Engineering Living Shorelines in NH: Living Shorelines 101

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DEPARTMENT OF ENVIRONMENTAL SERVICES

technical assistance

convening capacity

policy development

federal consistency

LIVING SHORELINE PROJECTS

{living shoreline}

is a term used to define a number of shoreline protection options that allow for natural coastal processes to remain through the strategic placement of plants, stone, sand fill, and other structural and organic materials.

(Restore America's Estuaries)

BY THE NUMBERS

17
coastal communities

~400,000
people

18
miles coastal shoreline

326
miles tidal shoreline

6,000
acres
salt marsh

39
miles shoreline structures

88% OF NH TIDAL SHORELINE IS NATURAL
‘THE ORIGINAL LIVING SHORELINE’

Salt marshes are among our most productive and valuable ecosystems

- Plants support food webs
- Secondary production
- Plant structure for habitat
- Support of biodiversity
- Protection from flooding
- Protection from coastal erosion
- Removal of sediments & excess nutrients
- Aesthetic, Recreational & Educational values
- Self-sustaining ecosystems
- Long term carbon storage

Beaches and Dunes

Protection from flooding

Protection from coastal erosion

Aesthetic, Recreational & Educational values (tourism)

Plants support food webs

Secondary production (Piping Plover, Snowy Owl, Monarch)

Plant structure for habitat

Support of biodiversity

Self-sustaining ecosystem (often)

Coastal Banks and Buffers

Protection from coastal erosion
Aesthetic value
Plants support food webs (2ndary production) and habitat

Support of biodiversity
Self-sustaining ecosystem (often)

From: Wilkinson Ecological Design

Naturally Eroding Banks

Support Bluff-Toe marshes
Provide sediment for adjacent habitats
Support mudflat food webs

Woody structure for habitat
Support of biodiversity ?
Other ?

Ecosystem Services

Daily et al. 1997 No Particular Ecosystem	Costanza et al. 1997 Tidal marsh & mangroves	Millennium Assmnt. 2005 Estuaries & marshes	Zedler & Kircher 2005 Wetlands	Brander et al. 2006 Wetlands
not included	food production; raw materials	fiber, timber, fuel	food production; raw materials	commercial and recreational fishing & hunting; harvesting of natural materials; energy resources
maintenance of biodiversity	habitat/refugia	biodiversity	habitat/refugia	appreciation of species existence
provision of aesthetic beauty and intellectual stimulation that lift the human spirit	recreation	cultural & amenity; aesthetics; recreational	cultural; recreation	recreational activities; appreciation of uniqueness to culture/heritage
protection of coastal shores from erosion by waves.	disturbance regulation	flood/storm protection; erosion control	disturbance regulation	storm protection flood protection
protection - UV rays; climate stabilization; moderation of weather extremes & impacts.	not included	atmosphere & climate regulation	gas regulation	climate stabilization; reduced global warming
purification of air & water; detoxification & decomposition of wastes	waste treatment	waste processing	waste treatment	improved water quality; waste disposal
cycling & movement of nutrients	none	nutrient cycling & fertility	nutrient cycling	improved water quality; waste disposal

Tidal Marsh Ecosystem Services
Value per Annum per Hectare

Value per Annum per Hectare

- Costanza et al. 1987: $9,900
- In 2008 $ (Gedan et al. 2009): $14,400

New Services:

- Carbon sequestration (European market): $135
- Denitrification (Piehler and Smyth 2011): $6,128

Future Services: . . . ?

