OUR SHORE: Nature-based Shoreline Stabilization

John Maclaine
Nonpoint Source Training Center
Commissioner's Office

DEP's Mission

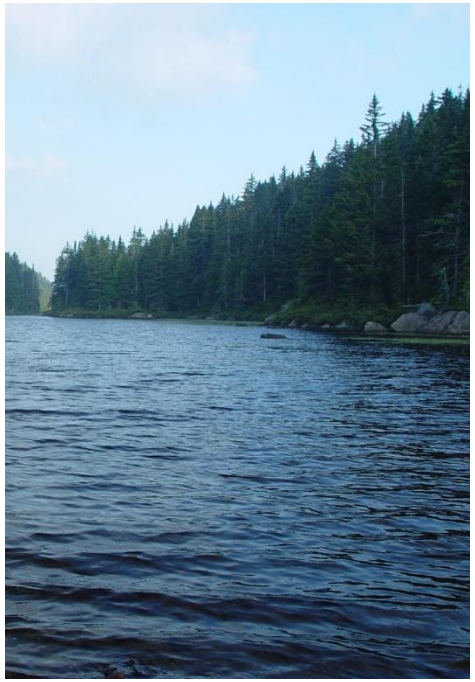
- Legislative mandate directs DEP to prevent, abate and control the pollution of the air, water and land.
- The charge is to preserve, improve and prevent diminution of the natural environment of the State.
- The Department administers programs, educates and makes regulatory decisions that contribute to the achievement of this mission.

DEP Nonpoint Source Training Center

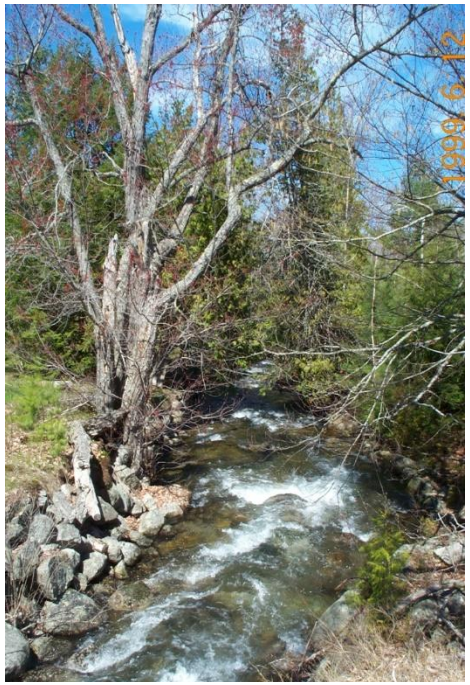
- In-person classes, seminars, webinars, online classes
- Resources and Guidance Materials
- Certifications:
  - Certification in Erosion Control Practices (~5,000)
  - Certification in Post-Construction Stormwater (~150) Inspection

We're always looking for training hosts and locations around the State

Maine's Natural Resources



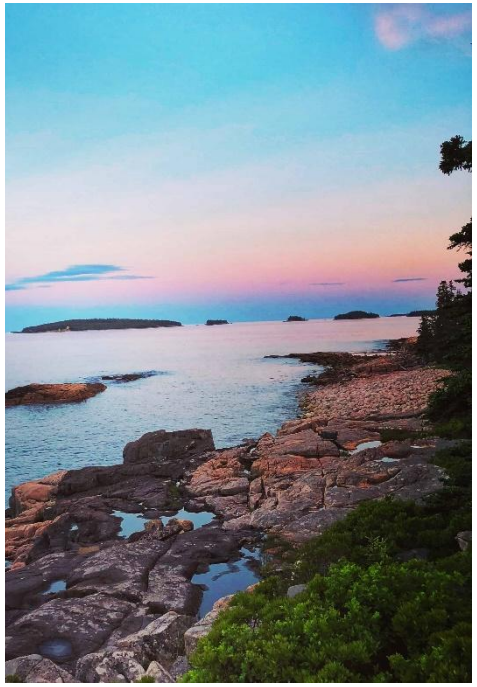
~6,000 Lakes & Ponds



>45,000 Miles of Rivers & Streams

5 Million Acres of Wetlands

157,500 acres of Coastal Wetlands



3478 miles of Coastline

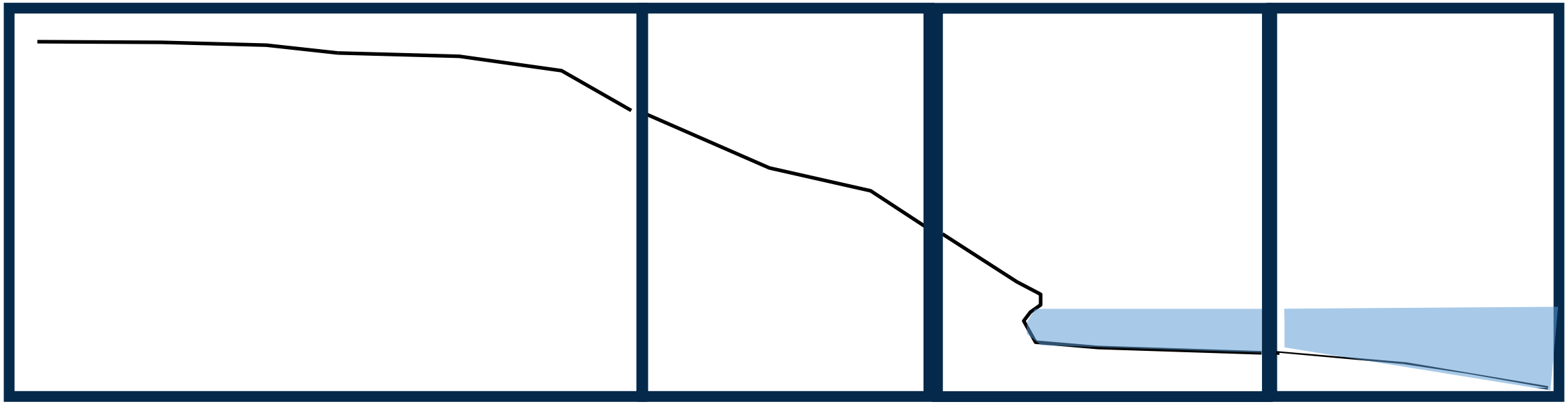
A Combination of Factors Causes Shoreline Erosion

Land Use & Overland Water

Height/Slope of Bank & Soils

Toe Stability & Groundwater

Wave energy/Ice



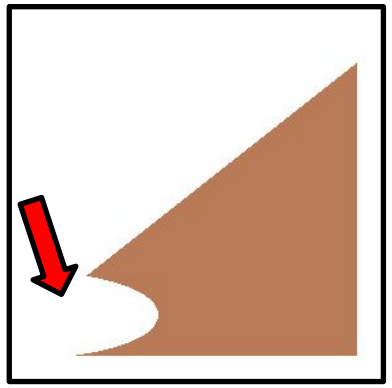
What's changed on the land?

How tall and steep is the slope? What protection exists?

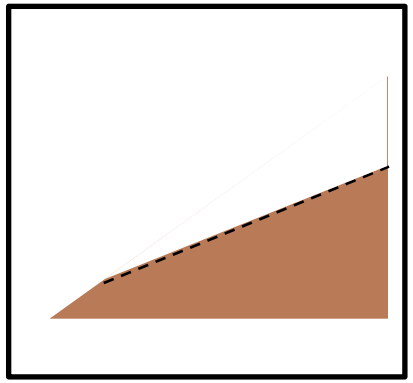
What's happening at the bottom?

How big are the waves and currents?

