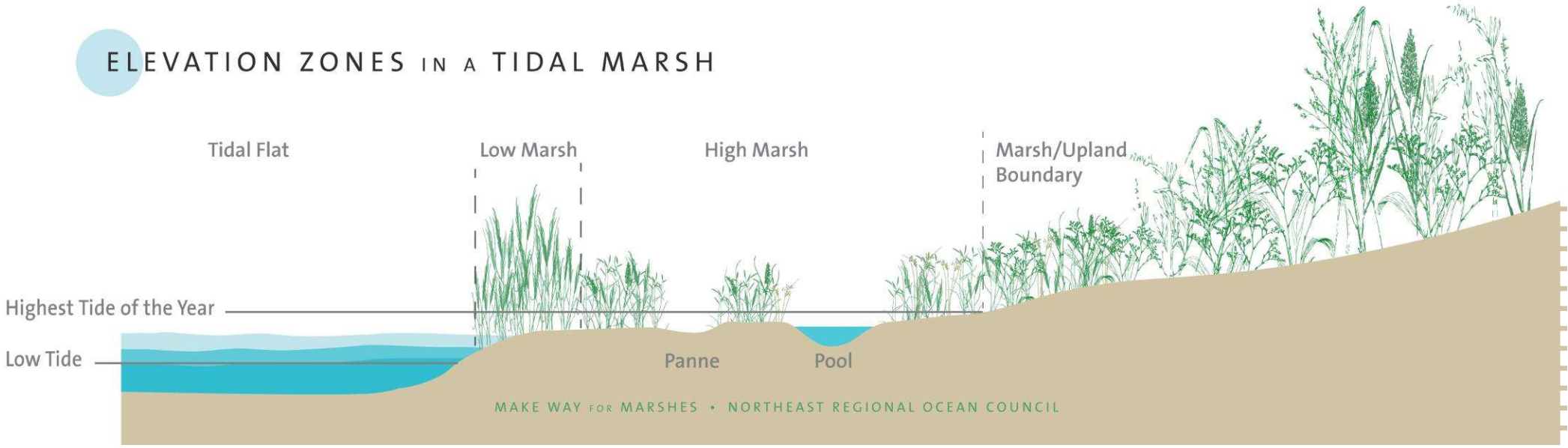
Collaborative Approach to Marsh Resiliency: 3-legged stool

