

# Coastal Sand Dunes and their Management



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**Coastal sand dunes** provide a **buffer** to protect adjacent uplands (both developed and undeveloped) and back-barrier marsh habitats from storms.

Dunes are **extremely dynamic features** that change constantly and have been migrating landward for millennia in response to storms and sea level rise.



Dune/Beach  
(Time 1)

Marsh

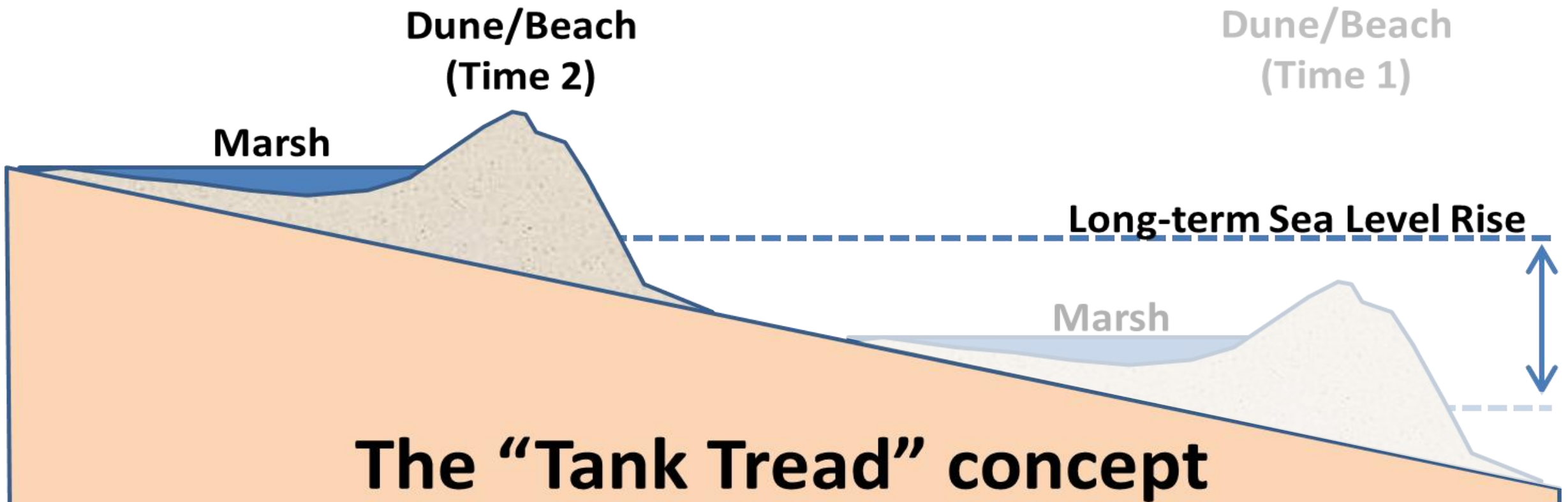
MSL

## The “Tank Tread” concept

Most coastal sand dunes formed a few thousand years ago and since then, have been moving landward in response to storms and increasing rates of sea level rise.