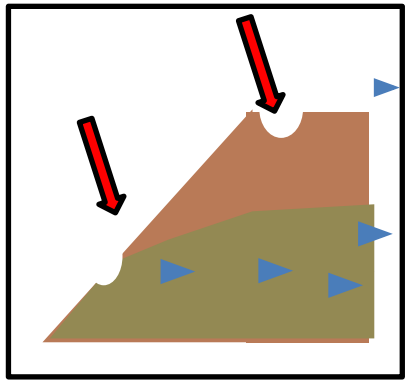
“Standard” Riprap Shoreline Stabilization



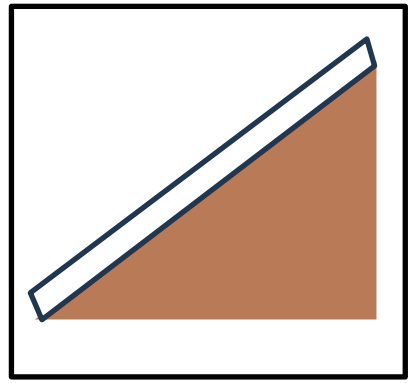
Toe Protection



Slope Preparation



Groundwater/ drainage



Soil Covering/Protection

BIG ROCKS

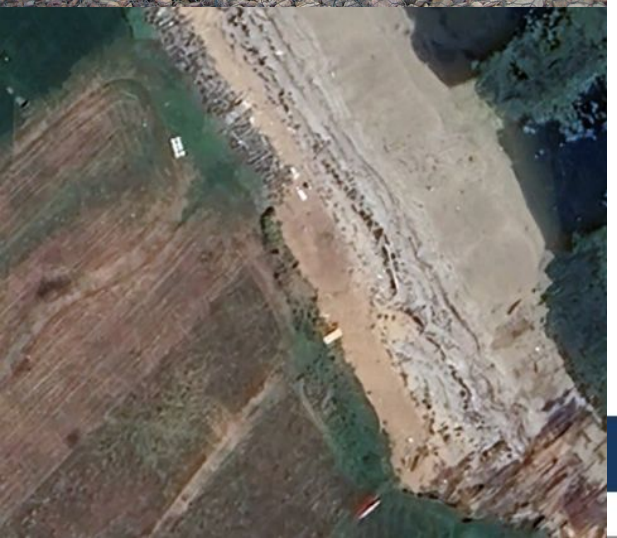
BIG MACHINES, LOTS OF DISTURBANCE

PLASTICS GEOTEXTILES FOR SEPARATION/ DRAINAGE

MORE ROCKS

Problems with Rip-Rap Stabilizations

- Applying “standard” solution regardless of cause
- Thermal impact, lack of shading
- Destruction of habitat
  - Hard for animals to cross
  - Provides no cover
  - Extremely long time to naturalize
- Plastic filter fabrics
  - Clogging, microplastics, sealing off soil
  - Prevents rooting of plants into subsoil
- Still Deflects energy
  - Nearshore erosion, deepening
  - Erosion increase to adjacent shorelines
- Structures degrade over time



NRPA Standards and Shoreline Stabilization

- **Existing uses**: The activity will not unreasonably interfere with existing scenic, aesthetic, recreational or navigational uses
  - **Vegetation removal, access**

- **Soil erosion:** The activity will not cause unreasonable erosion of soil or sediment nor unreasonably inhibit the natural transfer of soil from the terrestrial to the marine or freshwater environment.
  - **Preventing all erosion has negative consequences too**

- **Harm to habitats; fisheries**: The activity will not unreasonably harm any significant wildlife habitat, freshwater wetland plan habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine or marine fisheries or other aquatic life.
  - **Filling aquatic habitats, disconnecting land/water, cover, shade, disrupting migratory species**

- **Flooding:** The activity will not unreasonably cause or increase the flooding of the alteration area or adjacent properties.
  - **End effect and flanking erosion, nearshore deepening, loss of fringe marsh habitats**

Minimizing Impacts

Photo Credit: Damon Yakovleff CCSWCD

“OUR SHORE” CONCEPT

Assessment & Selection of Stabilization Tools that:

1. Use the least amount of intervention and disturbance necessary

2. Allow shorelines to function as natural systems as quickly as possible

This is key to protecting the shoreline stability, water quality, and habitat for fish and wildlife in the long term

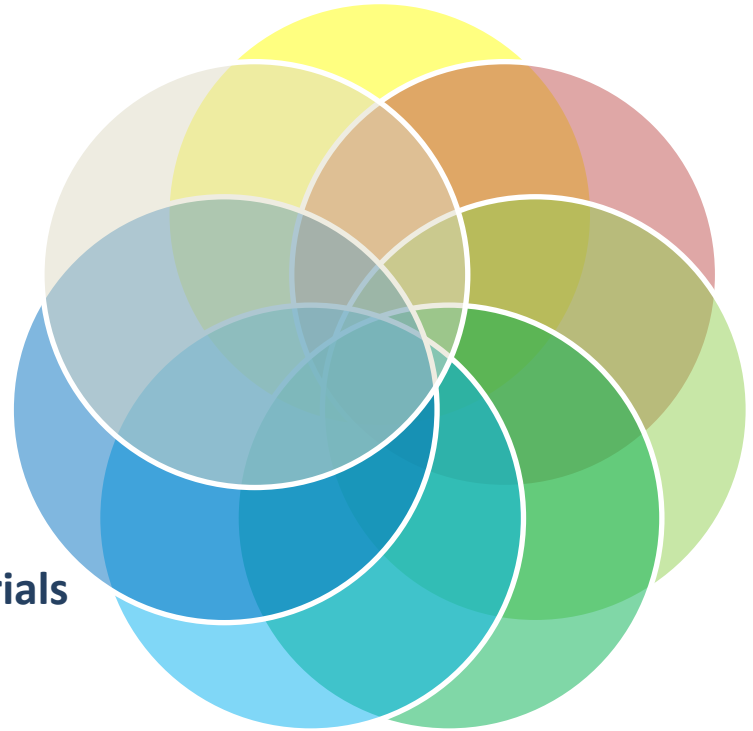
Expanding the Tool Box

Manufactured Products

Biodegradable Erosion Control Socks
Coir Logs
Natural Fiber Blankets & Filter Fabrics (long-lived, fully biodegradable), Burlap, Heavy Coir blankets
Temporary Erosion Control Blankets

Non-Biodegradable Materials

Gabions and Variations (e.g. marine mattresses)
Turf Reinforcement Mats (TRM)
Cellular Confinement Systems



Mulches & Organic Matter

Erosion Control Mix (permanent)
Fine Erosion Control Mix, super humus
Hay or Straw Mulch *(temporary erosion control/seed establishment*
Natural Mulches (duff, leaves, pine needles)
Other Natural Wood-Based Mulches & Chips
Hydraulically Applied Mulches & Biotic Soil Media
Plant-Based Compost

Mixed Materials

Infilled Riprap with Soil, Erosion Control Mix or variations for growing vegetation
Cobbles Mixed with Erosion Control Mix

Dead Wood & Tree Materials

Tree Root Wads
Dead Brush Bundles
Logs & Posts, Anchored Tree Material

Stone, Soil & Aggregate Materials

Riprap Stone
Bank-Run Stone & Cobbles
Crushed Stone
Pea Stone
Oyster Shells
Coarse Sand
Loam

Low > Medium > High
Erosion Contribution

Living Materials

Plantings, seed
Live Stakes
Live Poles
Live Posts
Living Brush
Living Fascines
Living Wattles

O U R S H O R E

Design goals and objectives

Observe and blend project with unaltered shorelines near the site,

Use native, natural, living, and biodegradable materials, and

Reach conditions that function as a naturalized shoreline over time.

Assessment of instability & Tool selection

Source and severity of erosion,

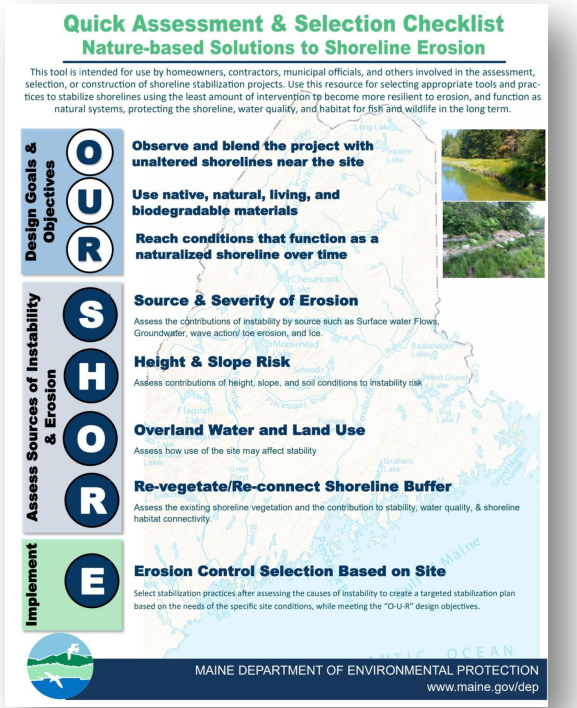
Height and slope risk,

Overland water and land use, and

Re-vegetation or reconnection shoreline buffer opportunities.