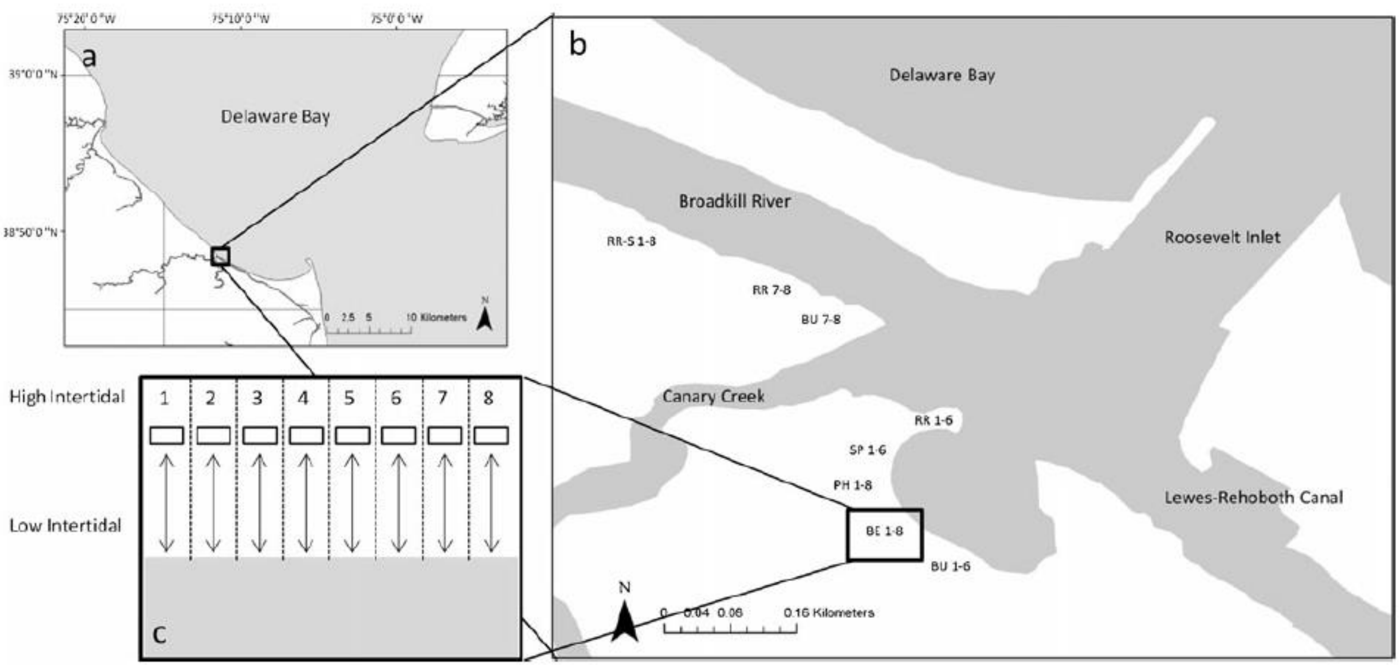
Atlantic silversides spawn in Spartina

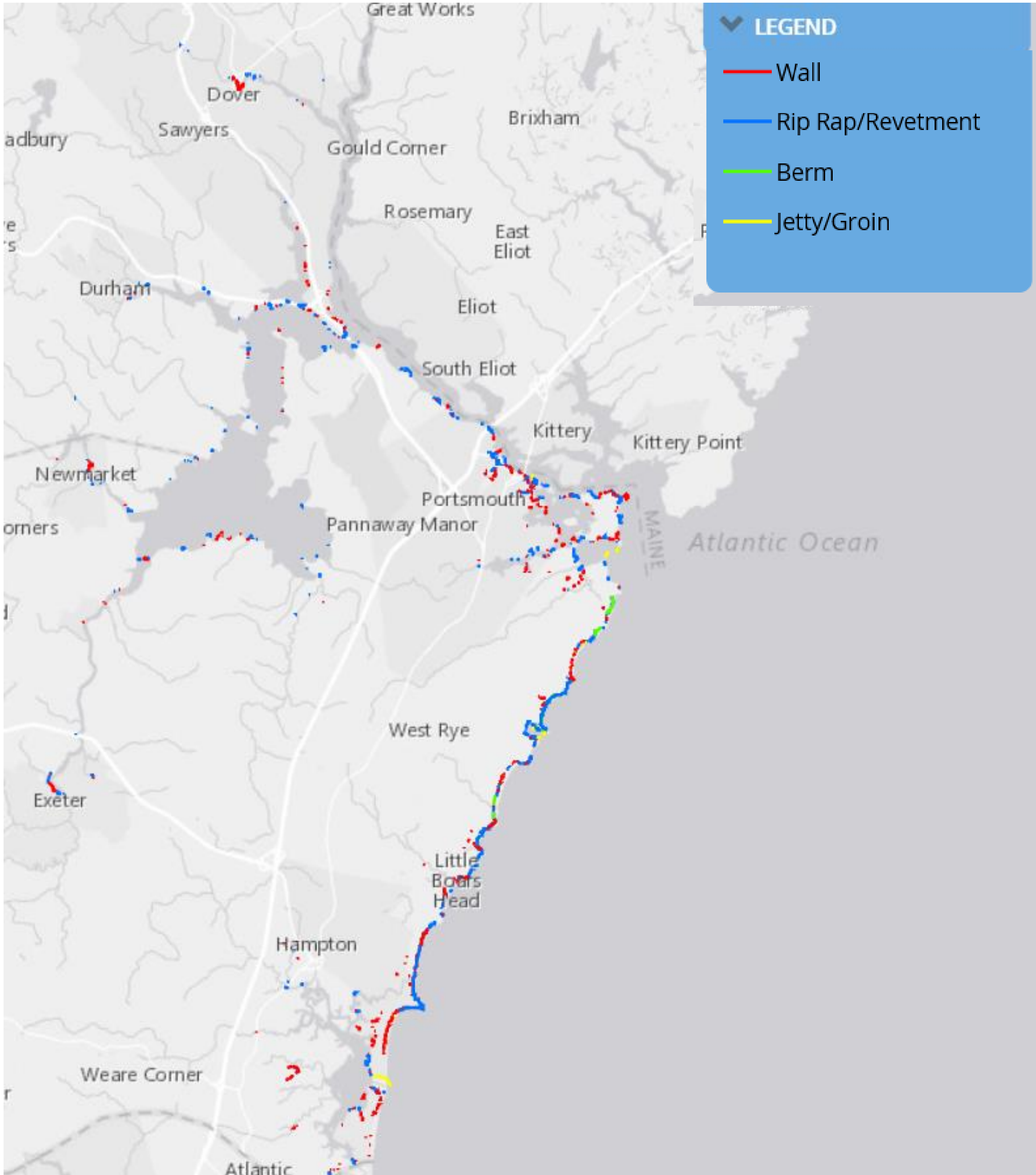
1104 Estuaries and Coasts (2012) 35:1100–1109

Table 1 *Menidia menidia* eggs collected and mean density (eggs/m^2) by shoreline type collected near Roosevelt Inlet, Delaware Bay, during spring 2010. Significant differences denoted by superscript letters (p<0.05)

Shoreline type	Total eggs	Mean eggs (eggs per m^2 per day) with SE	Percentage of total eggs collected
S. alterniflora[a]	2,922,150	32,468±10,400	93.8
P. australis[c,d]	94,190	1,046±1,003	3.0
Riprap-sill[a]	49,840	553±196	1.6
Riprap[b]	46,460	516±238	1.5
Beach[c]	2,530	28±14	0.1
Bulkhead[d]	4	0.04±0.04	<0.01