*P. Slovinsky, MGS*

*Adapted from Wells (1995)*



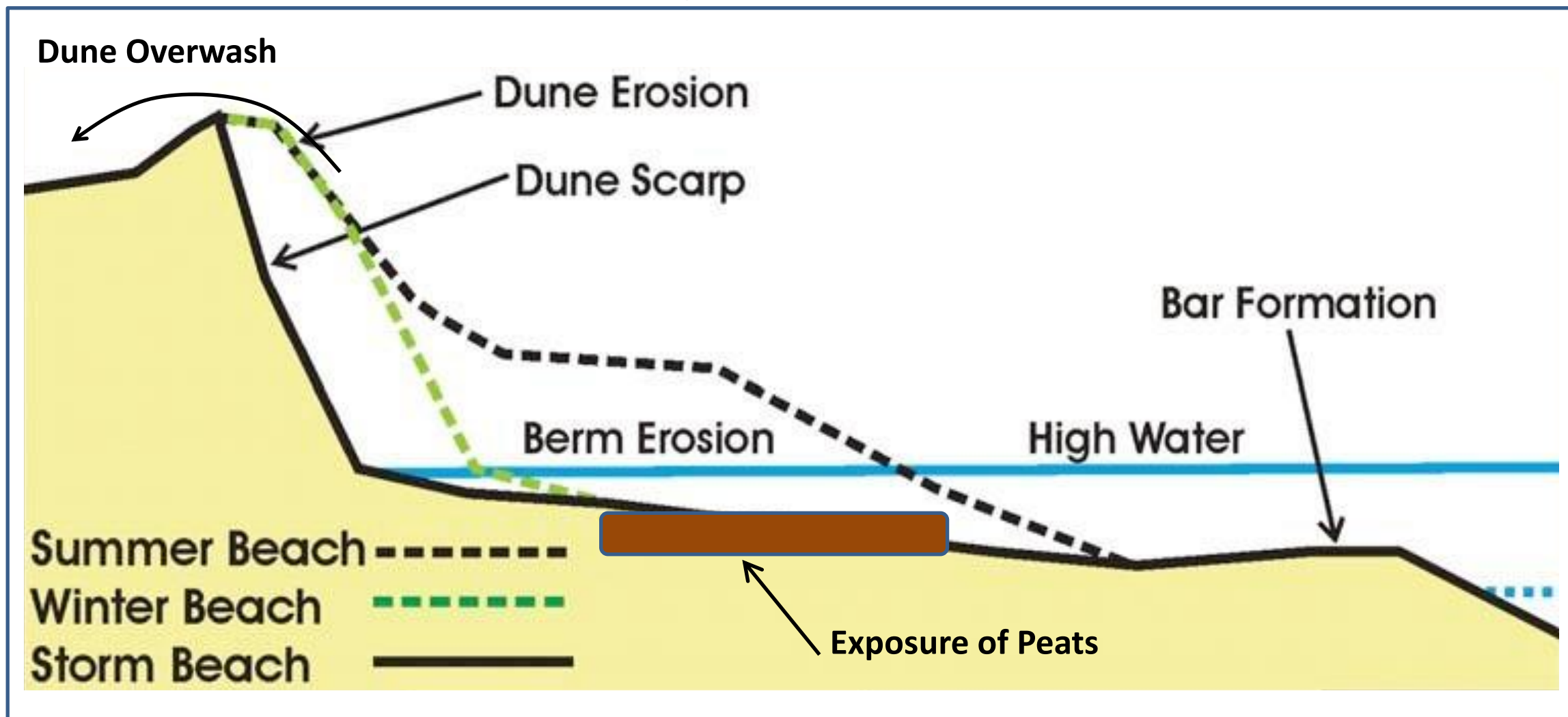
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# Coastal sand dunes and beaches respond to storms and short-term sea level rise through erosion, scarping, dune overwash, and bar formation