- Land Protection
- Restoration
- Tidal restrictions

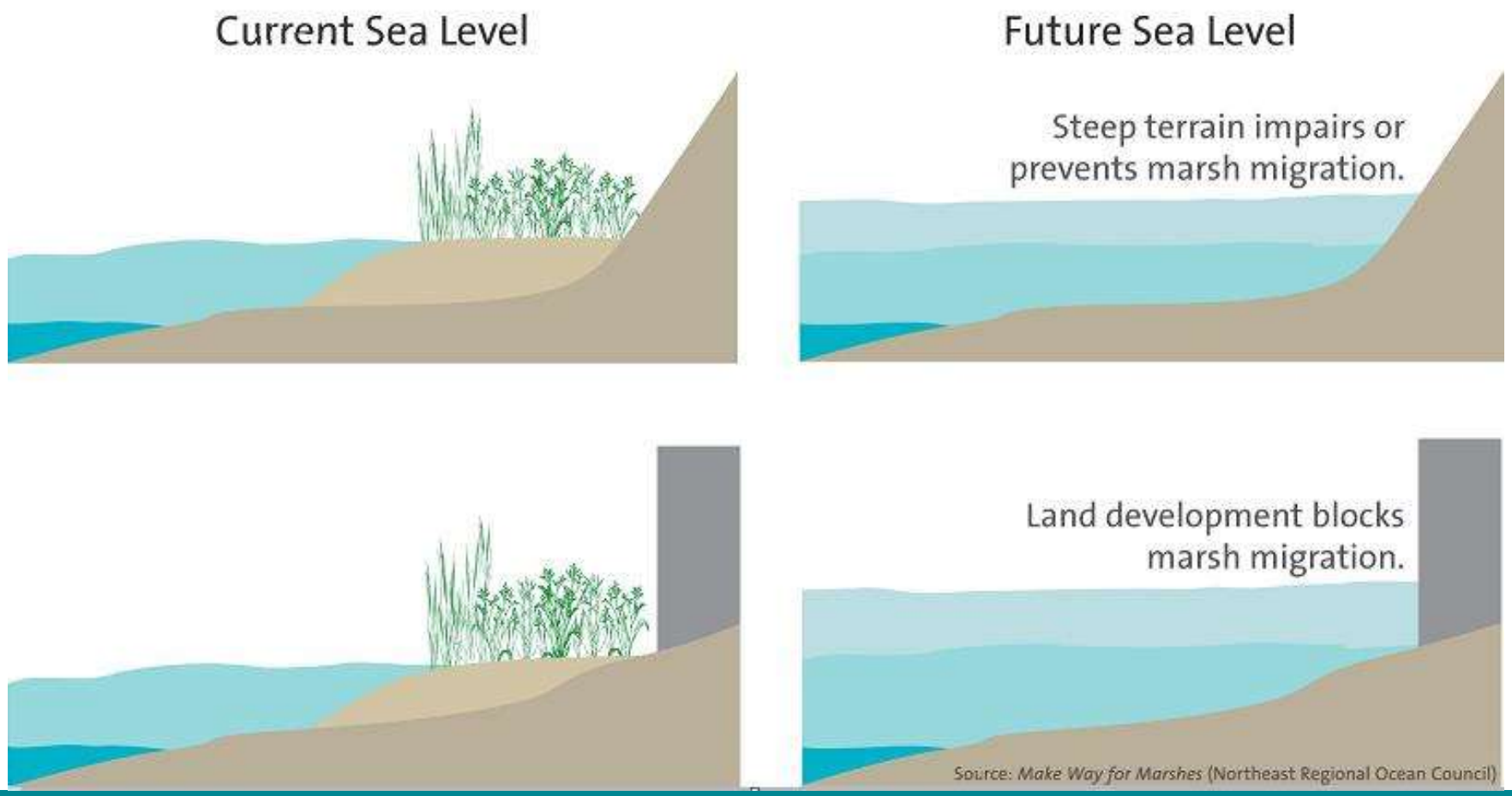


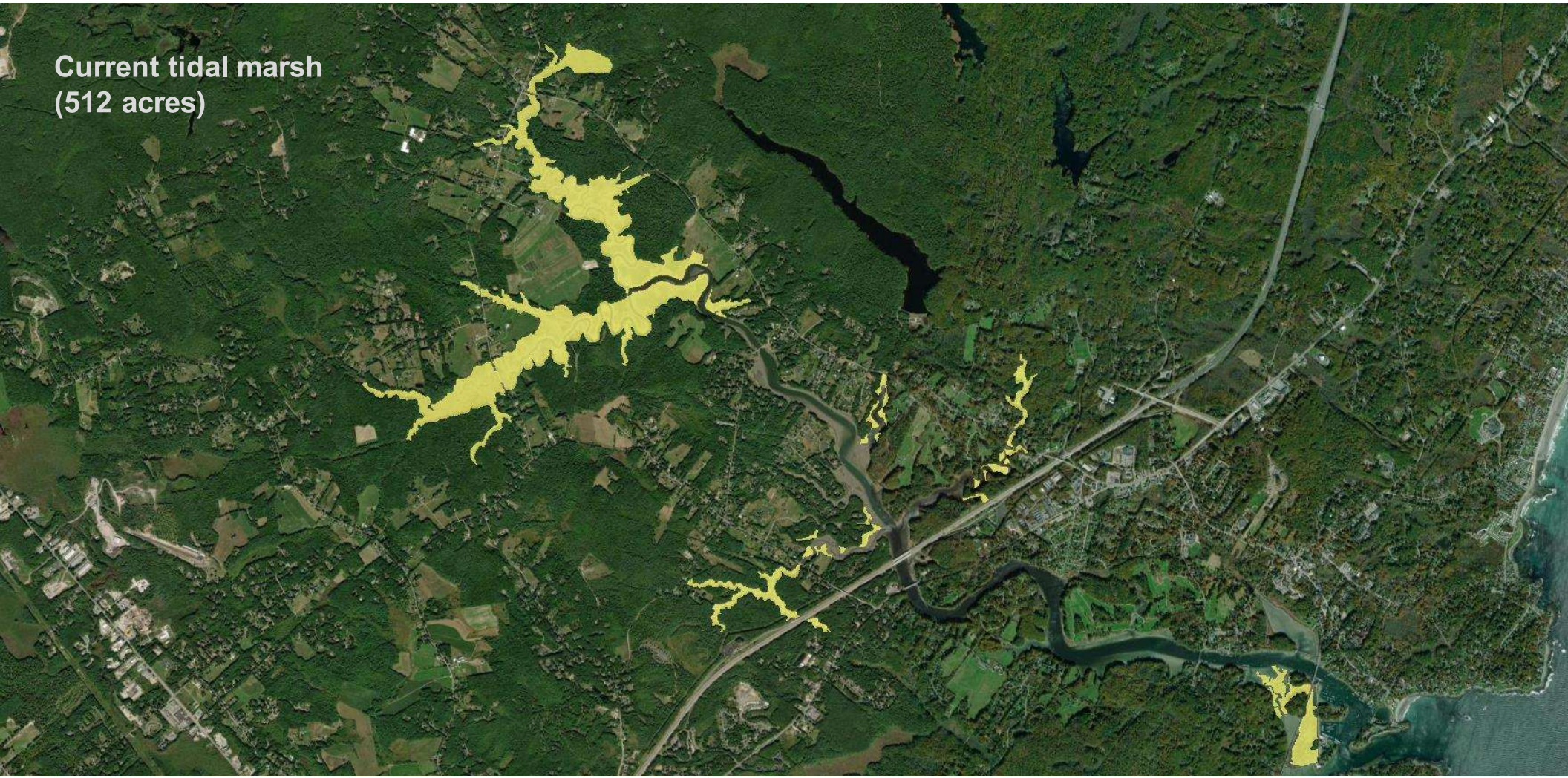


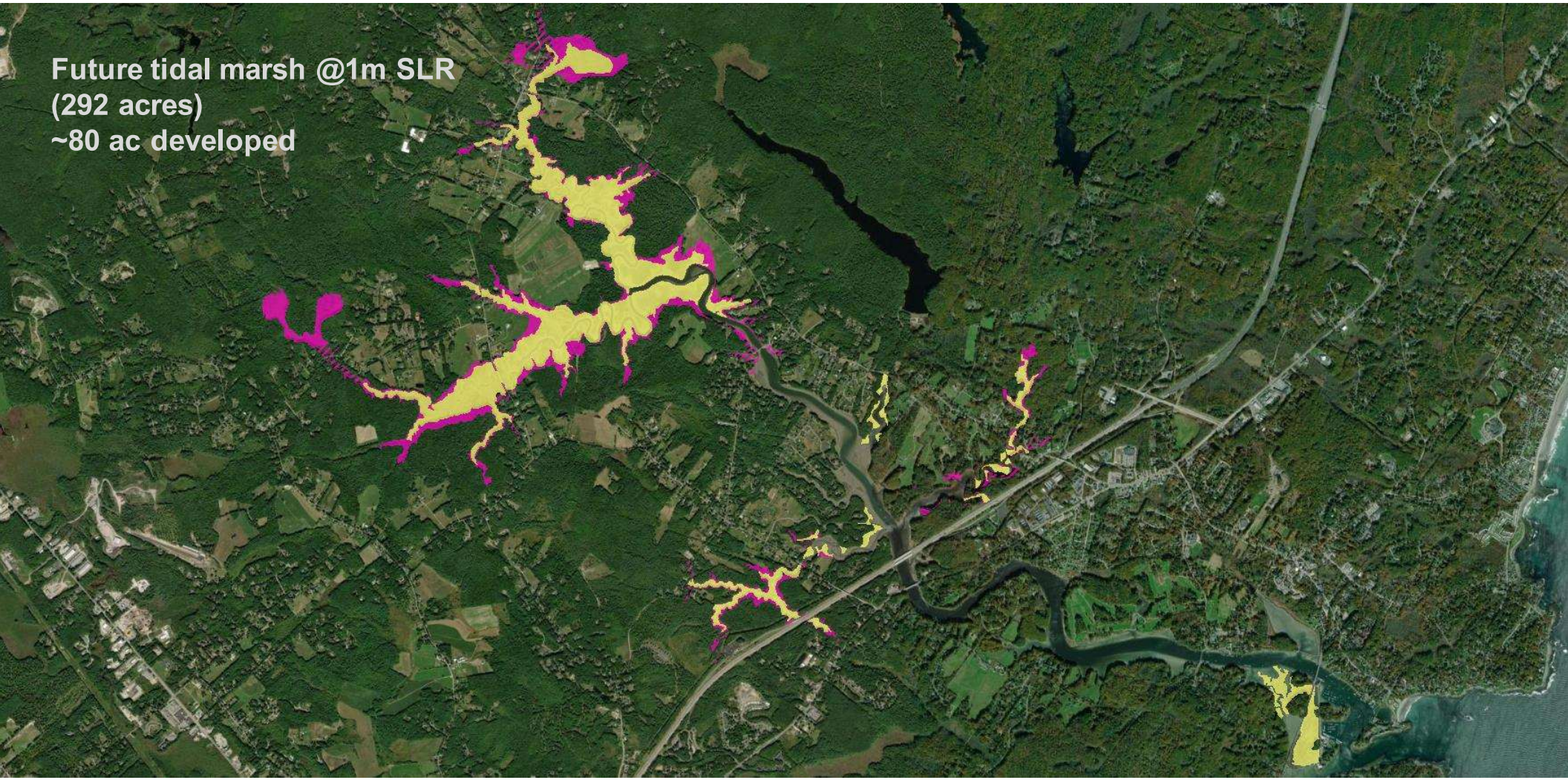
"Manage for 1.5 feet of relative sea-level rise by 2050 and 3.9 feet of relative sea-level rise by 2100, and consider preparing to manage for 8.8 feet of sea-level rise by 2100, especially for low-risk-tolerant infrastructure."

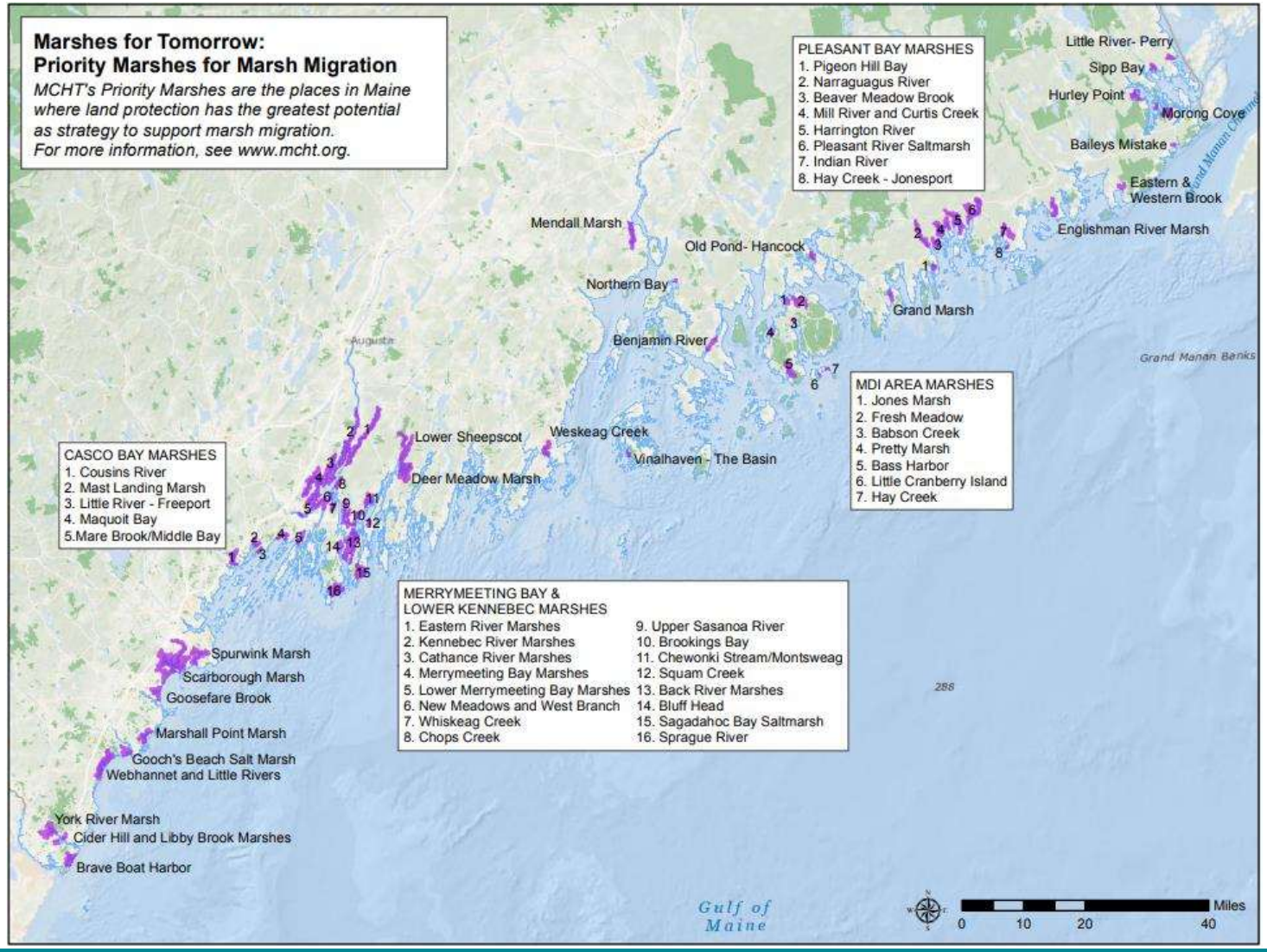

ELEVATION ZONES IN A TIDAL MARSH
Tidal Flat
Low Marsh
High Marsh
Marsh/Upland Boundary
Highest Tide of the Year
Low Tide
Panne
Pool
MAKE WAY FOR MARSHES • NORTHEAST REGIONAL OCEAN COUNCIL

BARRIERS TO MARSH MIGRATION

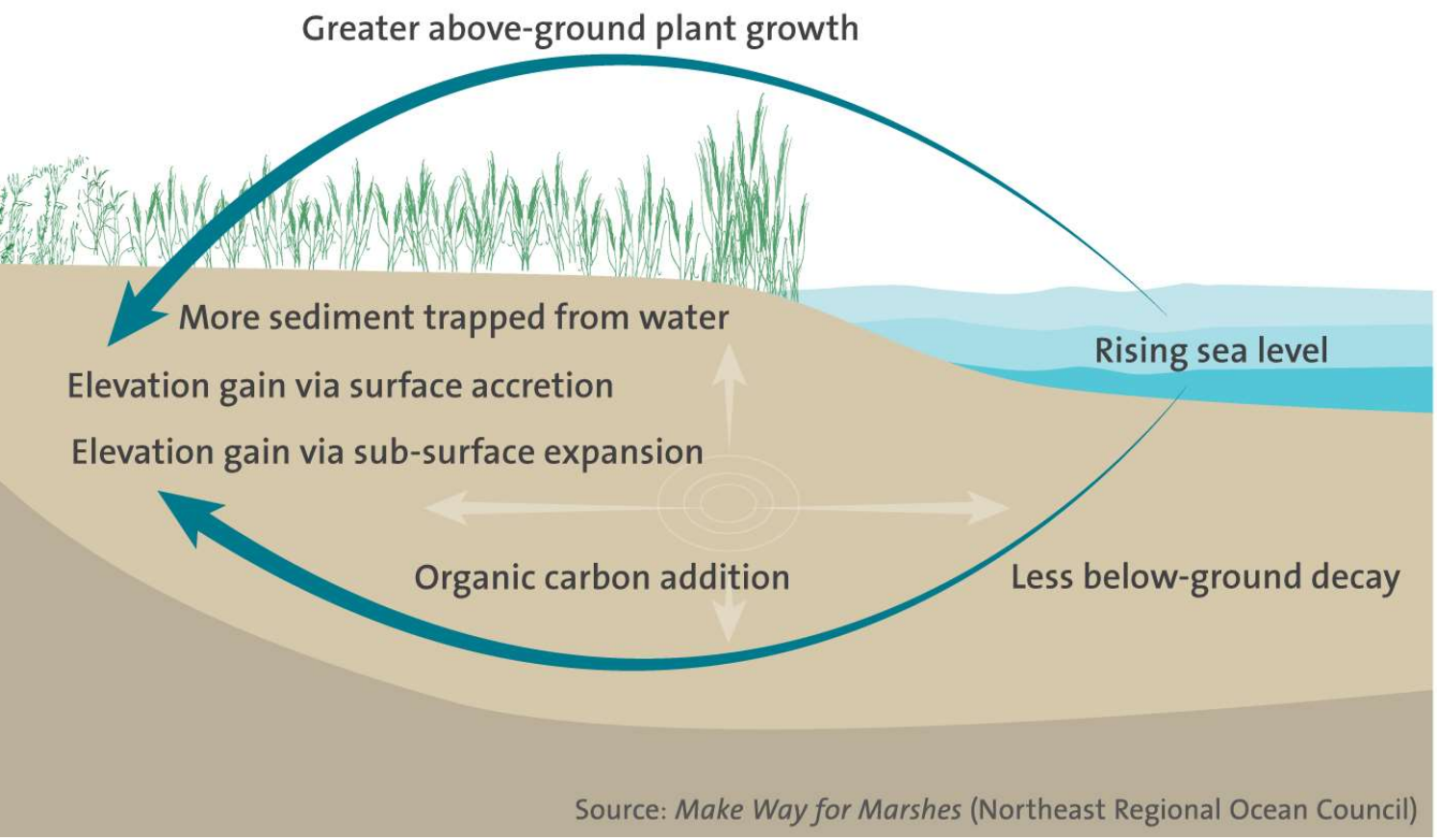



Current tidal marsh
(512 acres)


Future tidal marsh @1m SLR
(292 acres)
~80 ac developed


Marshes for Tomorrow:
Priority Marshes for Marsh Migration
MCHT's Priority Marshes are the places in Maine where land protection has the greatest potential as strategy to support marsh migration.
For more information, see www.mcht.org.
PLEASANT BAY MARSHES
1. Pigeon Hill Bay
2. Narraguagus River
3. Beaver Meadow Brook
4. Mill River and Curtis Creek
5. Harrington River
6. Pleasant River Saltmarsh
7. Indian River
8. Hay Creek - Jonesport
Little River- Perry
Sipp Bay
Hurley Point
Morong Cove
Baileys Mistake
Eastern & Western Brook
Englishman River Marsh
Mendall Marsh
Old Pond- Hancock
Northern Bay
Grand Marsh
Benjamin River
Grand Manan Banks
MDI AREA MARSHES
1. Jones Marsh
2. Fresh Meadow
3. Babson Creek
4. Pretty Marsh
5. Bass Harbor
6. Little Cranberry Island
7. Hay Creek
Lower Sheepscot
Weskeag Creek
Vinalhaven - The Basin
Deer Meadow Marsh
CASCO BAY MARSHES
1. Cousins River
2. Mast Landing Marsh
3. Little River - Freeport
4. Maquoit Bay
5.Mare Brook/Middle Bay
MERRYMEETING BAY &
LOWER KENNEBEC MARSHES
1. Eastern River Marshes
2. Kennebec River Marshes
3. Cathance River Marshes
4. Merrymeeting Bay Marshes
5. Lower Merrymeeting Bay Marshes
6. New Meadows and West Branch
7. Whiskeag Creek
8. Chops Creek
9. Upper Sasanoa River
10. Brookings Bay
11. Chewonki Stream/Montsweag
12. Squam Creek
13. Back River Marshes
14. Bluff Head
15. Sagadahoc Bay Saltmarsh
16. Sprague River
Spurwink Marsh
Scarborough Marsh
Goosefare Brook
Marshall Point Marsh
Gooch's Beach Salt Marsh
Webhannet and Little Rivers
York River Marsh
Cider Hill and Libby Brook Marshes
Brave Boat Harbor
Gulf of Maine
Miles
0
10
20
40

INCREASE IN MARSH SURFACE ELEVATION



Marshes can also move up!