Balouskus & Targett 2012





SHORELINE TODAY

12% total armored

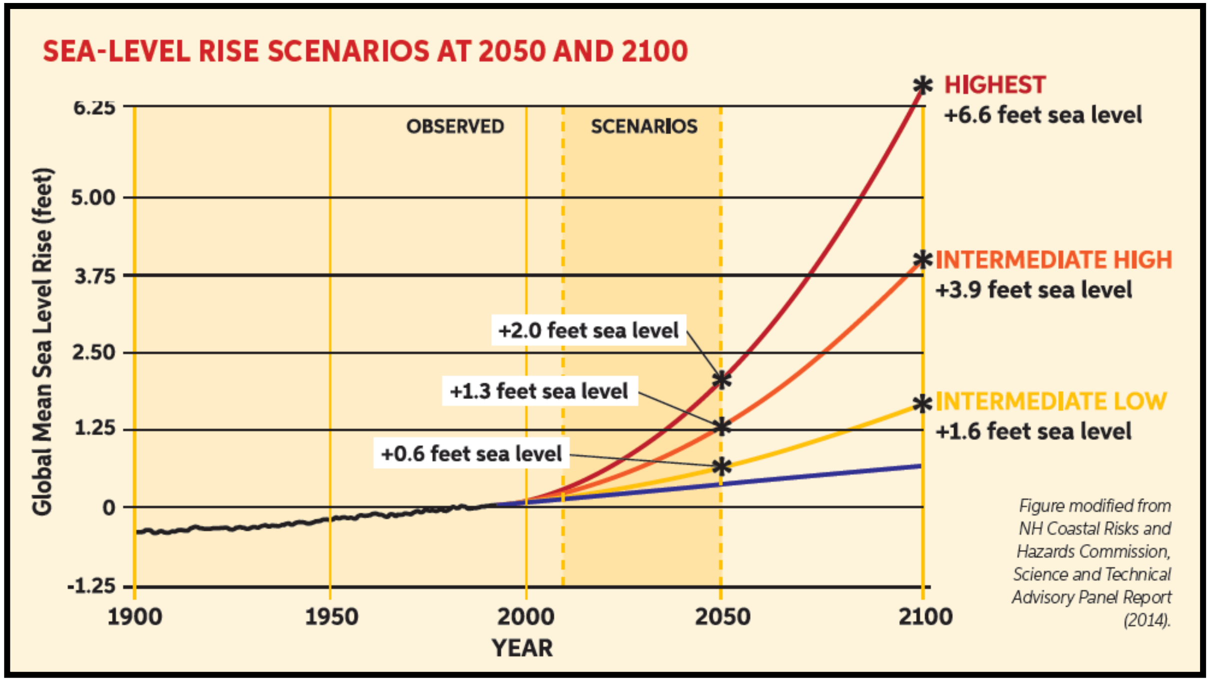
70% Atlantic Coast

5% Great Bay

Blondin & Howard 2014

SHORELINE **TOMORROW**

SEA-LEVEL RISE



PROJECTIONS

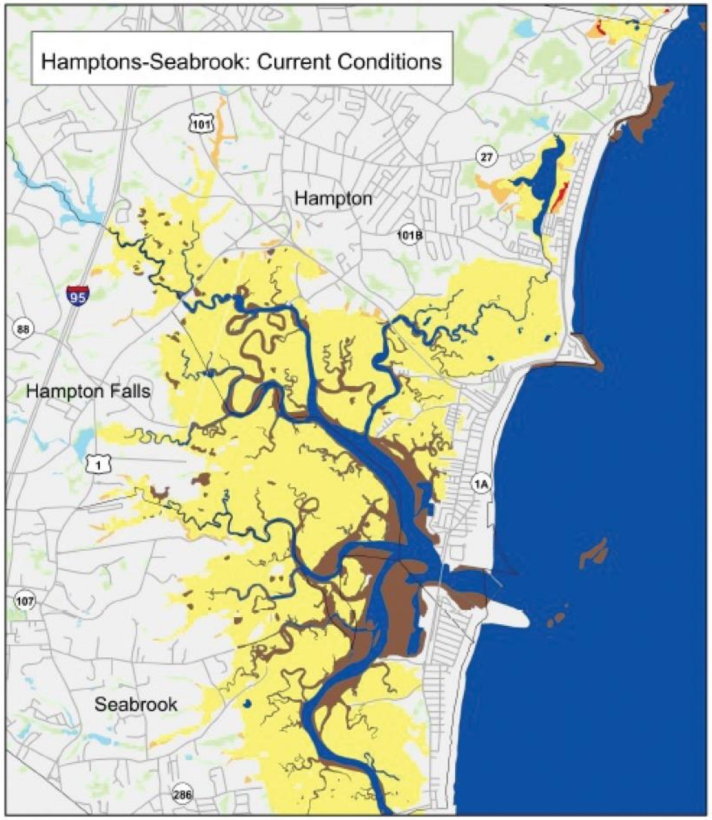
- 0.6 – 2.0 ft. by 2050
- 1.6 – 6.6 ft. by 2100