# Dune Overwash



# Dune Scarping



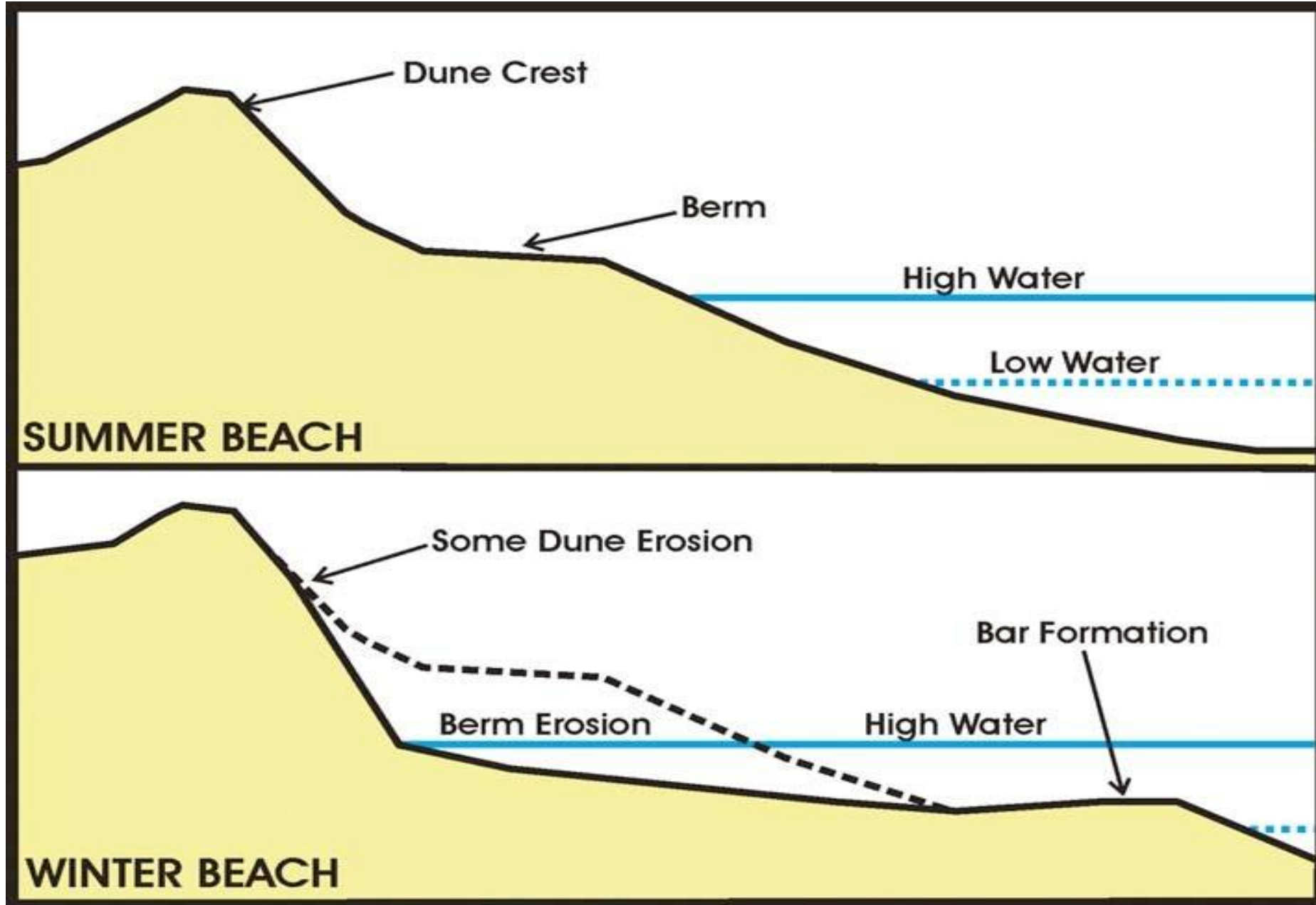
# Exposure of Marsh Peats



*Fortunes Rocks Beach, Biddeford, W. Kochtitzky, UNE, 2/2024*



# Dunes are also an integral part of seasonal sand exchange



**Summer Beach**  
**08-28-2008**



**Winter Beach**  
**01-26-2008**



**Seasonal Beach Changes – Summer vs. Winter**

# Regulatory Definition of a “Coastal Sand Dune System”

“Coastal sand dune systems” means sand and gravel deposits within a marine beach system, including, but not limited to, beach berms, frontal dunes, dune ridges, back dunes and other sand and gravel areas deposited by wave or wind action. Coastal sand dune systems