Maine Coast Heritage Trust

York River National Wild and Scenic River, December 2023

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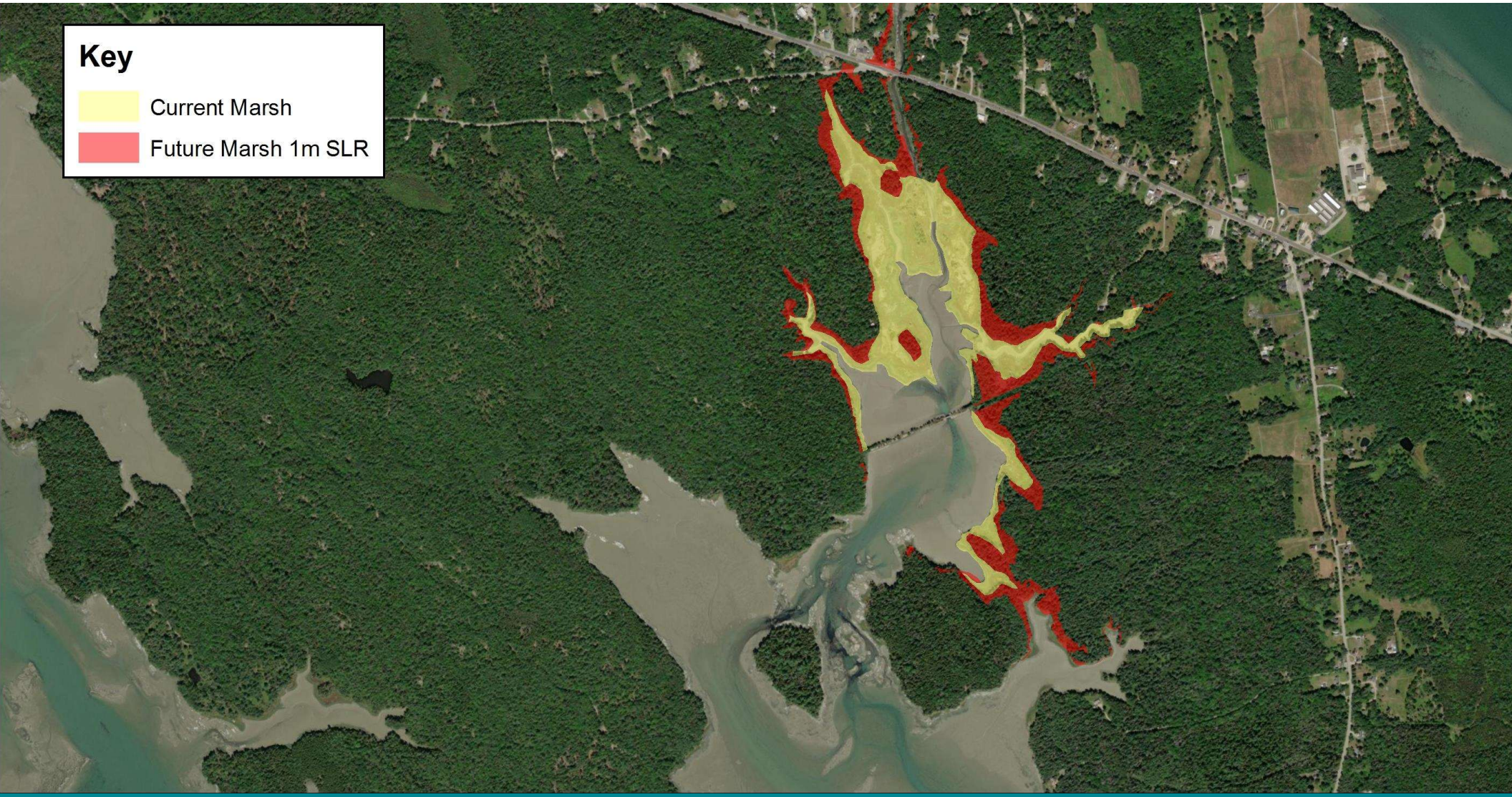
York River National Wild and Scenic River, December 2023


27 acres of marsh with two large pools (~13 acres)



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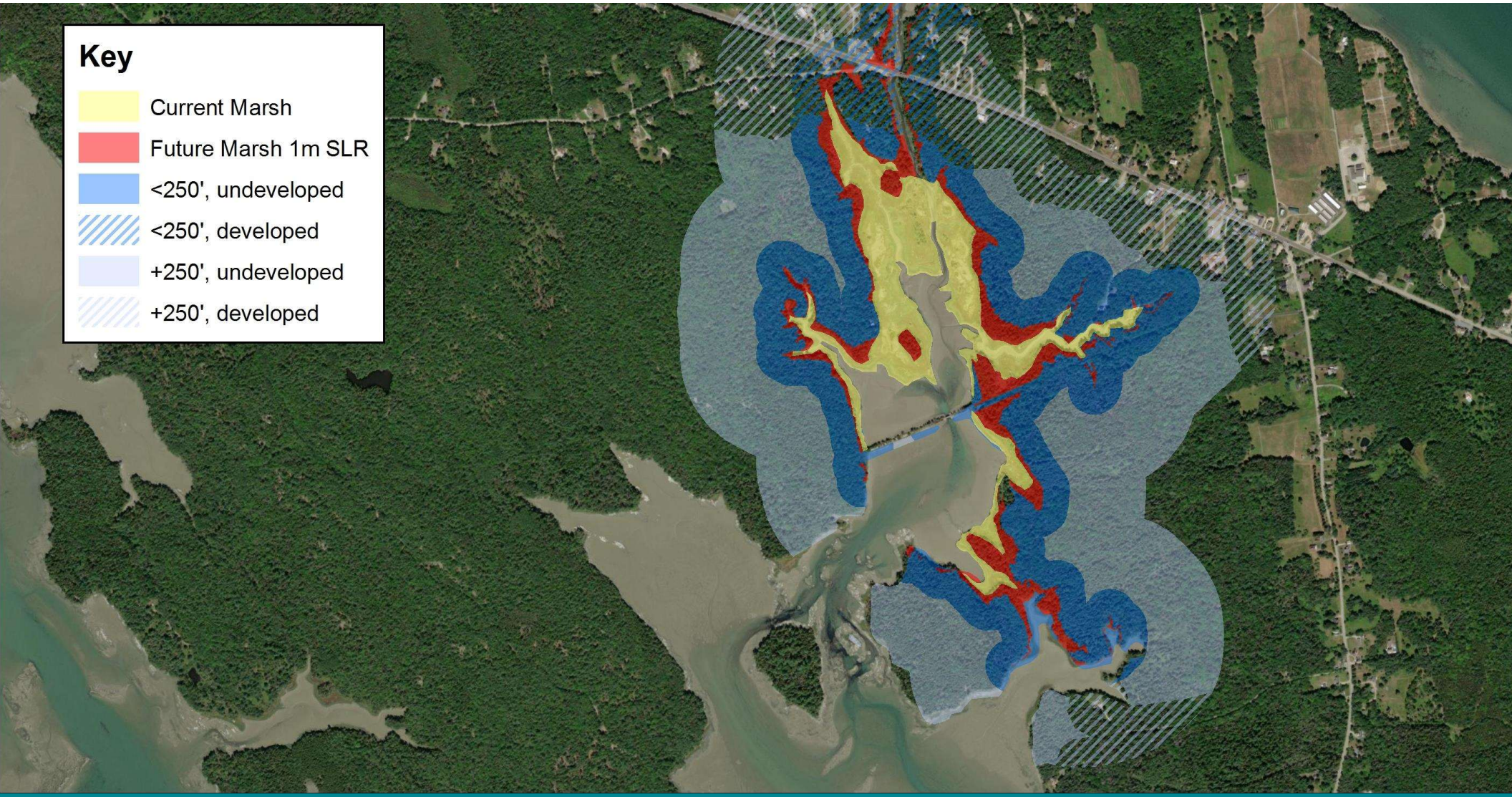

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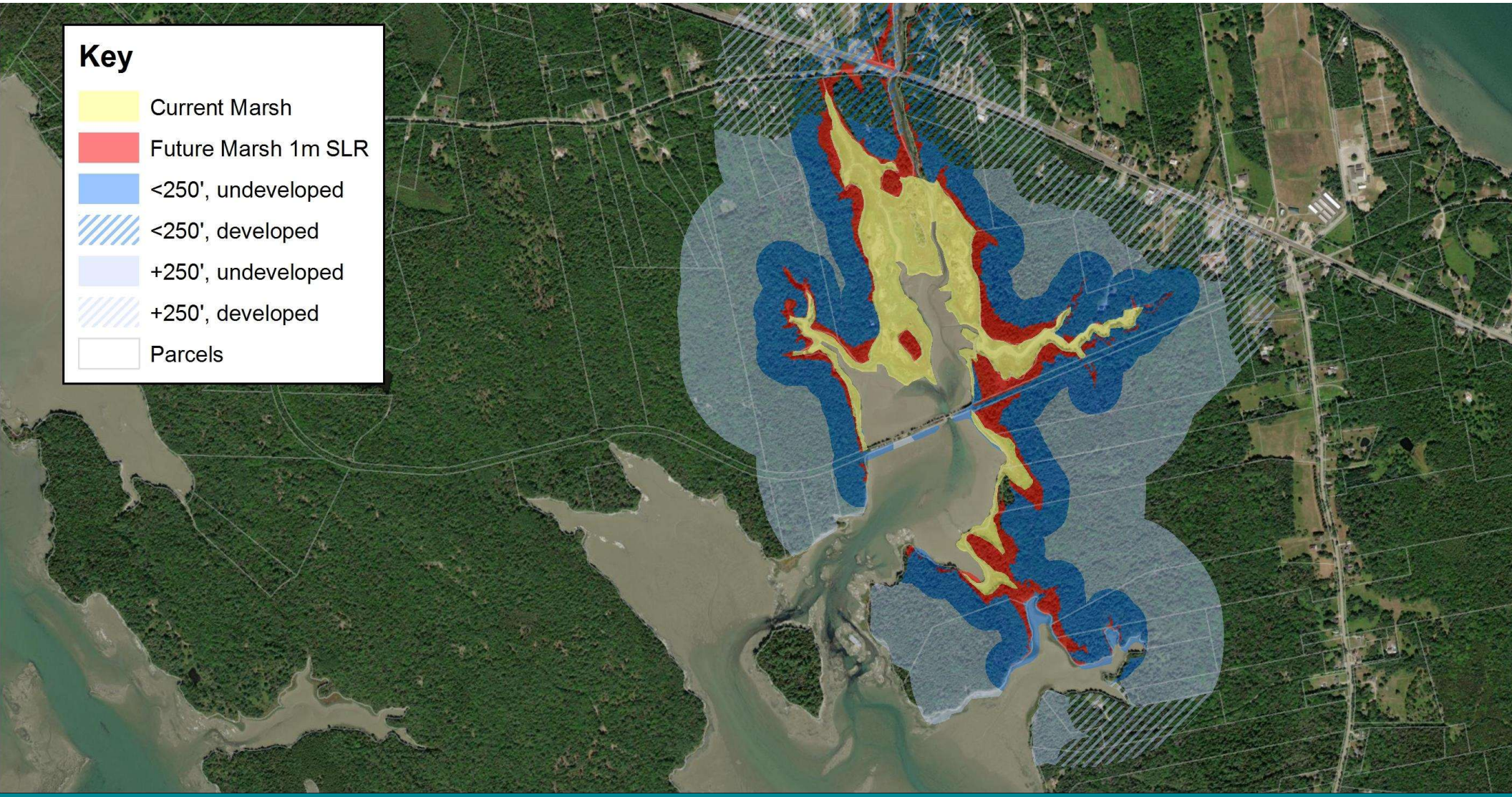

