Maine Geological Survey

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Sample sidebar from Coastal Bluffs Map

Types of Bluffs Along Maine's Coast

This map shows the shoreline type and relative stability of bluffs along a section of the Maine coast. The slope, shape, and amount of vegetation covering a coastal bluff and the adjacent shoreline are directly related to the susceptibility of the bluff face to ongoing erosion. As might be expected, less vegetated bluffs are more likely to be eroding than completely vegetated bluffs. Another important factor related to bluff stability is the material which makes up the bluff. Materials such as clay, gravel, and sand react differently to erosion and, when combined with variations in vegetation and slope, affect the rate of erosion for an individual bluff. When planning to reduce the risks of coastal erosion, it is important to take vegetation, slope, erosion rate, and sediment types into consideration.

On this map, a bluff is defined as a steep shoreline slope formed in sediment (loose material such as clay, sand, and gravel) that has three feet or more of vertical elevation just above the high tide line. Cliffs or slopes in bedrock (ledge) surfaces are not bluffs and are not subject to significant erosion in a century or more. Beaches and dunes do not form bluffs, except along the seaward dune edge as a result of erosion. This map does NOT identify erosion trends on beaches or sand dunes.

Coastal environments are dynamic and subject to continuous change. Gravitational processes of creep, slumping, and occasional landsliding modify the shape of coastal bluffs. Rising sea level along Maine's coast (at a rate of about 2 mm/year, slightly less than a foot per century) allows storms and coastal flooding to reach further inland and erode sediments at the base of bluffs. Steepening of bluffs by erosion at their base may lead to increased slumping and deposition of clay, sand, or gravel in the intertidal zone which then acts to stabilize the bluff for a period of several years to decades as coastal processes rework and remove the slumped material. Once the material at the base of the bluff is removed entirely, the bluff may then be undercut again and the cycle of slumping followed by protection of the bluff base will be repeated. Most bluffs erode erratically, perhaps losing ground one year and not the next. Over a period of many years a bluff may permanently retreat landward. Historical analysis can help determine the average rate of bluff retreat.

Over time, the appearance of bluffs will change. Coastal flooding, erosion, slumping, creep, deposition in the intertidal zone, ice action, ground-water drainage, and human alteration will change bluff appearance. For example, unvegetated beaches are more easily eroded than salt marshes, armored shorelines, or ledges. Also, bluffs covered with vegetation and having a gentle slope have been more stable than those with steep slopes and little vegetation. Understanding the processes that erode bluffs can help determine what solutions are appropriate to reduce future rates of property loss.

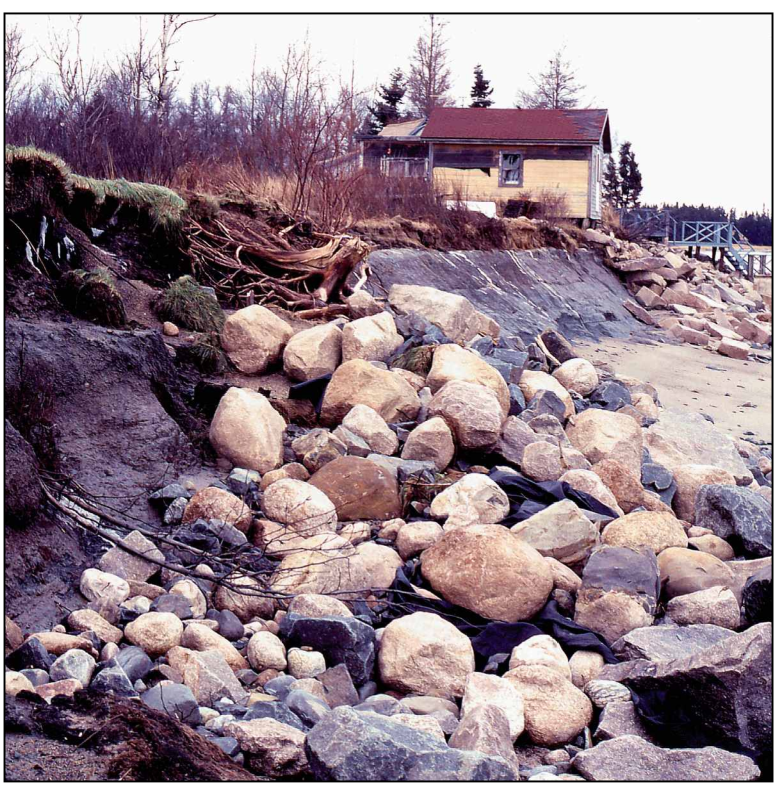
This map can help identify shorelines with increased risk of coastal erosion. Review the legend below in order to understand what the map shows and does not show. The colored categories correspond to field conditions when the map was made. Conditions may have changed in the last few years. Comparison of the information on this map with current conditions may indicate that a stability category is different now. Since bluff erosion may be cyclical, the change may only be temporary. If coastal development is near any bluff we recommend a professional evaluation be made to determine the risk to structures.