may extend into coastal wetlands. Coastal sand dune systems include dunes that may have been artificially created, dunes that may have been altered by development activity, and dunes supported by sand fencing or stabilization structures. Coastal sand dune systems naturally migrate landward through the process of overwash. For the purposes of this definition, a small windblown accumulation of sand within a street is not considered a dune.

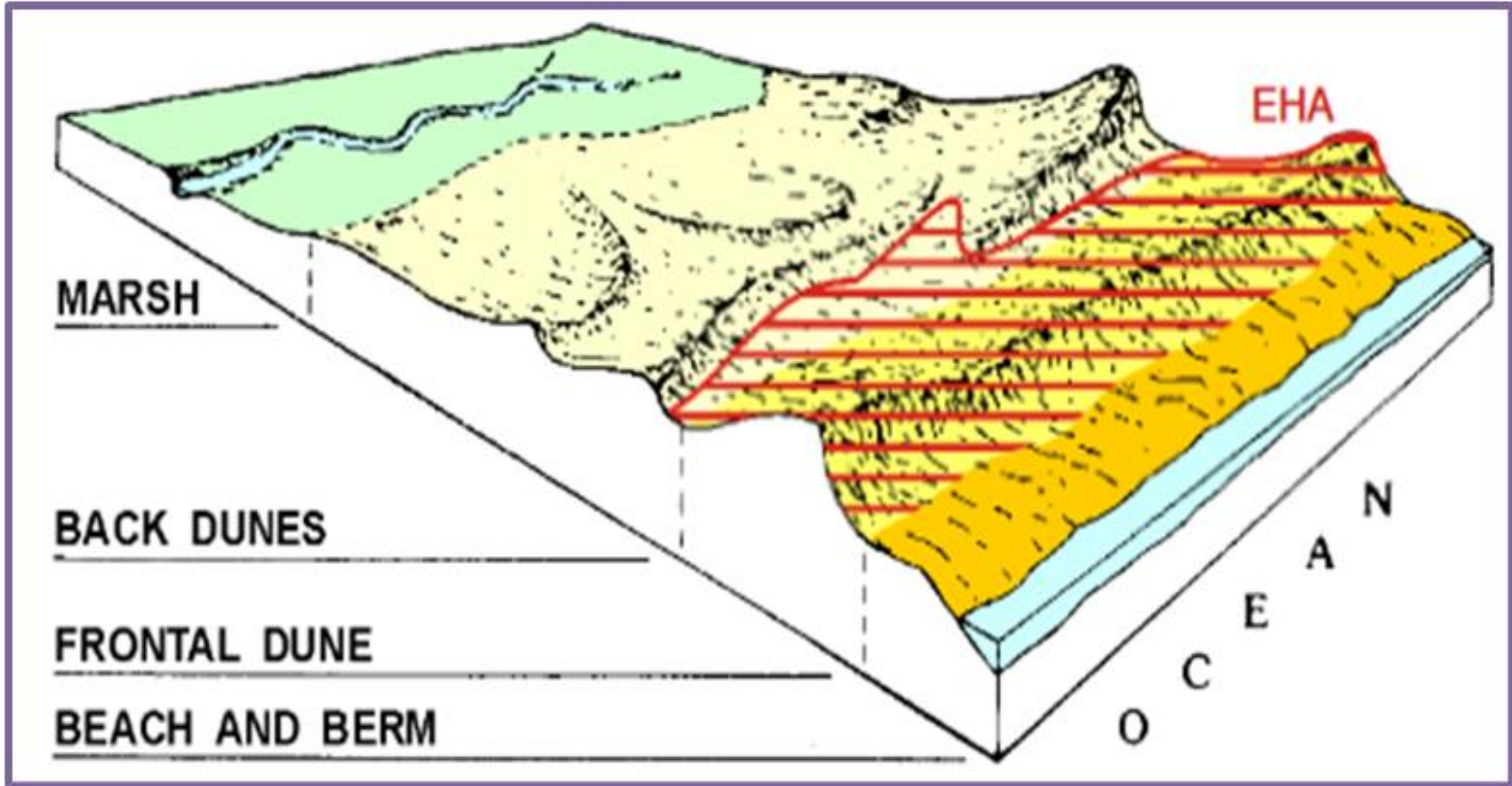
**Beach.** The zone of unconsolidated sand or gravel that extends **landward from the mean low water line to the seaward toe of a dune**. The definition of beach includes the beach face and berm.