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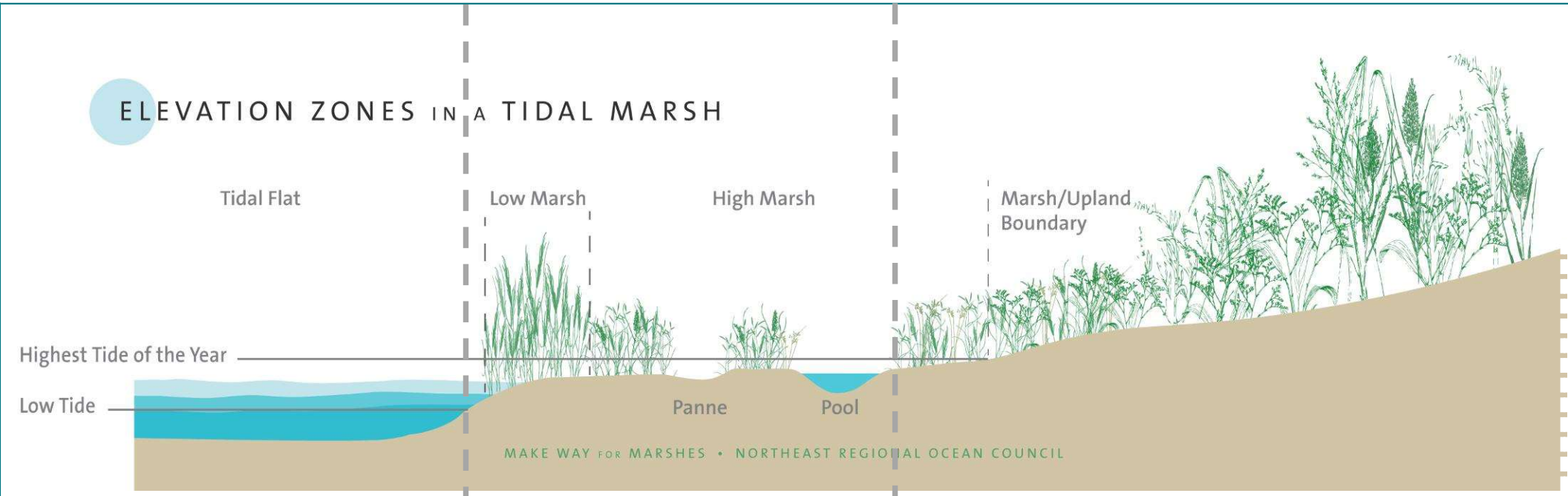
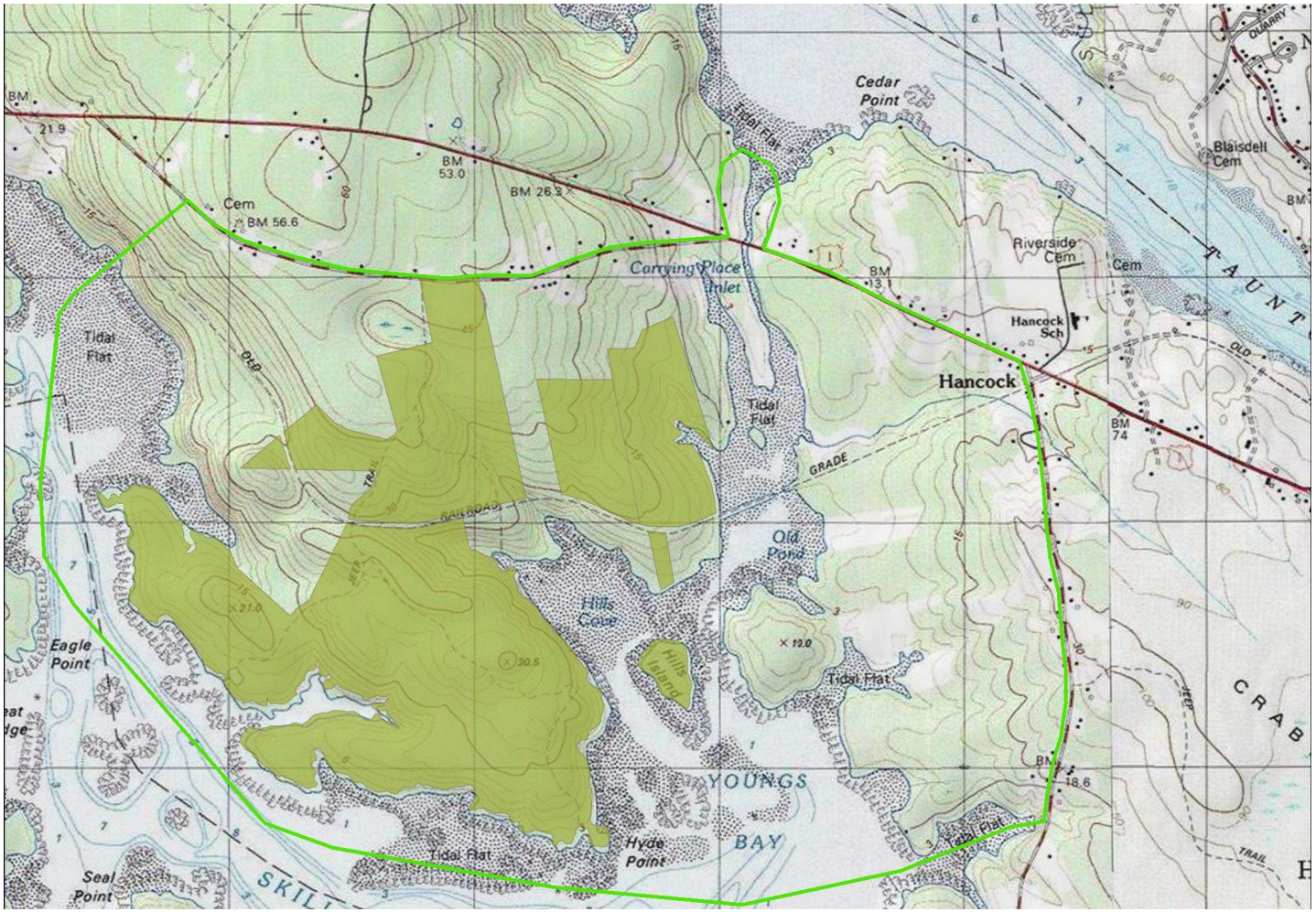
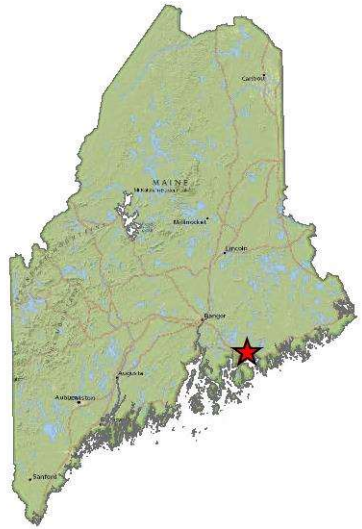
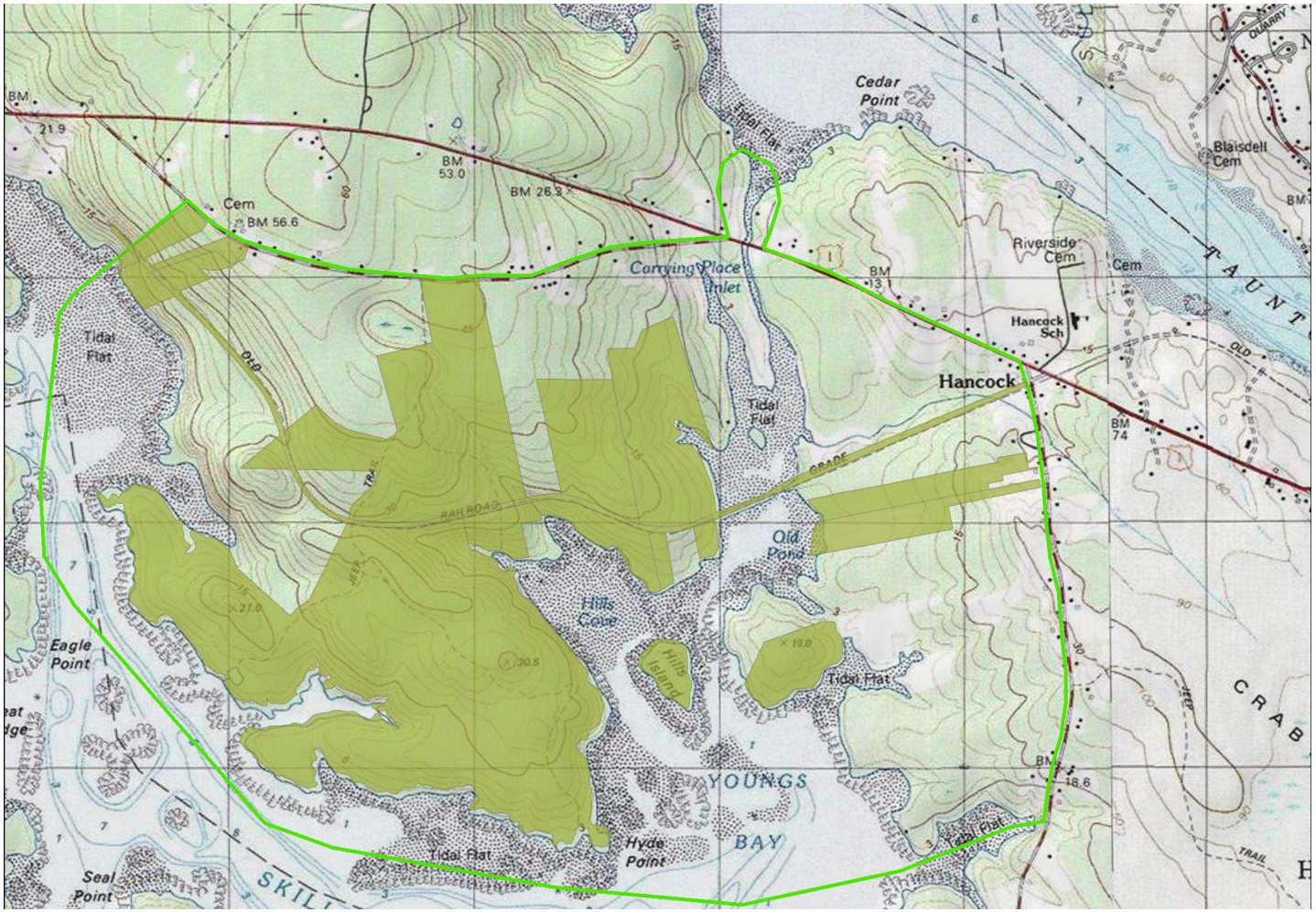


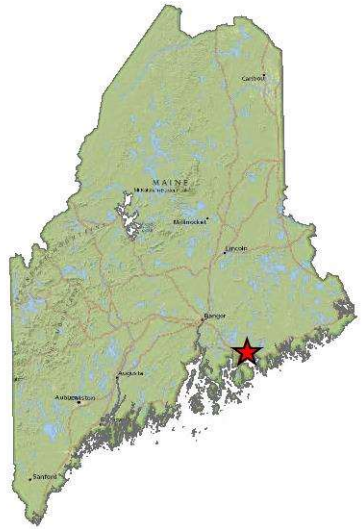
OWNERSHIP	State of Maine held in public trust	Typically private with public rights to “fish” “fowl” and “navigate”	Typically private with public rights as granted by gift, easement, etc.