Erosion Control Practices based on findings

Evaluate & **Enhance** control practices can be selected based on site specific needs.



Including Land Use Contributions

Putting Back Habitat Functions

- Terrestrial & Aquatic shade
- Land to Water Connection
- Travel corridor (connection along shore)
- Cover diversity
- Natural vegetation diversity
- Woody material inputs
- Soil Health and subsurface habitat
- Sediment Transfer
- Specific wildlife/fisheries considerations

Avoiding Wildlife Conflicts

Using Vegetation for Strength

Grass & Herbaceous plants alone

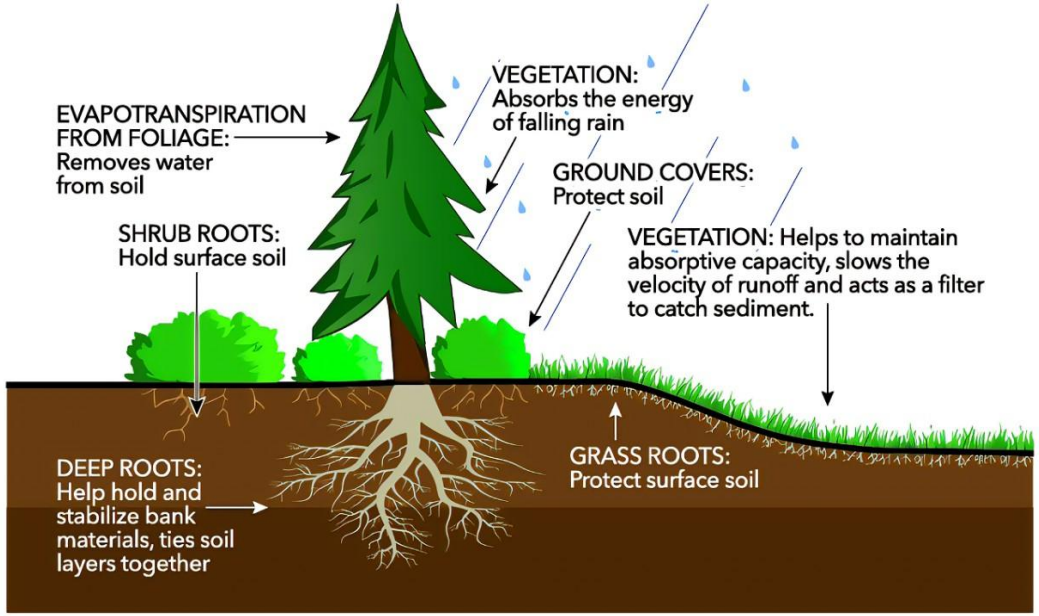
- Grass provides surficial protection against erosive forces as interconnected web
- Fine roots break easily during shear events

Shrubs

- Provide medium depth, spreading root systems
  - Increased deep root density exponentially related to higher stability
- Coverage of stems, shrubs etc. increases wave/rain deflection and droplet break up

Trees

- Provide buttressing, deep soil anchoring
- Deeper large roots more likely to pull out from shear events vs. breaking

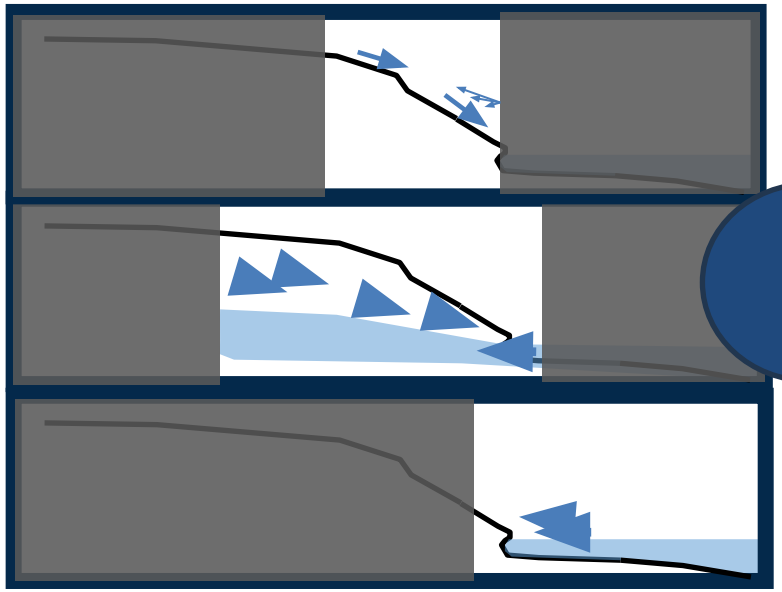


EFFECTS OF VEGETATION IN MINIMIZING EROSION

Overland Erosion & Wave Spray

Groundwater & Saturation

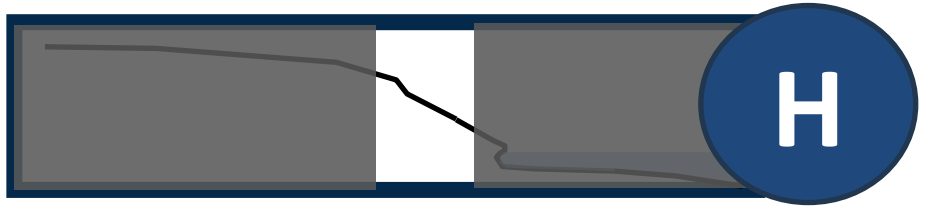
Toe Erosion



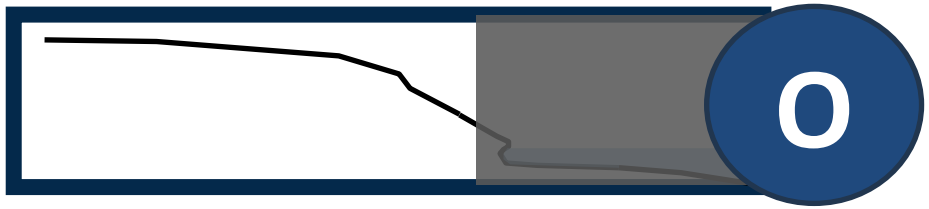
S Source of Erosion

Slope Alterations

Slope Protection



H Height & Slope

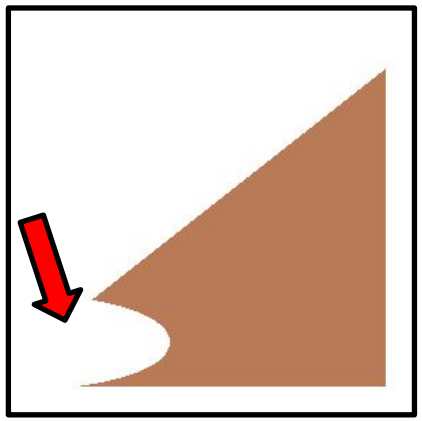


O Overland Water from Land Use

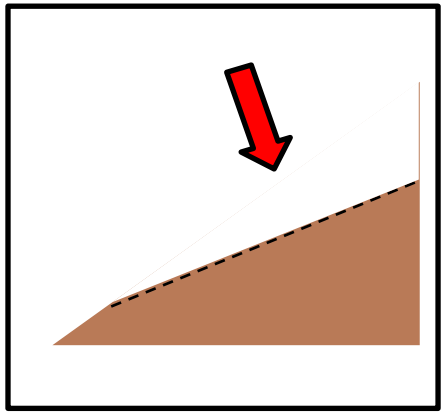
R Revegetate & Re-connect (Habitat)