<https://www.maine.gov/sos/cec/rules/06/096/096c355.doc>

*So coastal sand dunes can extend from back-barrier wetlands to the mean low water.*

# Mapping Coastal Sand Dune Geology

<https://www.maine.gov/dacf/mgs/pubs/digital/dunes.htm>



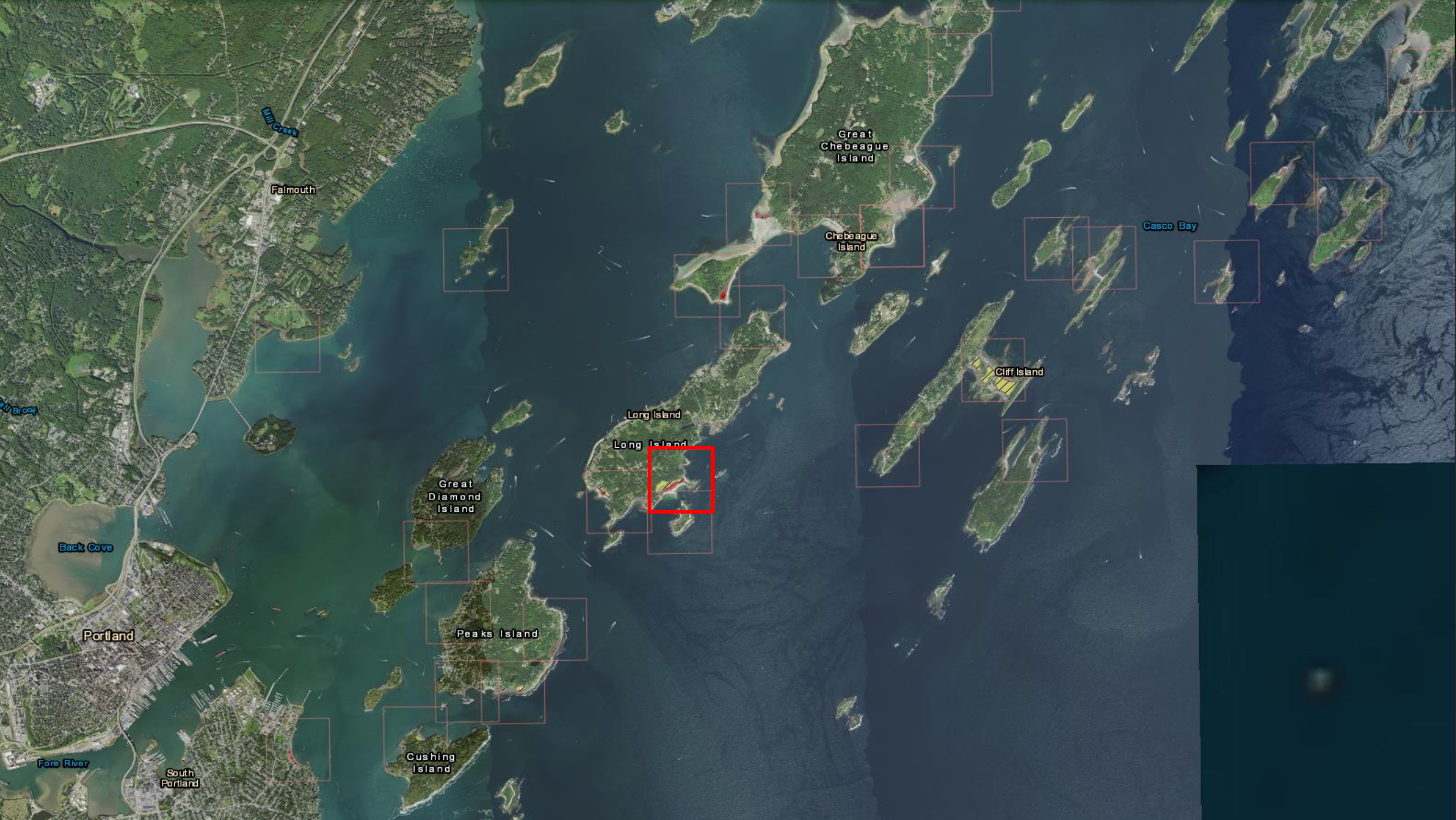
Find address or place

Map navigation controls: zoom in (+), zoom out (-), home, refresh.

Map labels: Mill Brook, Middle Brook, Back Cove, Fore River, South Portland, Portland, Falmouth, Casco Bay, Cliff Island, Long Island, Long Island, Peaks Island, Cushing Island, Great Diamond Island, Chebeague Island, Great Chebeague Island.