Old Pond Whole Place Conservation





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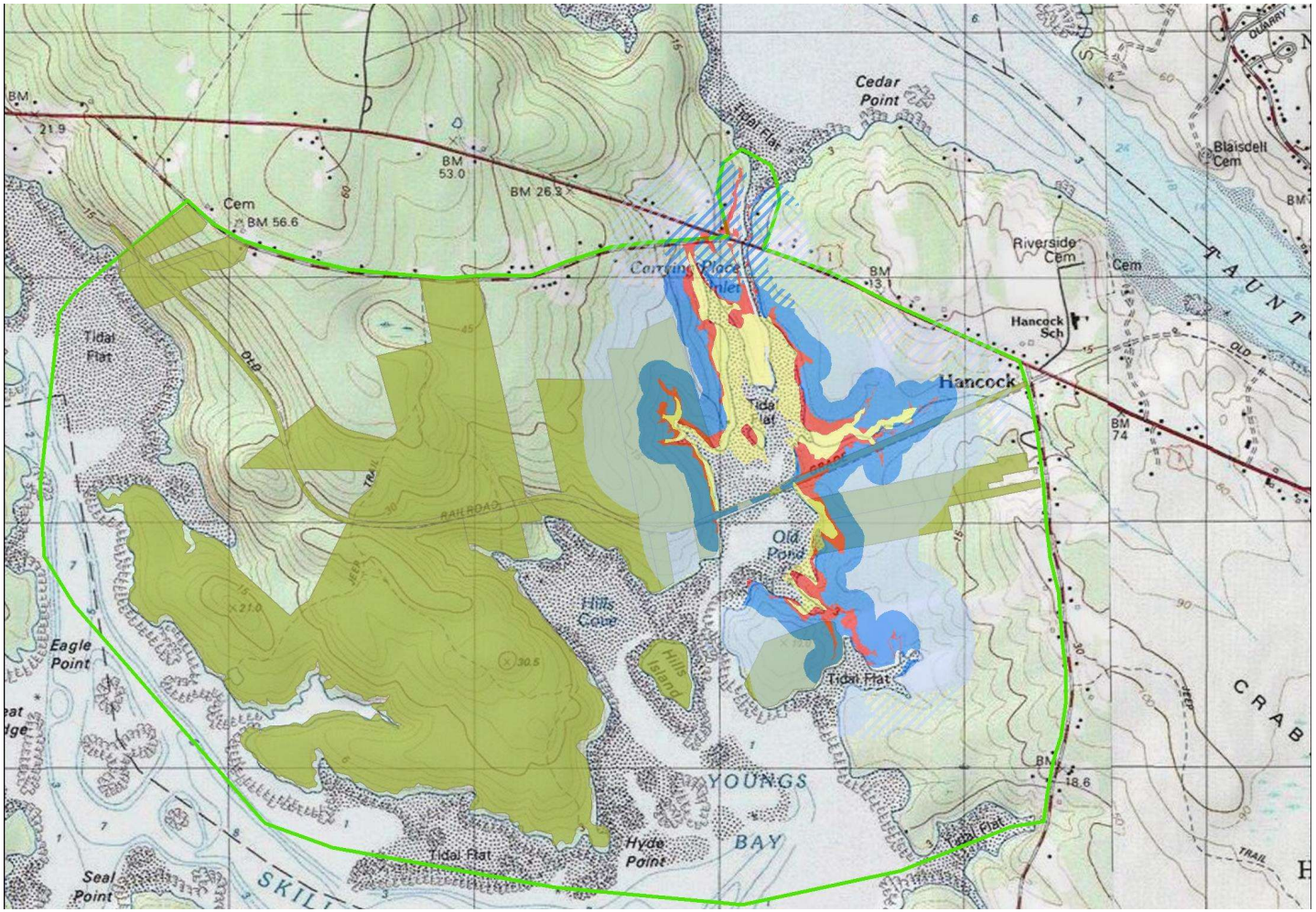

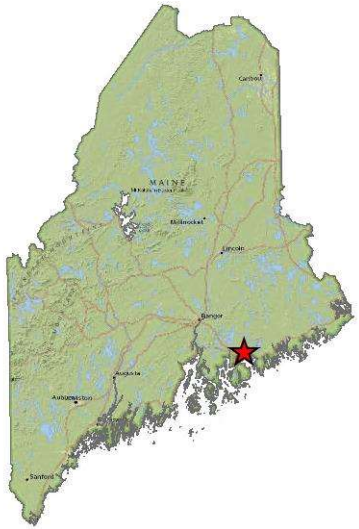

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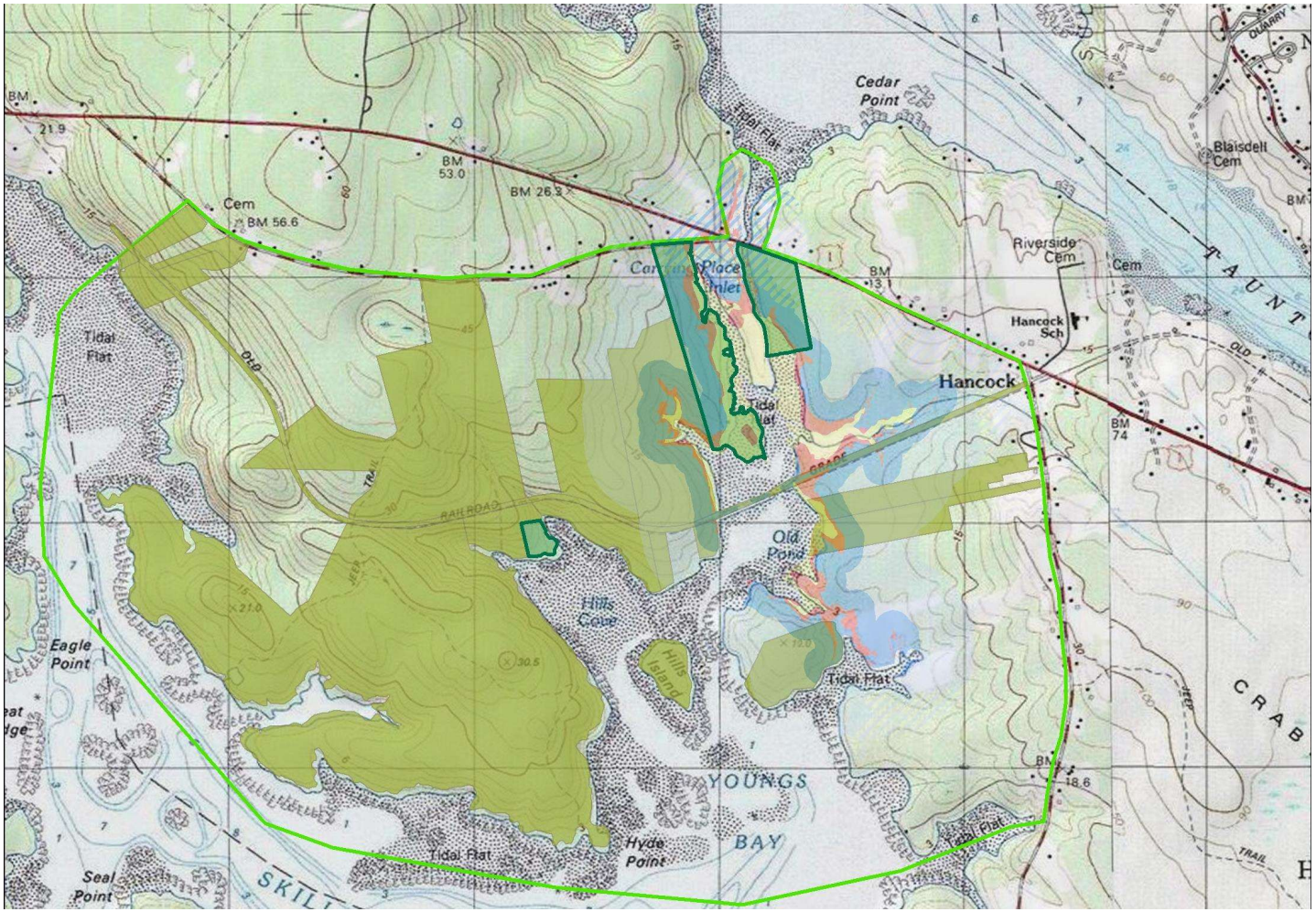