Stabilization Elements

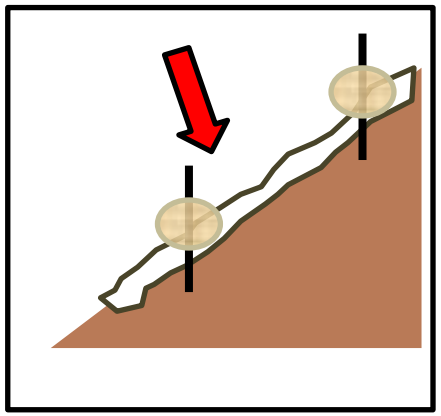
*Including Minimization & Considering Habitat



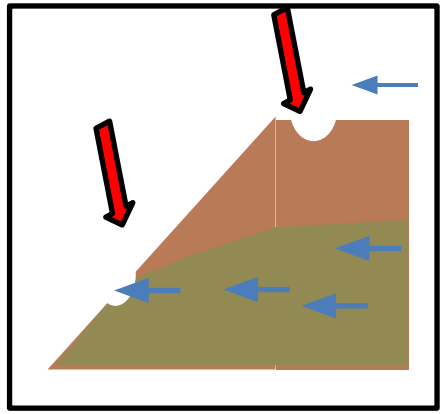
Toe Protection



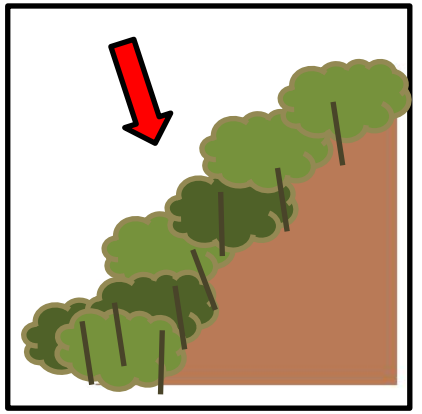
Slope Preparation (Height & Slope)



Soil protection (surface erosion protection)