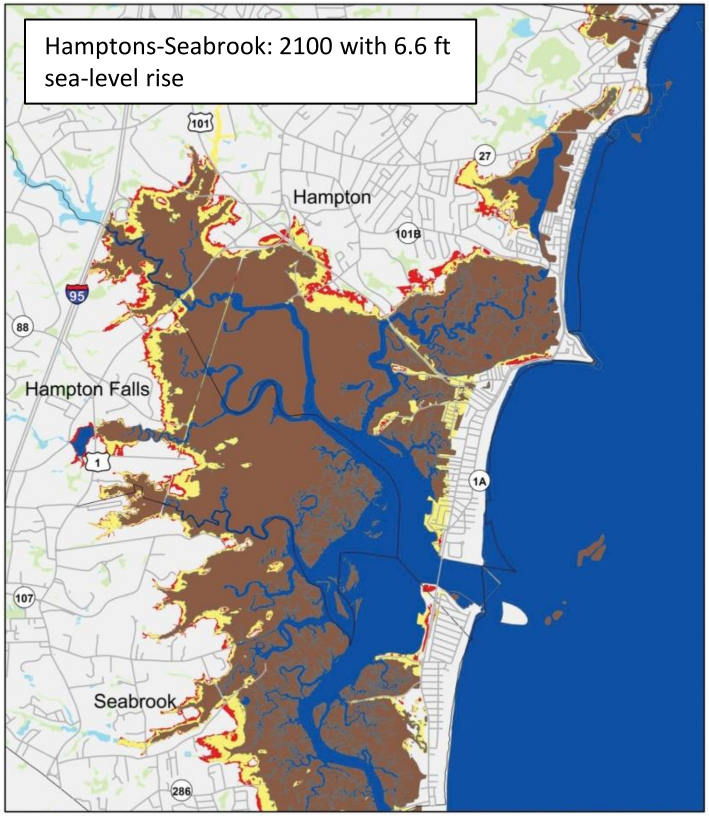
HOW TO PREPARE

1. Select time period
2. Commit to manage ***intermediate high***
3. Adjust if necessary

Example: If the design time period is 2050-2100, commit to manage 3.9 ft. of sea-level rise, but be prepared to manage and adapt to 6.6 ft. if necessary.