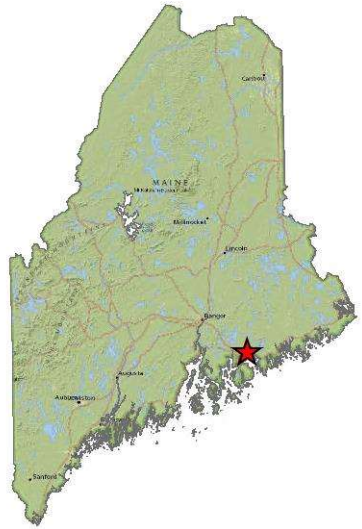

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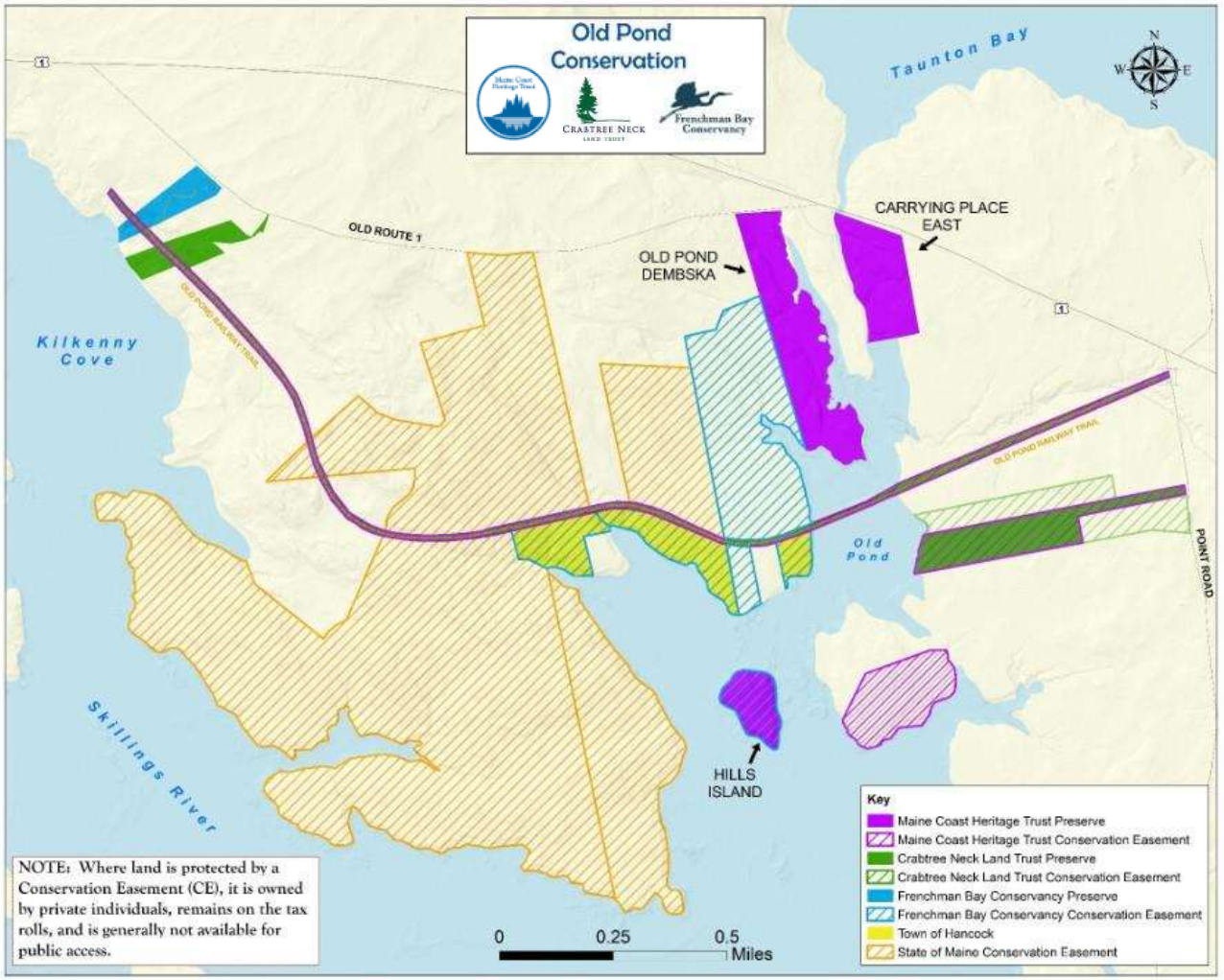
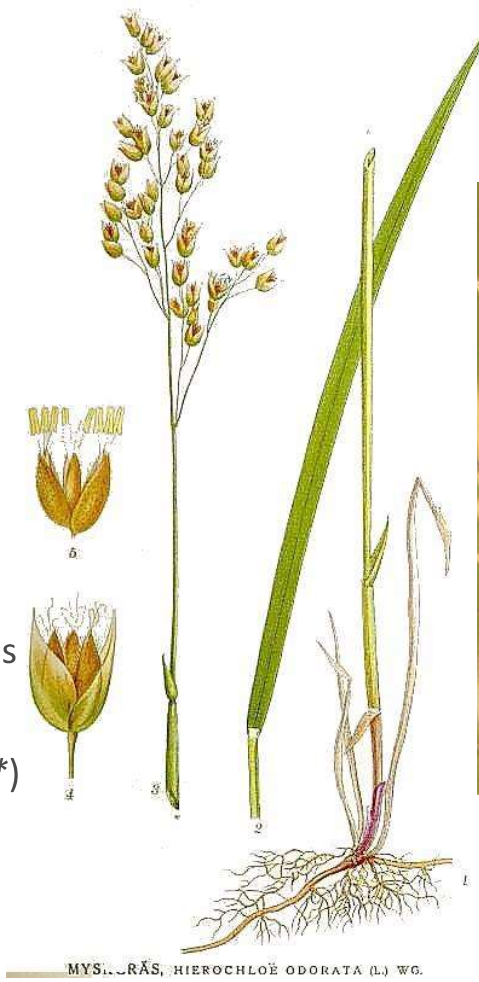

Old Pond Conservation
Crabtree Neck Land Trust
Frenchman Bay Conservancy
Taunton Bay
N
W
E
S
OLD ROUTE 1
CARRYING PLACE EAST
OLD POND DEMBSKA
Kilkenny Cove
OLD POND RAILWAY TRAIL
Old Pond
POINT ROAD
Skillings River
HILLS ISLAND
NOTE: Where land is protected by a Conservation Easement (CE), it is owned by private individuals, remains on the tax rolls, and is generally not available for public access.
0
0.25
0.5
Miles
Key
Maine Coast Heritage Trust Preserve
Maine Coast Heritage Trust Conservation Easement
Crabtree Neck Land Trust Preserve
Crabtree Neck Land Trust Conservation Easement
Frenchman Bay Conservancy Preserve
Frenchman Bay Conservancy Conservation Easement
Town of Hancock
State of Maine Conservation Easement

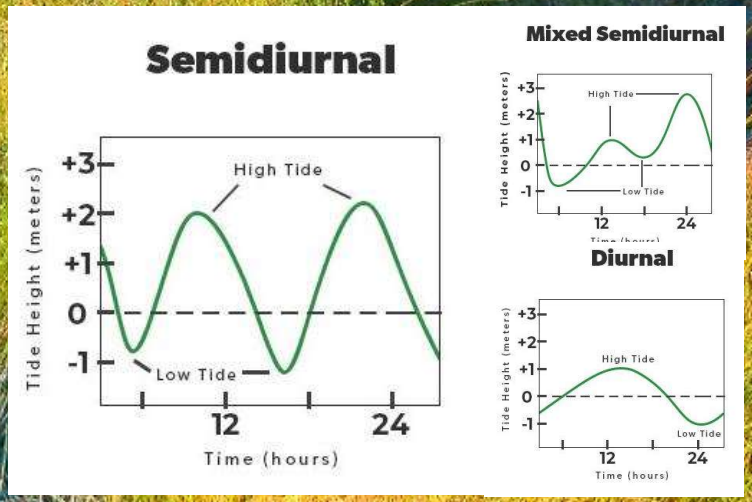
Why salt marsh restoration?

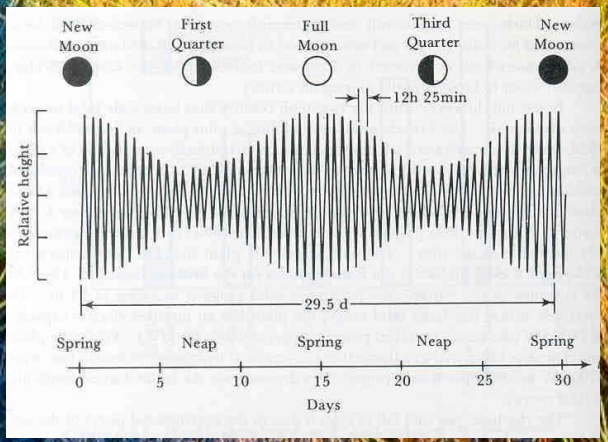
- Natural evolution from marsh/upland protection
- Highly modified and impaired systems
- Resiliency to SLR requires interventions
- Efforts are best option to save current marshes
- Marshes are important!
  - Habitat: Saltmarsh & Sharp-tailed sparrow, shorebirds
  - Nursery grounds
  - Cultural significance: sweet grass (*Hierchloe odorata**)
  - Carbon sequestration
  - Resiliency: buffer uplands and infrastructure



How do marshes function?

- Intertidal systems, semidiurnal
- Tidal flow brings salt water, sediment
  - Captured by plant stems and roots
  - Plant organic matter builds over time → carbon storage
- Each plant species adapted to specific inundation frequencies
  - Twice daily floods vs. twice monthly
  - Some air exposure
- Require
  - Sediment supply
  - Proper hydrology (vegetation)
- Can keep up with sea level rise*

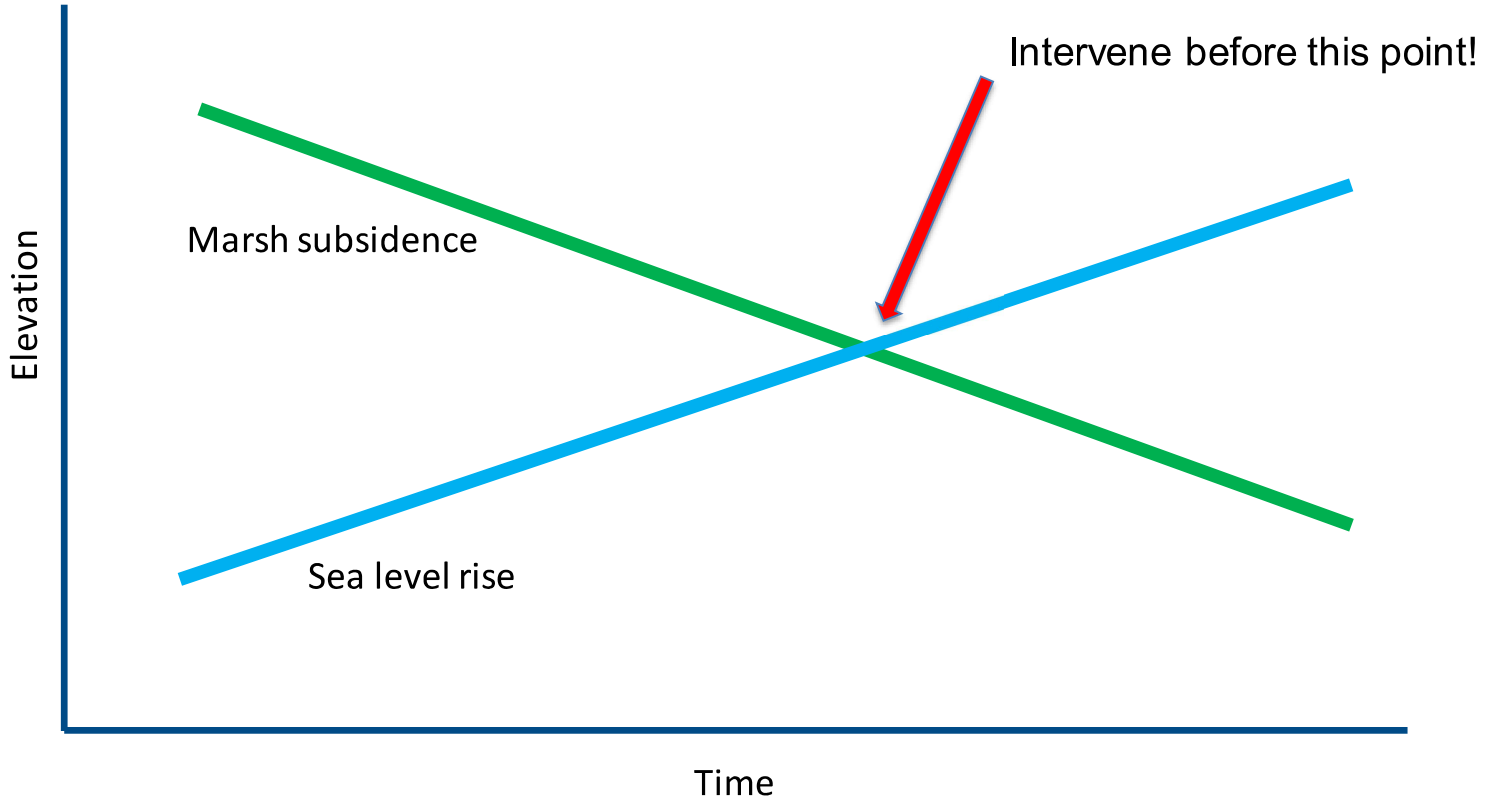




Marsh impairments

- How water flows on and off the marsh
- Tidal restrictions (e.g., undersized culverts)
- Extreme alterations to marsh platform
  - Salt hay agriculture
  - **Ditches** and **embankments** (infrastructure)
  - 90% + of east coast marshes
- Both lead to marsh subsidence (sinking)
  - Loss of habitat + carbon
  - Decreased resiliency
- Race against time