Scale bar: 1mi

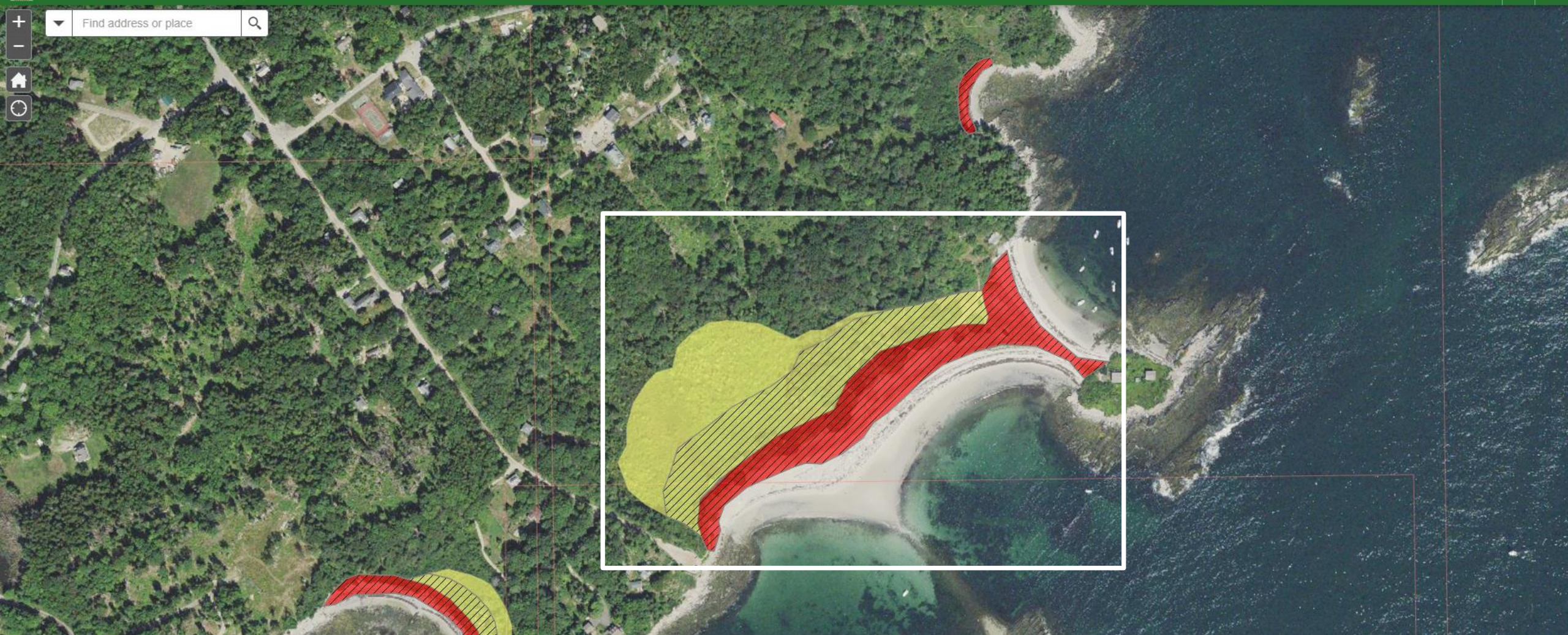
Coordinates: -70.014 43.645 Degrees



**How do we Map Coastal Sand Dune Geology?**  
<https://www.maine.gov/dacf/mgs/pubs/digital/dunes.htm>



Find address or place



Coastal sand dunes can be comprised of a **front dune (D1)** and **back dune (D2)** or sometimes just a front dune. They also can be **developed, undeveloped, and can extend into coastal wetlands and include an Erosion Hazard Area.**







**Front Dune**





**Back Dune**

**Front Dune**



**Back Dune**  
**(EHA can extend into the back-dune)**  
**Front Dune**

# How can one better manage the beach or dunes on their property?



Beach and Dune Best Management Practices

[https://digitalmaine.com/mgs\\_publications/630/](https://digitalmaine.com/mgs_publications/630/)

Maine Coastal Property Owner's Guide to Erosion, Flooding, and Other Hazards, 2<sup>nd</sup> Edition

[https://digitalmaine.com/mgs\\_publications/605/](https://digitalmaine.com/mgs_publications/605/)

# Beach and Dune Best Management Practices

- Post-storm driftwood and litter management
- Post-storm washover sand management
- Seaweed management
- Dune fencing
- Cobble-trapping fencing
- Dune path and walkover management
- Dune restoration or creation
- Enhanced dune restoration or creation
- Beneficial reuse of driftwood
- Beneficial reuse of holiday trees
- Beach scraping
- Beach nourishment

# Post-storm driftwood & litter management

Larger storms can result in litter and driftwood being washed into sand dunes. To the maximum extent, natural driftwood, sand, and wrack *should stay in the dune*. Non-natural lumber and litter should be *removed carefully*. Note that natural driftwood may also potentially be used to restore dunes. Overwash sand should not be disturbed if in a natural frontal dune. Permits are generally not needed to relocate driftwood or remove non-natural lumber.



# Post-storm washover sand management

Larger storms can result in sand being washed over into portions of both natural and developed dunes. This is a natural process called overwash, or washover, and allows sand dunes to build in elevation. In natural dunes, washover sand should be left in-place. In developed dunes (such as roads, driveways, or lawns), sand should be returned to the beach to the maximum extent practicable and spread to a depth of no greater than 3 inches.



# Seaweed Management

Seaweed washed up on the beach and at the base of dunes is vital to providing nutrients to dune grass and helps trap windblown sand. However, it can become a nuisance on some beaches. Thick mats of “nuisance” seaweed can be moved by-hand (rake, pitchfork, etc.) and spread at base of a dune scarp or on top of dune grass at a maximum thickness of 6” to enhance dune grass growth. This does not require a permit.

Excess seaweed can be spread behind the frontal dune crest to mimic storm washover. Raking of seaweed on the beach with mechanized equipment will require a Maine DEP permit and needs to minimize sand loss. Note that invasive seaweed species such as *Dasysiphonia japonica* should be removed from the beach and placed in a landfill, as possible.



# Simple dune fencing

Simple stake-and-twine dune fencing is effective at allowing natural dune growth while keeping people out of the dunes and is extremely easy to install and manage. Open snow-fencing (with openings 4 inches or greater) can also be used but is harder to place and more difficult to remove. Fencing should be placed in spring (after April 15), moved seaward in summer (as the dune grows), and generally removed in winter otherwise fencing will likely be damaged by winter storms. Fencing should be placed within 10-15 feet of dune edge and *at least a foot* above the highest predicted tides. Simple dune fencing can be placed without a permit.





# Enhanced dune fencing

Simple dune fencing relies on natural dune grass to trap sand.

Enhanced dune fencing traps windblown and storm-transported sand using different fence types. Shown top left is straight-line plastic snow fencing; middle-left is a zig-zag plastic snow fence; bottom left is a wood-stake matrix technique.

Enhanced fencing techniques maybe limited in terms of timing and require a permit from Maine DEP.

Examples are from work by Bar Mills Ecological in Ogunquit, ME and Truro, MA by Safe Harbors Environmental.



Top 2 images - Ogunquit Beach, S. Schaller (Bar Mills Ecological)  
Bottom image - Truro, Cape Cod, G. Peabody (Safe Harbor Enviro.)