SHORELINE **TOMORROW**

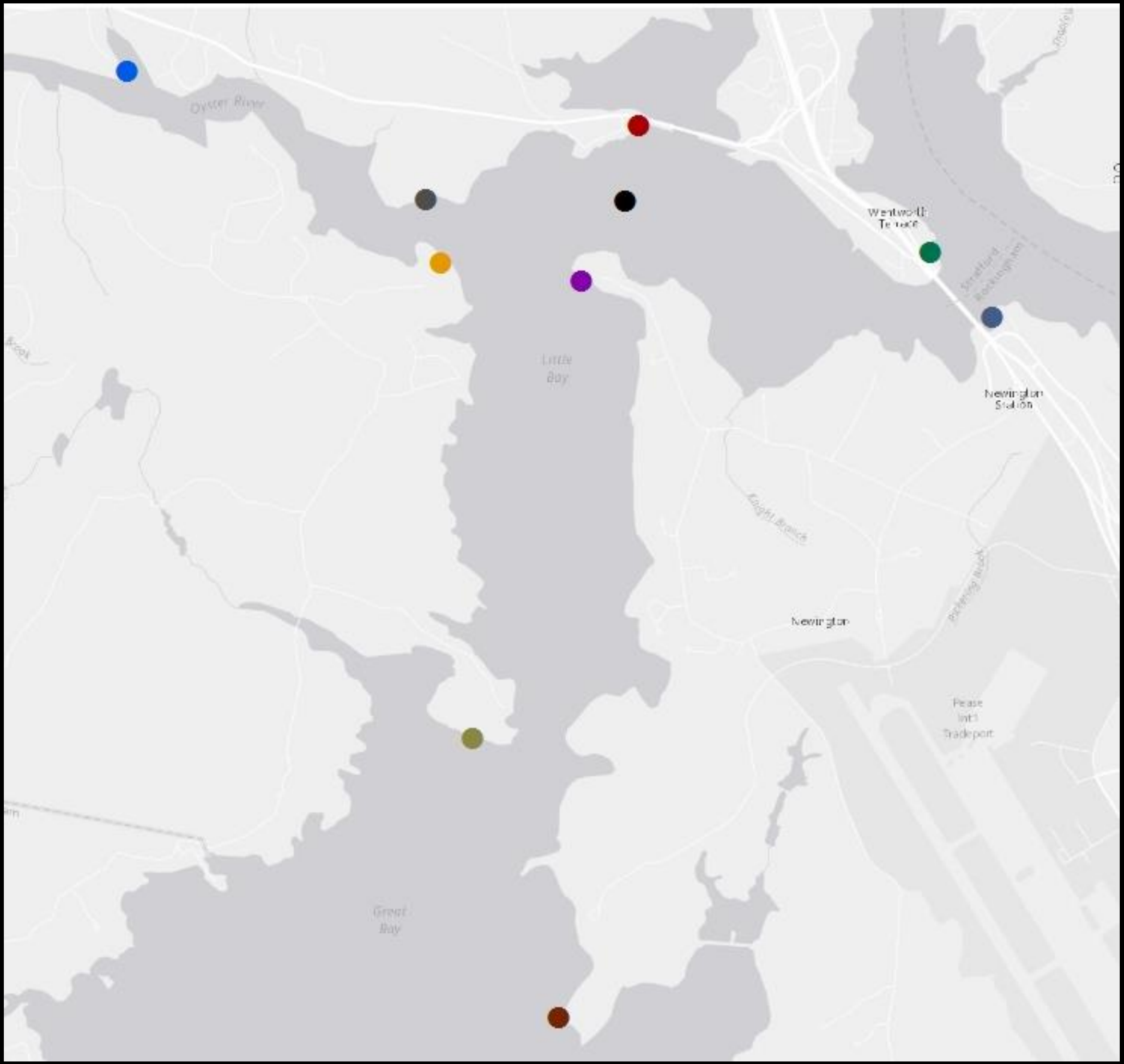




NH Fish & Game 2014

95 percent of existing salt marsh could be lost with 6.6 feet of sea-level rise

EROSION YESTERDAY



SRPC 1978.

EROSION TODAY & TOMORROW

Erosion at Wagon Hill Farm, Durham

THE DRIVE TO STABILIZE

Stabilization demand is increasing.

Over 550 permits 00's

CT survey suggests shorefront property owners are likely to armor in next 10 years

(Chris Field, UCONN)