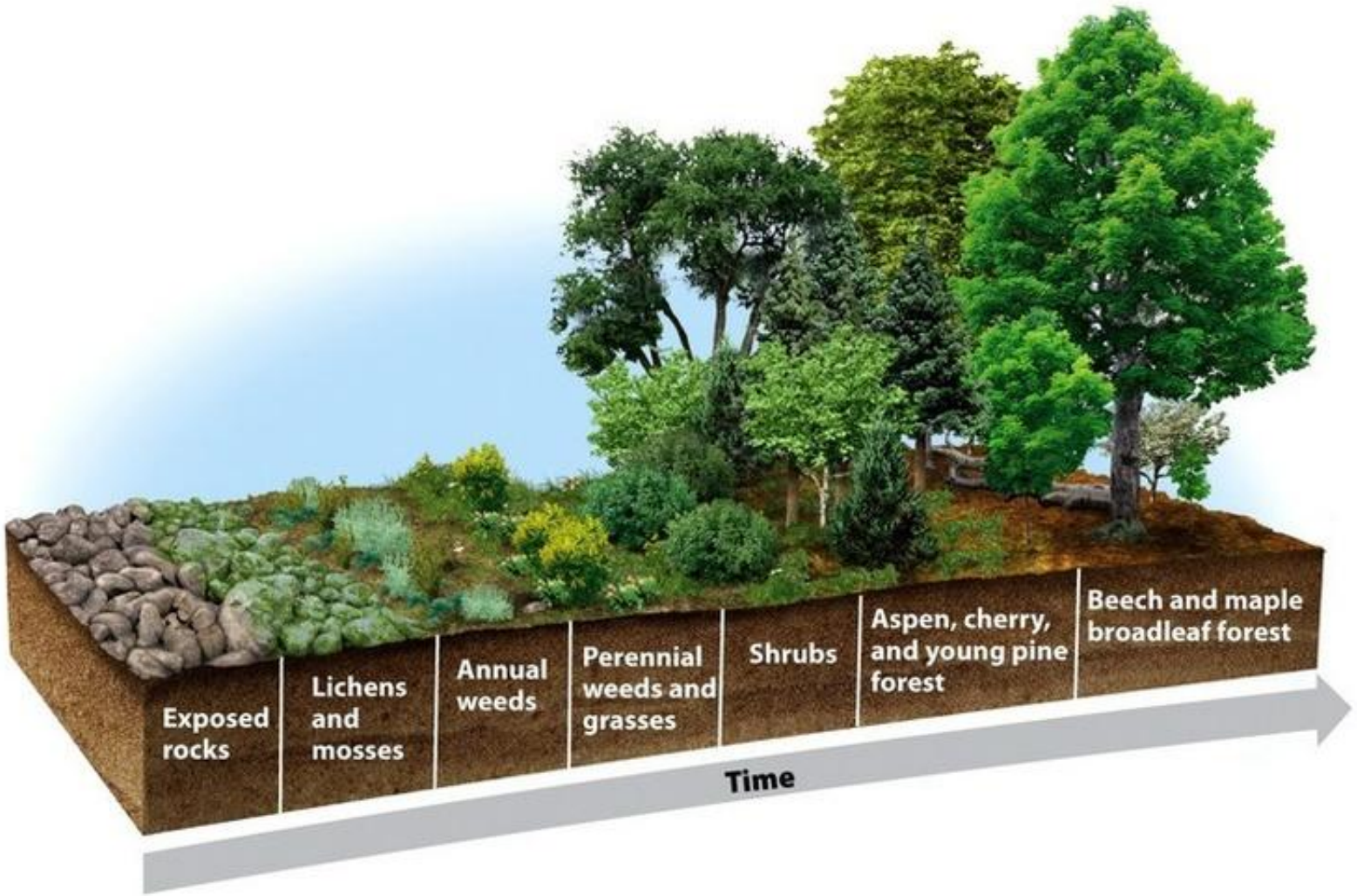


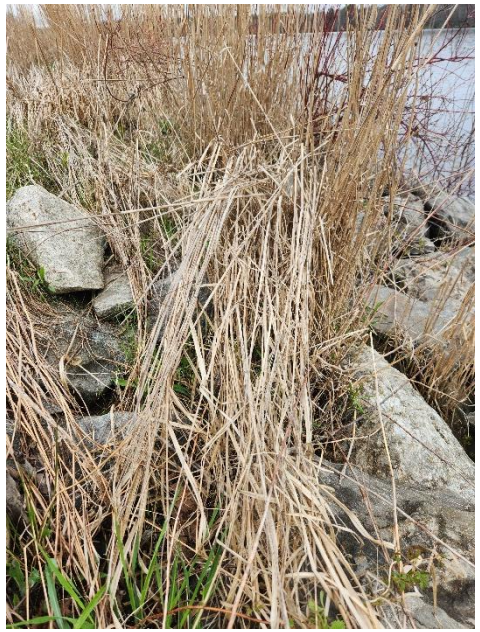
Overland Flows & Groundwater/Saturation



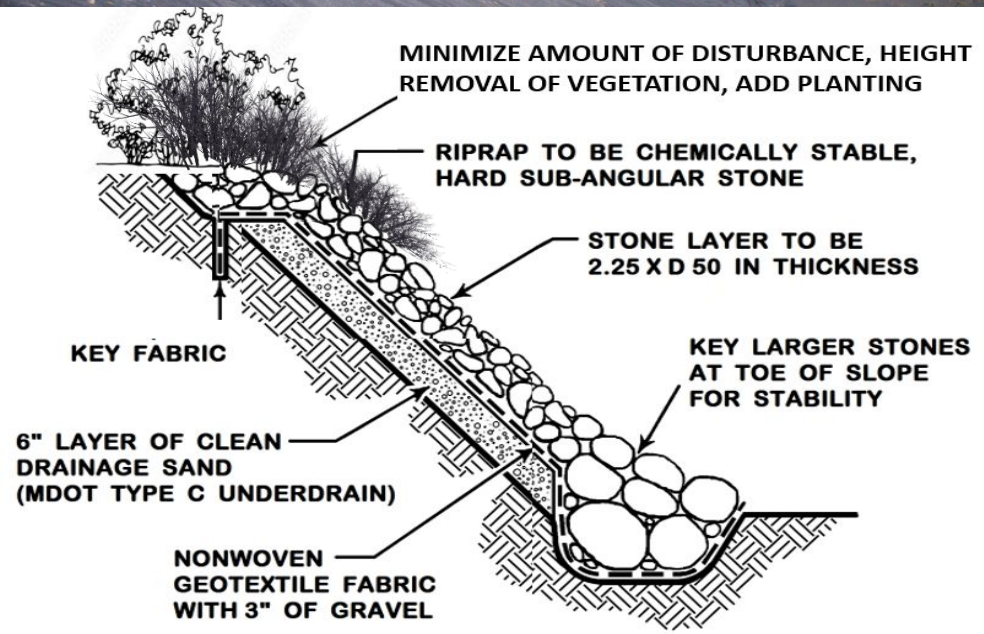
Vegetation/ Habitat Connection

If you fight against nature…she'll win





Geotextile Filter Layer?



Used extensively as standard filter layer behind riprap

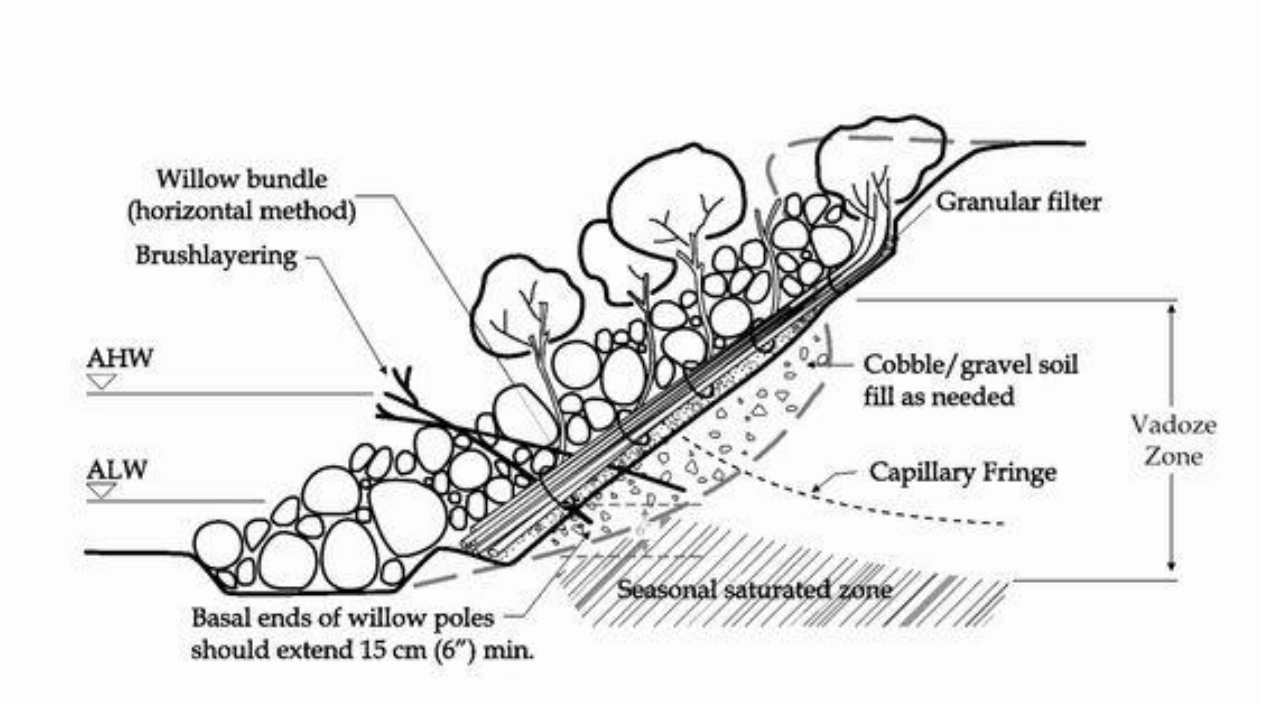
- easy
- readily accessible
- Has been mandated standard in designs

Potential problems:

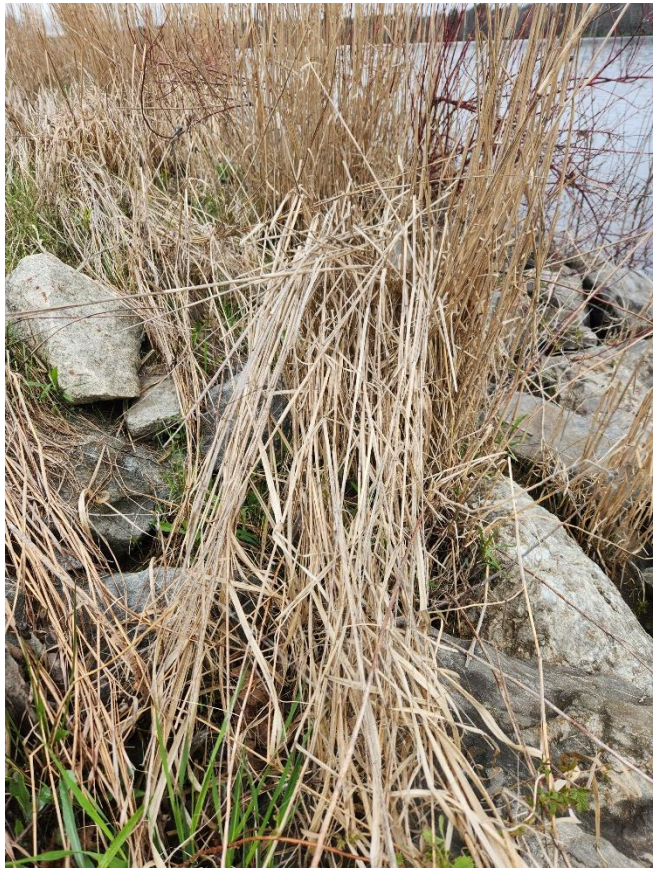
- Prevents vegetation growth
- Creates long lasting separation between surface and soil underneath
- Weak point of design
- Clogs with soil & bacteria over time
- May contribute to microplastic pollution
- Incorrect installation can lead to failure

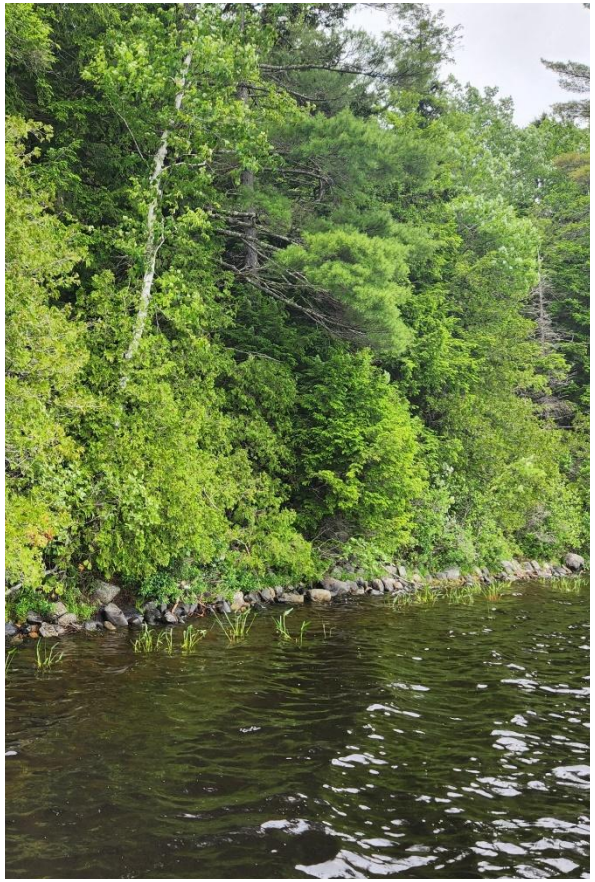
Geotextile alternatives that work with vegetation