# Cobble-trapping fencing

In some areas, a common problem during storms is cobbles being thrown up onto properties or even into structures. In certain locations, cobble-trapping fences can help mitigate this. These are open fences (50% porosity or greater) that can be installed seasonally (installed in the winter, removed during the summer), but **only in developed dune areas that are dominated by cobbles**. Cobbles trapped during storms need to be placed back onto the beach. Note that cobble-trapping fences requires a permit from Maine DEP Permit-by-Rule.

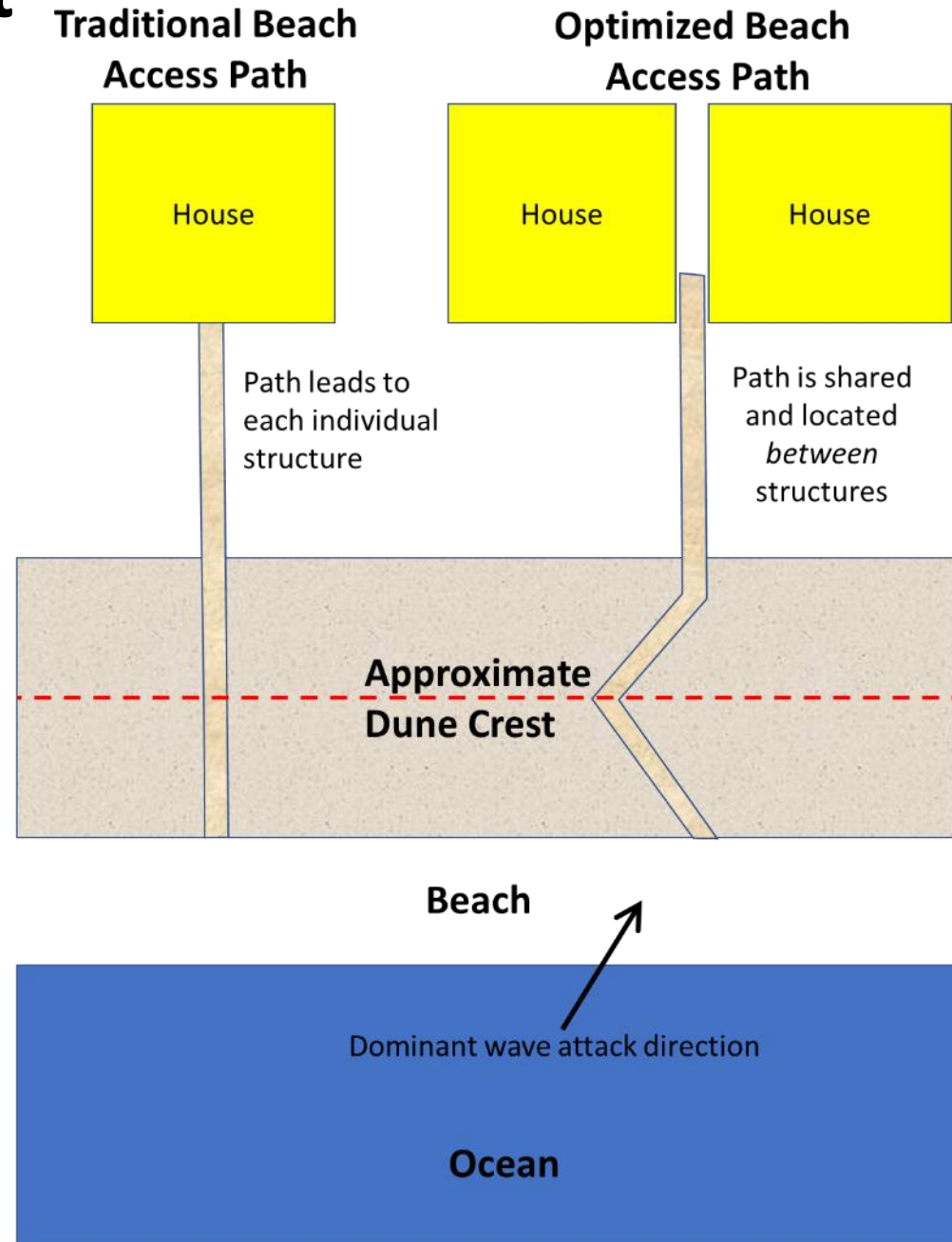


# Dune path management

The traditional beach access path is an individual path from the center of a structure through the dunes to the beach. This creates a “runway” for storm waves, flood water, and end-effect erosion at the path entrance. Instead, consider an optimized “zig-zag” design for beach access paths, in which the “zag” portion of the path curves away from the dominant storm wave attack direction.