THE SALT MARSH SQUEEZE

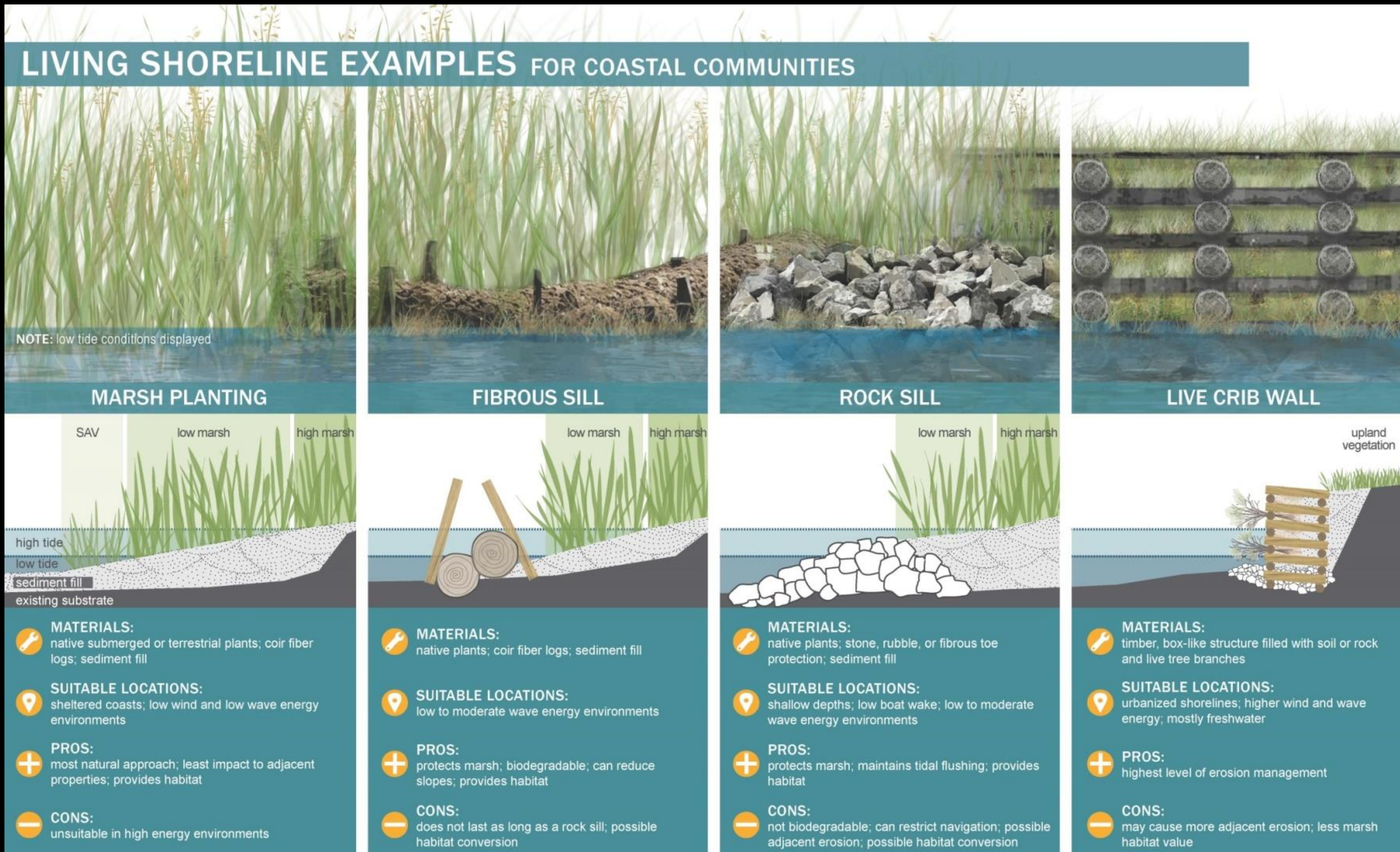
marsh migration

+

stabilization

=

salt marsh squeeze



Liz Podowski King 2015.

LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.

One square mile of salt marsh stores the carbon equivalent of **76,000 gal of gas** annually.

Marshes trap sediments from tidal waters, allowing them to **grow in elevation** as sea level rises.