- Longer term biodegradable filter materials/fabrics (Coconut coir/linen)
- Granular filters (well graded gravel without fines)
- Living brush layer filters under riprap

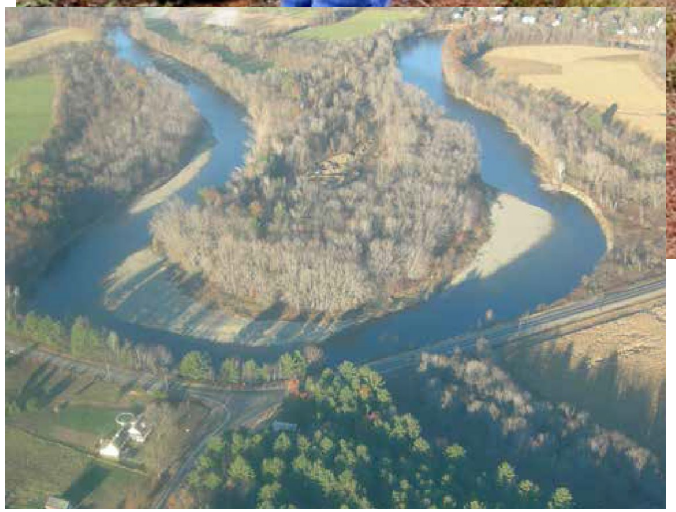


Living Riprap



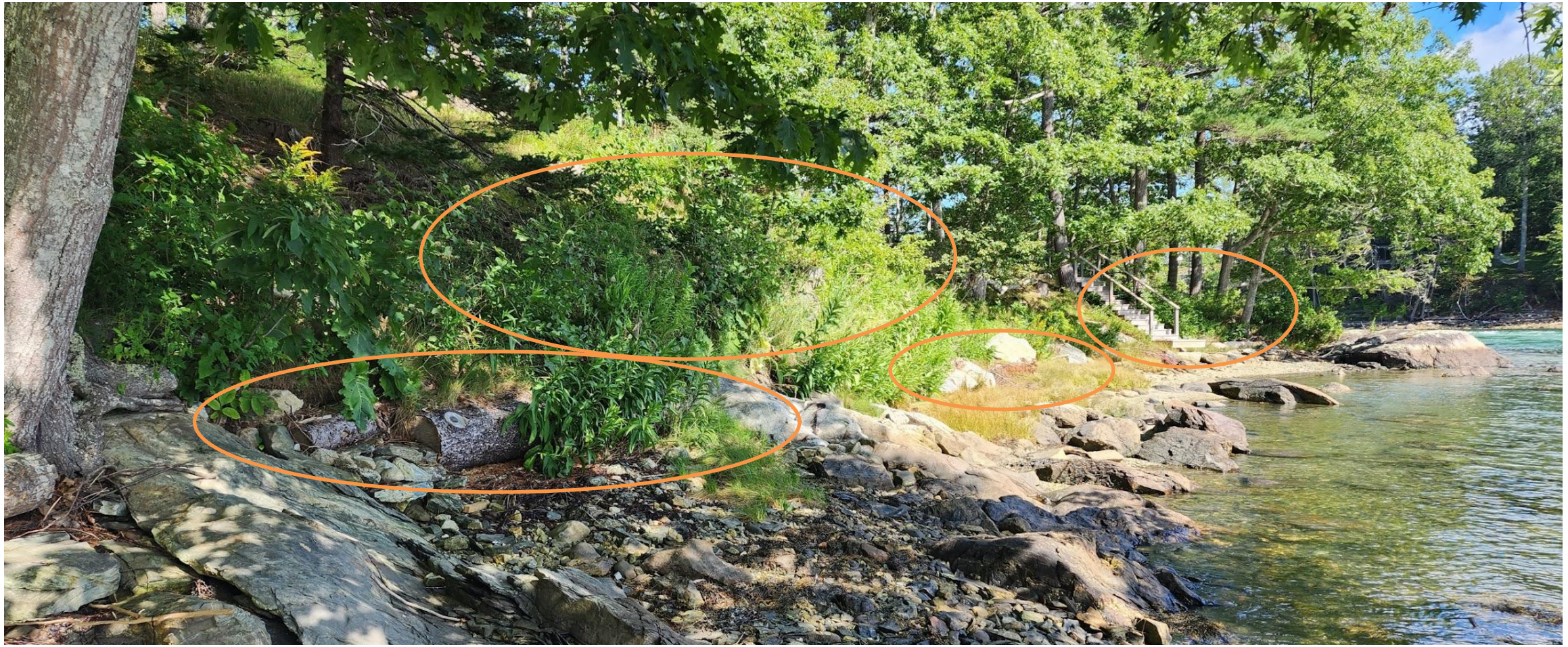
Combining vegetation & materials



Sandy River Bank Stabilization, Farmington Falls, Maine.
Land and Water Magazine September/October 2016.
Peter Hanrahan, CPESC

Parterre
Ecological

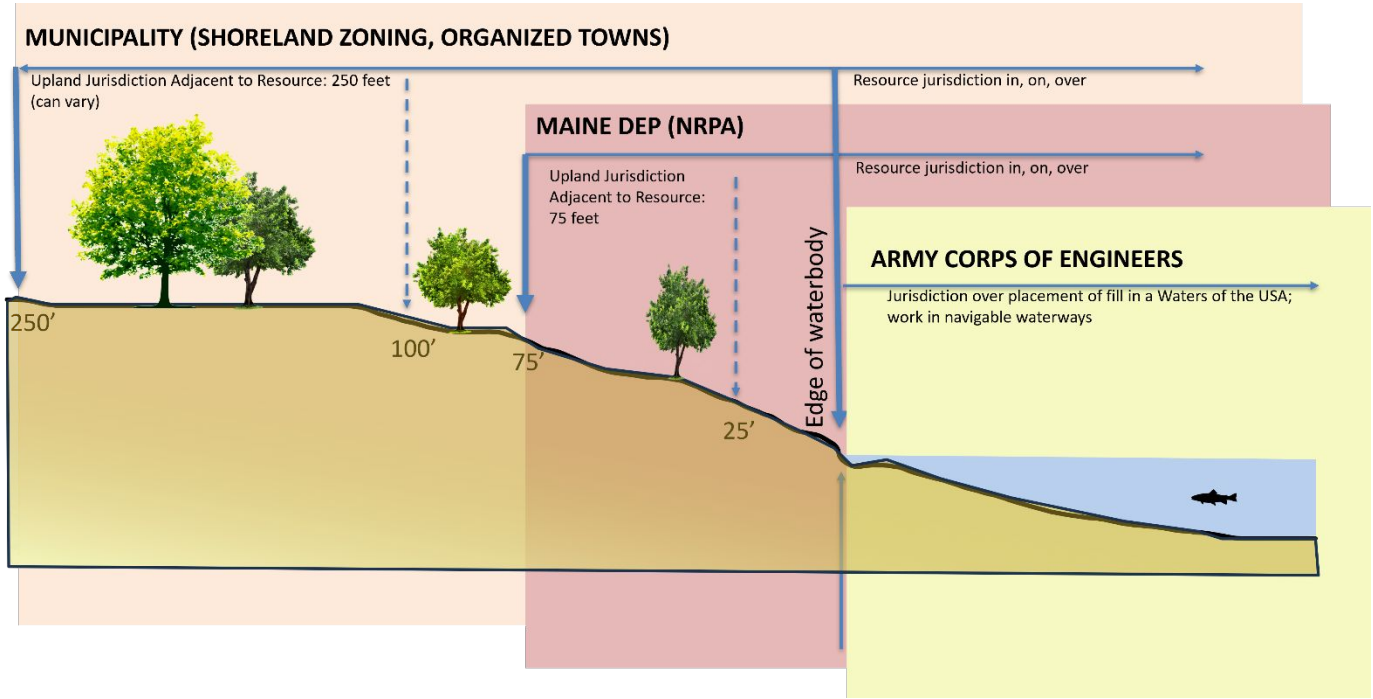
Minimal proactive living shoreline treatments combining coir logs and plantings that stabilize existing vegetation and soils and maintain stairway access to coastal wetland.