If possible, work with your neighbors to decrease the number of paths that cut through the dune and relocate paths so that no single path comes right up to the front of a house. Dune path rerouting currently requires a permit from Maine DEP.

If a straight path is desired, build it up over a contiguous dune ridge and use mats to limit grass trampling.



# Dune walkovers



*Old Orchard Beach, S. Schaller (Bar Mills Ecological)*

In certain locations (such as highly trafficked public access sites), dune walkovers may make more sense than a dune path. Walkovers allow for a straight path to the beach, but because they are elevated, allow for dune growth so that a contiguous protective dune ridge can be maintained. Dune walkovers can be constructed so they are seasonally removable (along open coast areas), or permanent (in low-energy dune areas). A dune walkover requires a permit from Maine DEP and has to meet certain elevation and slat spacing standards.

# Dune restoration or creation



In certain locations, sand dunes can be restored or created by bringing in sediment and planting with American Beach Grass. Late spring (April) planting is ideal, as plants are still dormant, winter storms are dissipating, and this allows a full growing season. If constructing a dune, try to build the crest to at least 1-foot above the 100-year base flood elevation. Note that construction activities may also be limited by bird nesting windows. A Maine DEP Permit will be needed for restoration and creation activities.

# Enhanced dune restoration or creation



Dune restoration may include enhanced techniques that utilize biodegradable stabilization materials such as coir logs, coir fabric, and wooden/biodegradable anchoring stakes. Biodegradable materials used in enhanced dune restoration must remain covered in sand and vegetation, be used in conjunction with vegetative plantings, and meet other design requirements, such as the slope of existing dunes. In cobble-dominated areas, restoration could include the construction of a cobble dune ridge. Depending on what is proposed, enhanced dune restoration activities may require a [Chapter 305 16-A Permit-by-Rule](#) or a Maine DEP Individual Permit.

# Dune restoration or creation by beneficially using driftwood



In beach and dune areas with washed up driftwood after winter storm events, driftwood can be strategically placed within dunes to trap windblown and washover sand and restore dunes. In the above example from Popham Beach State Park, Phippsburg, driftwood was placed in several rows to simulate natural dune ridges. Over the period of several months, the wood trapped windblown sand and dune vegetation established and trapped more sand. Note that placement activities may be limited by bird nesting windows. A Maine DEP Permit-by-Rule may be needed for dune restoration and creation activities that beneficially uses driftwood.

# Dune restoration or creation by beneficially using holiday trees



*Popham Beach, Phippsburg, P. Slovinsky, MGS, 3-25-2024*



*Popham Beach, Phippsburg, D. Von Savage, BPL, 4-13-2024*

Discarded holiday trees can be potentially used to help restore eroded sand dunes by strategically placing them to trap windblown sand. At Popham Beach, Phippsburg, holiday trees were collected by the Park for dune restoration. Trees were placed in shore-parallel directions in several rows to simulate natural dune ridge width. After only a few weeks, the trees have started to trap windblown and wave deposited sand. Note that tree placement activities may be limited by bird nesting windows. A Maine DEP Permit-by-Rule and a Solid Waste permit will be needed for dune restoration and creation activities that beneficially use discarded holiday trees.



# Beach Scraping



In certain locations, beach scraping can be an effective but usually temporary measure to repair eroded dunes. A tractor is used to scrape sand from about the high tide line up against the eroded dune scarp to simulate dune growth and the dune planted with vegetation. A Maine DEP Permit-by-Rule is usually required and work is limited by time-of-year restrictions.



# Beach Nourishment

Beach nourishment is typically undertaken as beneficial use of dredged materials from the dredging of a federal channel or harbor by the US Army Corps of Engineers. Communities will typically partner with the US Army Corps on these projects. Smaller projects may be undertaken by communities that privately dredge sandy areas. The goals of nourishment is to increase the protective dry beach width and elevation, and nourishment is sometimes coupled with sand dune construction or restoration. Sand grain size and texture must be compatible with existing beach sand. Work is limited by time-of-year restrictions. Smaller (<10,000 cubic yard) beach nourishment projects may qualify for a Maine DEP Permit-by-Rule, while large projects may require relatively extensive state and federal permitting.



# Other Resources that may be helpful

**MGS Coastal Sand Dune Geology Digital Data Web Map**

<https://www.maine.gov/dacf/mgs/pubs/digital/dunes.htm>

**MGS Coastal Sand Dune Geology 1:4,800-scale Online Maps** (alphabetical by location)

<https://www.maine.gov/dacf/mgs/pubs/online/dunes/dunes.htm>

**MGS Beach and Dune Best Management Practices**

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**Maine Geological Survey Hazards Page**

<https://www.maine.gov/dacf/mgs/hazards/index.shtml>