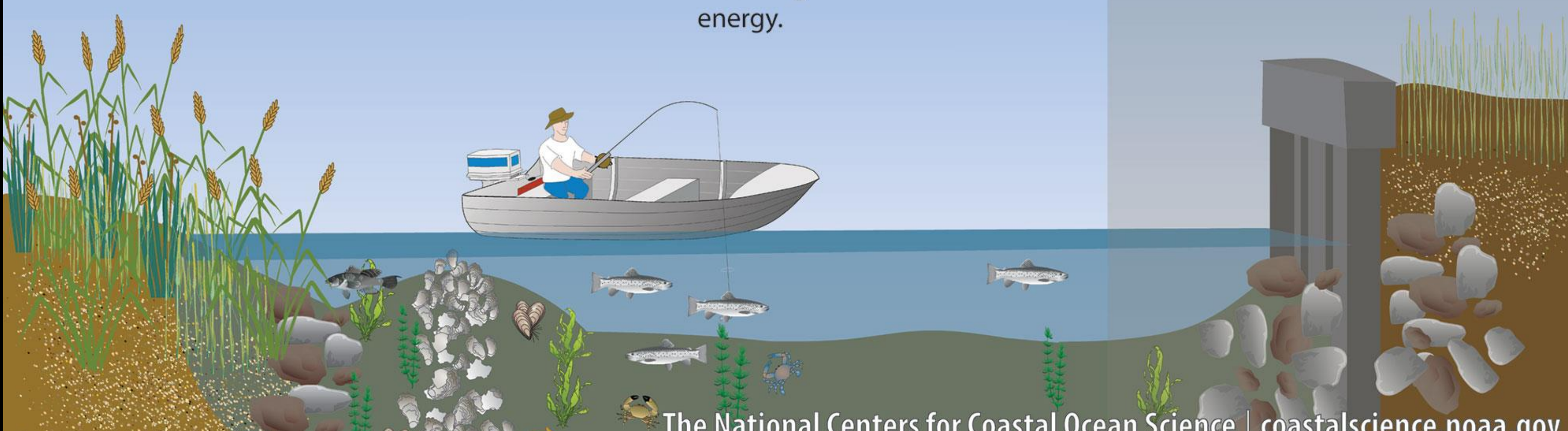
Living shorelines improve **water quality**, provide fisheries **habitat**, increase **biodiversity**, and promote **recreation**.

Marshes and oyster reefs act as natural **barriers** to waves. **15 ft** of marsh can **absorb 50%** of incoming wave energy.

Living shorelines are **more resilient** against storms than bulkheads.

33% of shorelines in the U.S. will be **hardened** by **2100**, decreasing fisheries habitat and biodiversity.

Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward **erosion**.



The National Centers for Coastal Ocean Science | coastalscience.noaa.gov

Some graphics courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)

A BUSINESS OPPORTUNITY

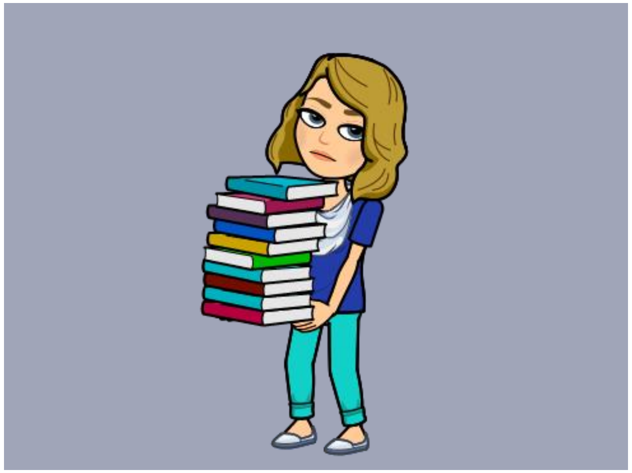
ENGINEERS | ECOLOGISTS | CONTRACTORS

A FEW MORE TIDBITS ABOUT LIVING SHORELINES

20 YEARS BEHIND RIVER RESTORATION AND STABILIZATION IN NEW HAMPSHIRE

NOT NEW TO PERMITTING, BUT PERMITTING IS SHIFTING TO FAVOR

WE ALL WANT MORE INFO BUT NEED MORE PILOTS PROJECTS



An Introduction to Living Shorelines

NOAA VIDEO

TIME FOR LUNCH!

(Living Shorelines 201 at 12:30PM)