The Home Place Team - Blue Hill, Maine

The Home Place Team - Blue Hill, Maine Sites (Continued)

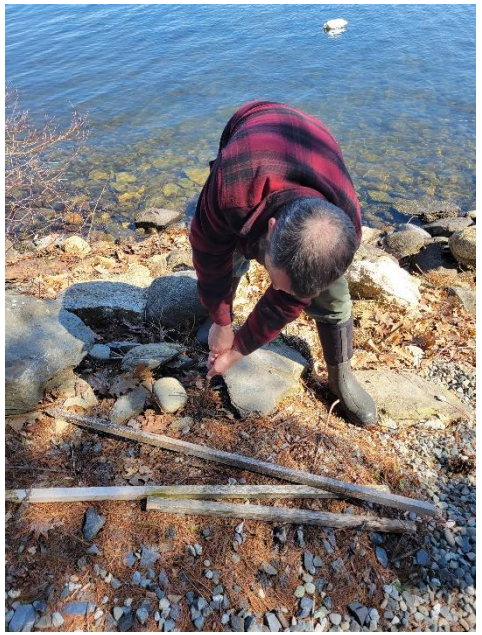
Permitting Nature-based Stabilizations



- New Permit By Rule (Ch. 305, "PBR") for Shoreline Stabilization will become effective in late June
- Previously, many nature-based projects could not be performed under PBR
- Creates vegetation establishment standards, updates BMPs, and more…

De minimis activities

- Vegetation establishment & support
  - Planting native seeds
  - Live staking with pilot hole or slit planting
- New *de minimis* guidance memo on planting native plants under NRPA
  - Conditions where planting of vegetation is not considered an alteration under Chapter 310
  - Applies to native plants only
  - Less than 1 cubic yard (~25 plants) for establishment of native plants, annually
  - Planting areas immediately mulched
  - Other considerations…



Updated PBR Standards for all stabilization projects

Existing Section 8 standards still in place; new standards added, including:

- No removal of trees ≥4 in. DBH for placement of riprap (may remove trees for regrading to meet <1.5:1 slope requirement, equipment access, and hazard tree removal)
- Allows natural & biodegradable materials to assist in establishment of vegetation
- Separates toe treatment type and slope treatment methods
- New methods allowed for filter layers: groundwater & saturation
- Specifically allows use of tree root wads, woody material (driven or anchored)
- Allow for limited in-water methods beyond riprap (limited to 200 sq feet)
  - E.g. Marsh sills, encapsulated soil lifts, brush layering/mattresses, coir logs, modified erosion control socks/bags
- Allows non-toxic biodegradable tackifiers
- Stricter standards on vegetation removal for stabilization

Updated Riprap Standards - PBR

- Must plant 10-foot-wide native vegetative buffer, unless not feasible due to structure near shoreline or presence of existing buffer ≥5 feet
- If feasible, vegetation must be planted within riprap (encouraged, not required)
- Riprap cannot be placed within 5 feet of an abutting property, unless there is riprap on the abutting property (up to the property line) or abutting property owner gives permission
- Limited in height
- Toe protection is allowed independent of slope impacts

Moving Forward…

Establish clear guidance for the regulated community on nature-based design techniques where little guidance exists and provide incentive to implement these types of projects more widely.

Help build out a training in the form of regulatory decision-support information. Host written and video training content for delivery online and through in-person trainings.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Shoreline Stabilization Options in Maine
The "O.U.R. S.H.O.R.E" Program is being developed to provide guidance and training for using nature-based design practices to protect against shoreline erosion. This program serves homeowners, contractors, resource managers, and community leaders, providing them with how-to information and showcases different project examples from throughout the state to successfully use nature-based designs. OUR SHORE is also an emerging network of engineers, earthwork contractors, designers, and municipal officials interested in learning and sharing these techniques in Maine.
Through "O.U.R. S.H.O.R.E," people can:
1. Assess sources of erosion
2. Identify design recommendations while preserving and restoring natural functions to shorelines
3. Navigate regulatory process to streamline installation of erosion control measures
The OUR SHORE Guide to Nature-Based Shoreline Stabilization Options in Maine (PDF) – DRAFT IN DEVELOPMENT includes basic guidance on shoreline function, erosion processes in different environments, and the importance of vegetation in stabilizing soils. The OUR SHORE approach relies on targeting the contributing sources of erosion and instability to select and combine erosion control practices that will address these causes using the least intervention necessary while using natural, biodegradable or living materials. The guidance provides techniques and considerations to include habitat and shoreline functions into the design of any project, even when riprap is used, so the outcome over time is a naturalized and more resilient shoreline. A short list of common materials, and how to descriptions and pictures of common design practices are included.

IN DEVELOPMENT


Nature-Based Solutions to Shoreline Erosion

Preliminary

DEP Issue Profile

November 2024

For more information, contact John Maclaine
John.Maclaine@maine.gov

Coastal and inland waterfront erosion in Maine is a growing concern due to storms, flooding, and rising sea levels. Nature-based design solutions may offer an effective, long-term plan for safeguarding both private and public property. These designs provide strength, improve the beauty of waterfront properties, and bring a range of benefits to the community and to the health of the environment. Unfortunately, we are learning that rip-rap stone revetments without plants can make erosion worse for neighboring waterfront areas, are failing during storms, and may not be a resilient solution to erosion.

Photo 1: bluff face enhanced by pinned logs, lifts of coir filled with organics and plantings. Courtesy of Nathan Robbins.

Nature-Based Solutions incorporate a blend of plants that root into the environment, helping sediment exchange and accumulation. As plant communities mature, these designs gain strength, offering greater resilience over time compared to traditional rip-rap revetments (**See Photo 1**). Living shorelines present a sustainable and cost-effective alternative for protecting shorelines against destruction from storms and waves. Nationwide, Nature-Based Solutions are becoming embraced as the most effective plan to address waterfront and riverfront erosion.

Nature-Based Solutions to Shoreline Erosions, also known as "Living Shorelines," are design techniques that use natural materials to combat shoreline erosion and flooding, while at the same time offering many advantages to the local ecosystems. These designs have a proven track record in Maine, especially along rivers, streams, and lakes. The application of Nature-Based Solutions for erosion management is expanding to include estuaries and ocean coasts in Maine where the challenges presented by wave energy, tidal fluctuations, and winter ice can be severe.

Find Nature Based Solutions Quickly!

"O.U.R. S.H.O.R.E" provides guidance and training for installing Nature-Based solutions to protect against inland and coastal waterfront erosion. This program offers detailed how-to information across Nature-Based best practices and showcases different project examples from throughout the state. Through "O.U.R. S.H.O.R.E," people can **1. Assess sources of erosion, 2. Identify design recommendations**, and, 3. **Navigate regulatory process** to streamline installation of Nature-Based erosion control measures. This program serves homeowners, contractors, resource managers, and community leaders, providing them with the necessary support to successfully use Nature-Based Solutions.

The **Assessment Checklist for Erosion** offers a streamlined process checklist for site evaluation and selection of Nature-Based design practices.

***Observe** and blend project with any unaltered shore near site...*

***Use** native, natural, living, and biodegradable materials...*

***Reach** conditions that function as a naturalized shore over time...*

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
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PROGRAM ISSUE PROFILE


Quick Assessment & Selection Checklist

Nature-based Solutions to Shoreline Erosion

This tool is intended for use by homeowners, contractors, municipal officials, and others involved in the assessment, selection, or construction of shoreline stabilization projects. Use this resource for selecting appropriate tools and practices to stabilize shorelines using the least amount of intervention to become more resilient to erosion, and function as natural systems, protecting the shoreline, water quality, and habitat for fish and wildlife in the long term.