Salisbury Marsh, MA
Google images


Intervene before this point!
Marsh subsidence
Sea level rise
Elevation
Time

Owner type	Acres	Percent of total candidate acreage (18,159)
Federal	2,680	14.7%
State	4,186	23%
Municipal	407	2%
Land Trusts	1,894	10.4%
Private, non-conserved	8,800	48.4%

Salt Marsh Adaptation and Resiliency Team (SMARTeam)

A group committed to working with partners to restore northeast salt marshes and prepare them for SLR and marsh migration

- 20+ members—researchers, managers, restoration practitioners
- 3-person design review team
  - Susan Adamowicz, Rachel Carson Wildlife Refuge, USFWS
  - Geoff Wilson, Northeast Wetland Restoration
  - David Burdick, University of New Hampshire
- Restoration design and implementation for the Northeast Region
- Decoding and interpreting impacts of **salt hay agriculture**

Salt hay agriculture

- 1600's – 1900's
- "Reclaiming marshlands"
  - Block out saltwater via **embankments**
  - Systematically drain surface with **ditches**
- Productive soils, less work (?)
- Crops for livestock/horses
- Highly profitable
- Methods changed through time, layered infrastructure
- Now unmaintained, but altering hydrology

Essex County Historical Collections, accessed via https://archive.org/details/essexinstitutehi47esseuoft
The Salt marshes of the Massachusetts Coast by Henry Follansbee Long

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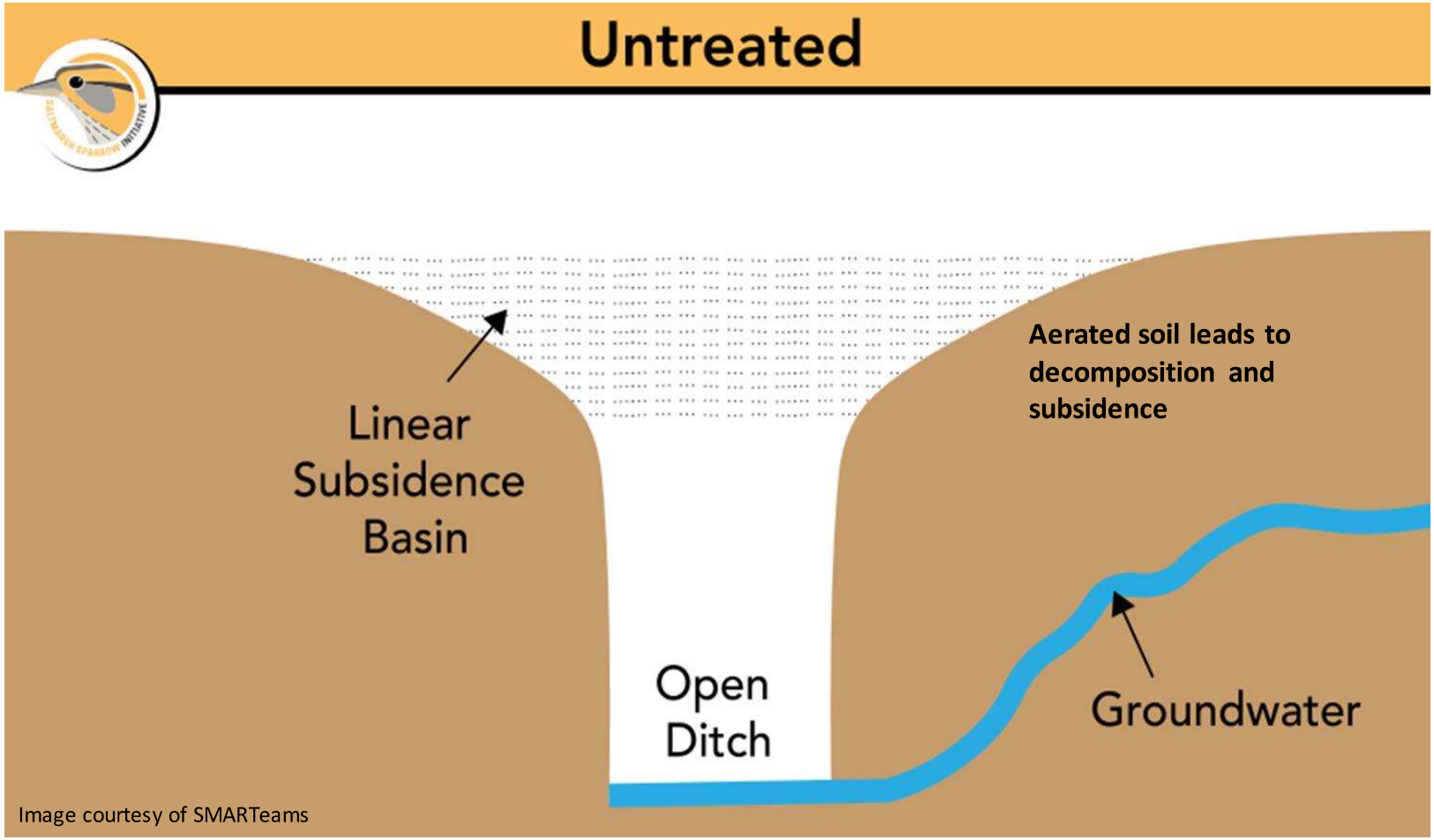
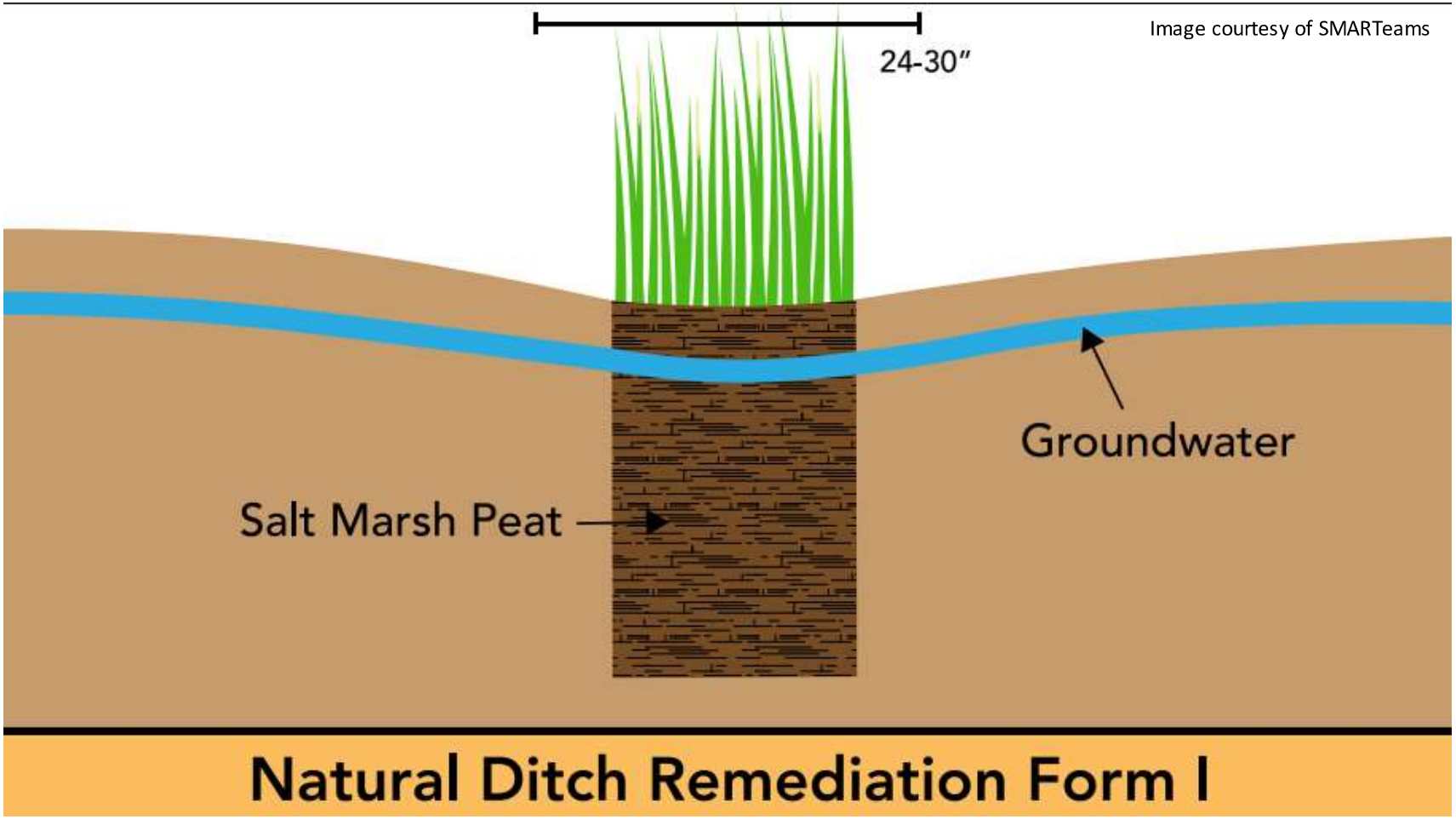
Oxidative subsidence trajectory



Oxidative subsidence trajectory

Image courtesy of SMARTeams



“Zombie ditches”