Design Goals & Objectives — O U R

Observe and blend the project with unaltered shorelines near the site

Use native, natural, living, and biodegradable materials

Reach conditions that function as a naturalized shoreline over time

Assess Sources of Instability & Erosion — S H O R

Source & Severity of Erosion

Assess the contributions of instability by source such as Surface water Flows, Groundwater, wave action/ Ice erosion, and Ice.

Height & Slope Risk

Assess contributions of height, slope, and soil conditions to instability risk

Overland Water and Land Use

Assess how use of the site may affect stability

Re-vegetate/Re-connect Shoreline Buffer

Assess the existing shoreline vegetation and the contribution to stability, water quality, & shoreline habitat connectivity.

Implement — E

Erosion Control Selection Based on Site

Select stabilization practices after assessing the causes of instability to create a targeted stabilization plan based on the needs of the specific site conditions, while meeting the "O-U-R" design objectives.

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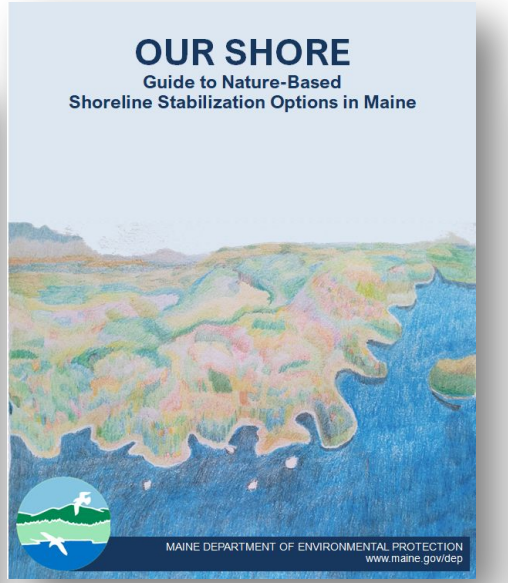
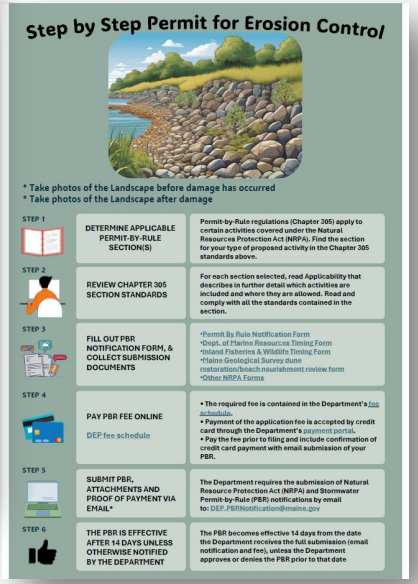
ON SITE CHECKLIST


OUR SHORE

Guide to Nature-Based
Shoreline Stabilization Options in Maine

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
www.maine.gov/dep

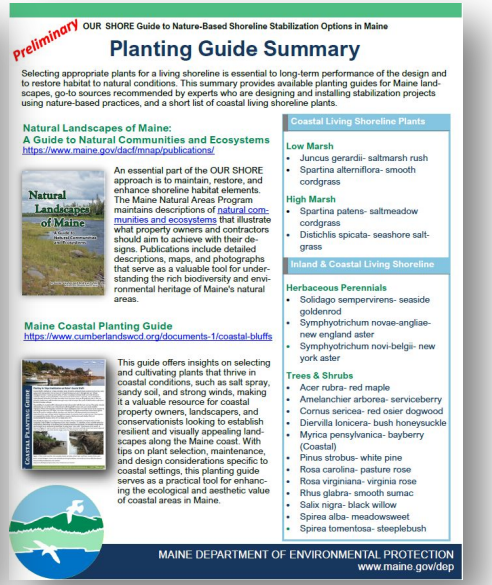
OUR SHORE GUIDE


Step by Step Permit for Erosion Control

* Take photos of the Landscape before damage has occurred
* Take photos of the Landscape after damage

STEP 1	DETERMINE APPLICABLE PERMIT-BY-RULE SECTION(S)	Permit-by-Rule regulations (Chapter 305) apply to certain activities covered under the Natural Resources Protection Act (NRPA). Find the section for your type of proposed activity in the Chapter 305 standards above.
STEP 2	REVIEW CHAPTER 305 SECTION STANDARDS	For each section selected, read Applicability that describes in further detail which activities are included and where they are allowed. Read and comply with all the standards contained in the section.
STEP 3	FILL OUT PBR NOTIFICATION FORM, & COLLECT SUBMISSION DOCUMENTS	•Permit By Rule Notification Form •Dept. of Marine Resources Timing Form •Inland Fisheries & Wildlife Timing Form •Maine Geological Survey dune restoration/beach nourishment review form •Other NRPA Forms
STEP 4	PAY PBR FEE ONLINE DEP fee schedule	• The required fee is contained in the Department's fee schedule. • Payment of the application fee is accepted by credit card through the Department's payment portal. • Pay the fee prior to filing and include confirmation of credit card payment with email submission of your PBR.
STEP 5	SUBMIT PBR, ATTACHMENTS AND PROOF OF PAYMENT VIA EMAIL*	The Department requires the submission of Natural Resource Protection Act (NRPA) and Stormwater Permit-by-Rule (PBR) notifications by email to: DEP.PBRNotification@maine.gov
STEP 6	THE PBR IS EFFECTIVE AFTER 14 DAYS UNLESS OTHERWISE NOTIFIED BY THE DEPARTMENT	The PBR becomes effective 14 days from the date the Department receives the full submission (email notification and fee), unless the Department approves or denies the PBR prior to that date

PERMITTING SUPPORT


Preliminary

OUR SHORE Guide to Nature-Based Shoreline Stabilization Options in Maine

Planting Guide Summary

Selecting appropriate plants for a living shoreline is essential to long-term performance of the design and to restore habitat to natural conditions. This summary provides available planting guides for Maine landscapes, go-to sources recommended by experts who are designing and installing stabilization projects using nature-based practices, and a short list of coastal living shoreline plants.

Natural Landscapes of Maine:
A Guide to Natural Communities and Ecosystems
https://www.maine.gov/dacf/mnap/publications/

An essential part of the OUR SHORE approach is to maintain, restore, and enhance shoreline habitat elements. The Maine Natural Areas Program maintains descriptions of natural communities and ecosystems that illustrate what property owners and contractors should aim to achieve with their designs. Publications include detailed descriptions, maps, and photographs that serve as a valuable tool for understanding the rich biodiversity and environmental heritage of Maine's natural areas.

Maine Coastal Planting Guide
https://www.cumberlandswcd.org/documents-1/coastal-bluffs

This guide offers insights on selecting and cultivating plants that thrive in coastal conditions, such as salt spray, sandy soil, and strong winds, making it a valuable resource for coastal property owners, landscapers, and conservationists looking to establish resilient and visually appealing landscapes along the Maine coast. With tips on plant selection, maintenance, and design considerations specific to coastal settings, this planting guide serves as a practical tool for enhancing the ecological and aesthetic value of coastal areas in Maine.

Coastal Living Shoreline Plants

Low Marsh
- Juncus gerardii- saltmarsh rush
- Spartina alterniflora- smooth cordgrass

High Marsh
- Spartina patens- saltmeadow cordgrass
- Distichlis spicata- seashore saltgrass

Inland & Coastal Living Shoreline

Herbaceous Perennials
- Solidago sempervirens- seaside goldenrod
- Symphyotrichum novae-angliae- new england aster
- Symphyotrichum novi-belgii- new york aster

Trees & Shrubs
- Acer rubra- red maple
- Amelanchier arborea- serviceberry
- Cornus sericea- red osier dogwood
- Diervilla lonicera- bush honeysuckle
- Myrica pensylvanica- bayberry (Coastal)
- Pinus strobus- white pine
- Rosa carolina- pasture rose
- Rosa virginiana- virginia rose
- Rhus glabra- smooth sumac
- Salix nigra- black willow
- Spirea alba- meadowsweet
- Spirea tomentosa- steeplebush

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PLANT SELECTION

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