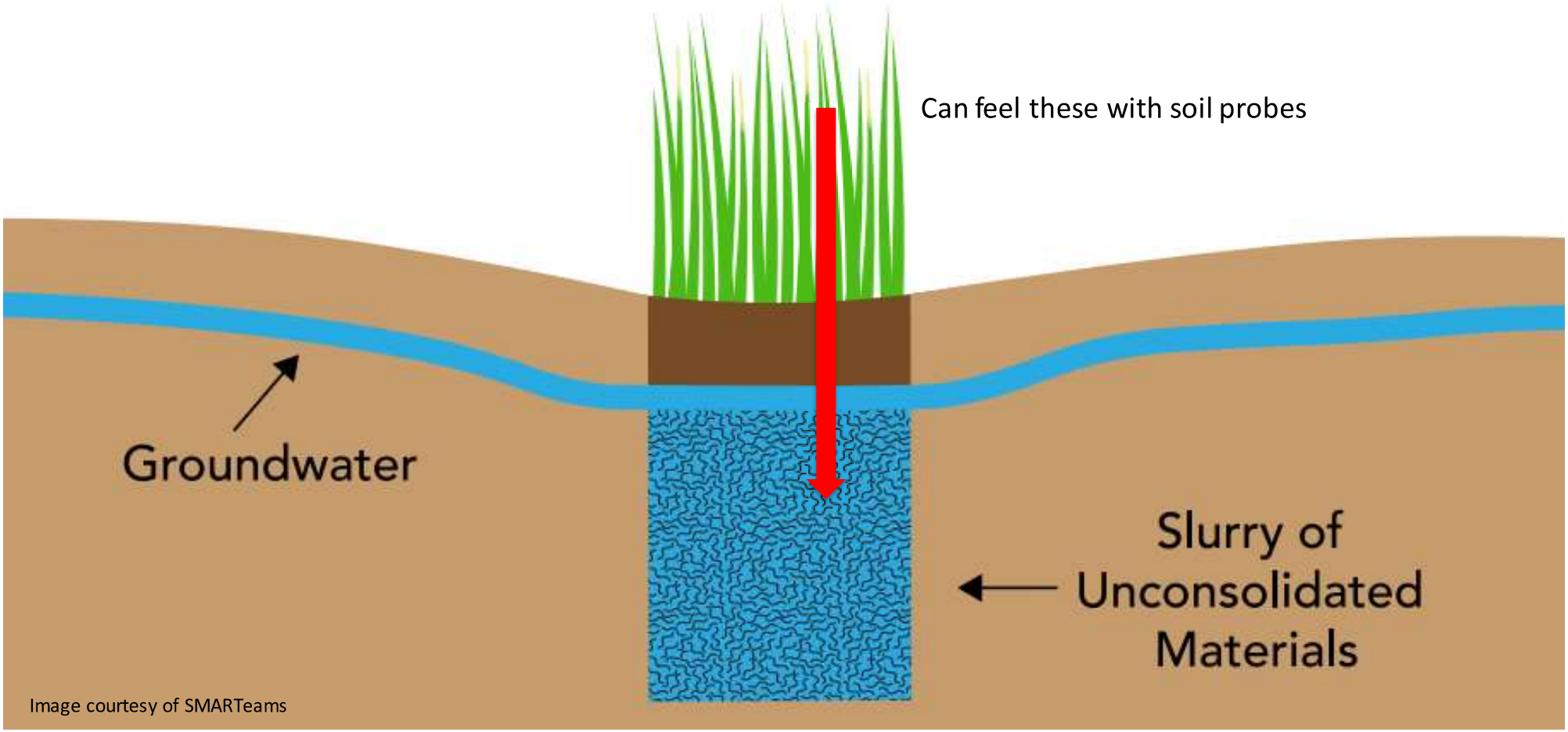


Image courtesy of SMARTeams

Waterlogging subsidence trajectory

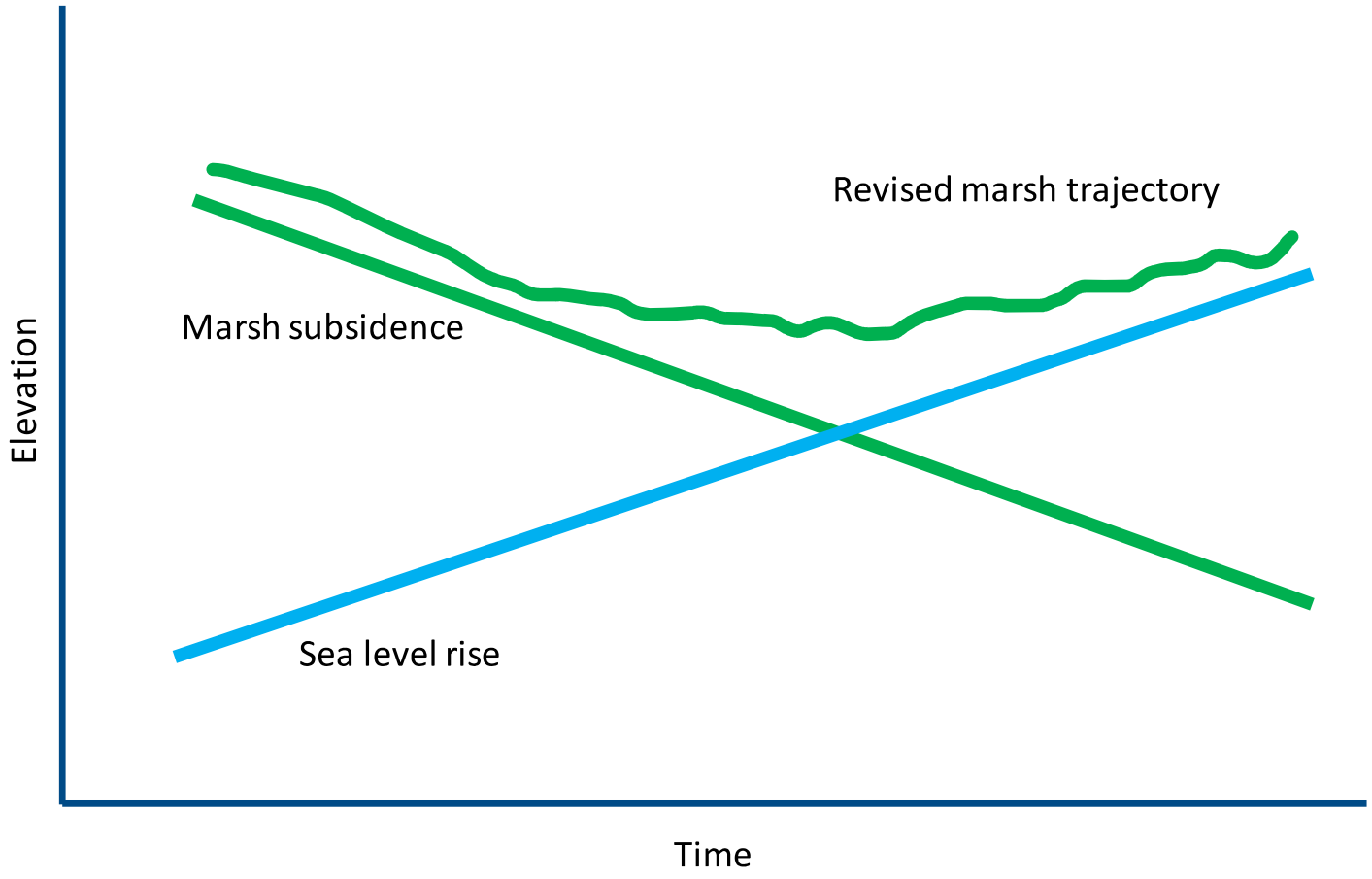
- Clogged ditches
- Water cannot properly drain
- Stagnation, reduced flushing
- Vegetation die-off
- Sudden root collapse → subsidence
- Decomposition
- Expansion over time
- **Reduced resiliency**

Old Pond Marsh, Hancock, ME
Photo credit: Tatia Bauer

Old Pond Marsh, Hancock, ME
Photo credit: Tatia Bauer

2007

2018


Revised marsh trajectory
Marsh subsidence
Sea level rise
Elevation
Time

Restoring marsh functions

Goal: establish single channel hydrology

1. Ditch remediation
   - Reduce ditch density
   - Halt oxidative subsidence
2. Channel remediation
   - Drain pools
   - Reintroduce tidal flow
   - Reestablish vegetation

Old Pond Marsh, Hancock, ME
Photo credit: Tatia Bauer

Ditch remediation

Halt oxidation, rebuild elevation

- Fall, peak biomass
- Mow vegetation, roll
- Place in treatment ditches
- Repeat for 2-4 years (or longer)

Burdick et al. 2019; Mitigating the Legacy Effects of Ditching in a New England Salt Marsh

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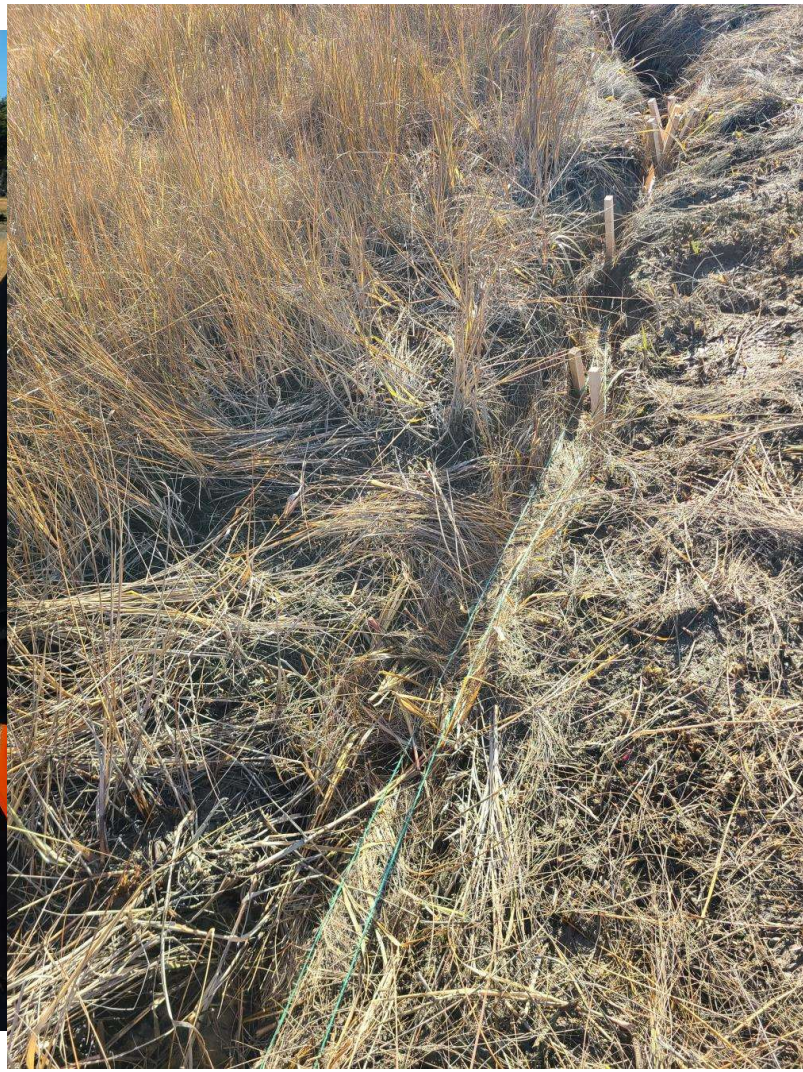

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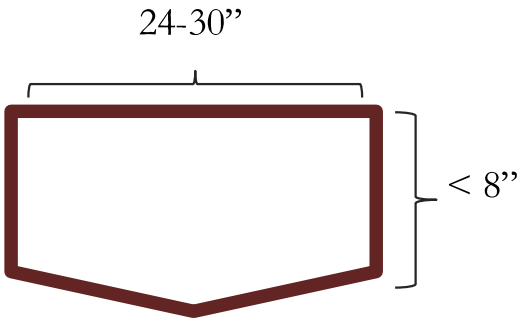
Channel remediation

Drain pools, revegetate

- Dig runnels
- Connect pools to main channel
- Utilize existing infrastructure when possible
- Build microtopography mounds



Restoring marsh functions

Goal: establish single channel hydrology

1. Design phase (Year 0)
    - Map unique legacy features for the site
    - Baseline measurements (hydrology, veg, elevation)
    - Design single channel hydrology
    - Aerial imagery + field visits
    - $100-150/acre

Old Pond Marsh, Hancock, ME
Photo credit: Joe Taft


Early embankments
Late embankments
Single channel
Ditch remediation
Channel remediation


Early embankments
Late embankments
Single channel
Ditch remediation
Channel remediation

Restoring marsh functions

Goal: establish single channel hydrology

Year 0: Design phase (Year 0)

Year 1-3: Implementation (Year 1-3)

- Channel remediation (November 10 – April 10)
- Ditch remediation (October-November)

Year 1++: Long-term monitoring

- Pools draining and revegetating
- Elevation gain

Permitting

- Require design plans
- Must be filed and accepted before work can begin
- U.S. Army Corps of Engineers General Permit
  - Specific measurements: square yards of earth moved, linear feet of ditching etc.
  - Letters to State and Tribal Historic Officers (Section 106 of Historic Preservation Act)
  - Various maps
- State of Maine Permit by Rule ($270)
- Double check with municipal regulations/permits
- **Salt marsh sparrow habitat**
  - Could trigger additional regulations, documents, or monitoring recommendations.
  - Projects are designed for recovery

Ultimate vision

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Next steps

- Rapid assessment
- Assessing funding opportunities
  - Design is relatively cheap (~$100/ac)
  - Construction is more expensive (+$1,000/ac)
  - Different sources for public and private
- Connect with other efforts
  - Climate Ready Coast (SMPDC)
  - Marshes for Maine's Future