Highly unstable bluff with an unvegetated bluff face and a salt marsh shoreline. Sediments on the bluff face are exposed and fallen tree trunks lie at the base of the bluff. A salt marsh has recently formed on the tidal flat, partly on the top of an old landslide deposit.

Highly unstable bluff with an unvegetated bluff face and a beach/gravel flat shoreline. The bluff face is too unstable to support vegetation. This bluff, a glacial esker, is eroded by waves to create a mixed sand and gravel beach in front the bluff.

Unstable bluff with a partially vegetated bluff face and a salt marsh shoreline. This bluff, protected by a salt marsh, remains unstable. There are small bushes on the bluff as well as small non-vegetated areas that indicate continuing bluff retreat.

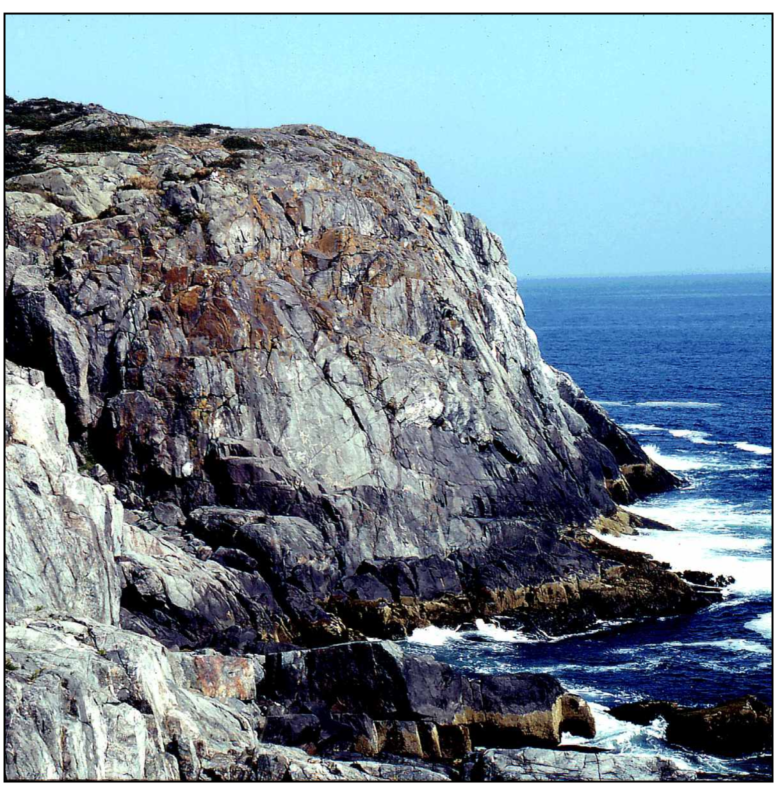
Unstable bluff with a partially vegetated bluff face and a beach/gravel flat shoreline. Slump scars on the bluff face expose sand, gravel, and roots. Fine sediments are removed by waves and currents, leaving gravel to form a beach at the base of the bluff.



Highly unstable bluff with an unvegetated bluff face and an armored shoreline. This armored bluff is eroding despite an effort to shore it up with riprap, or loosely piled stone blocks. Maintenance at this site could improve bluff stability.

Stable bluff with a vegetated bluff face and an armored shoreline. The bluff face is fully vegetated and supports a mature stand of trees with vertical trunks. The presence of a wooden bulkhead suggests that erosion has occurred in the past.

Stable bluff with a vegetated bluff face and a salt marsh shoreline. A low bluff face is covered by shrubs landward of a salt marsh terrace. In this location the mature marsh protects the base of the bluff from rapid erosion and slows bluff recession or retreat.



No bluff with a ledge shoreline. A steep slope on the bedrock surface is not a bluff. On this map, bluffs must be made of sedimentary material, generally with 3 feet or more relief. This shoreline type is very slow to change.

Lengths of Bluff Types Shown on This Map

Town	Highly unstable bluff	Unstable bluff	Stable bluff	Non-bluff shoreline	Unmapped shoreline
Brunswick	0.8	3.8	13.7	15.1	2.6
Harpswell	1.1	16.0	52.9	73.5	6.8
Phippsburg	0	0	0.8	3.9	0.2
West Bath	0.3	0.6	3.8	2.6	0
Total	2.2	20.4	71.2	95.1	9.6

Note: Len gth of bluff types in the table above are in miles. Distances are only for the town shoreline shown on this map, not for the entire town or unmapped locations.

Related Maps

Dickson, S. M., 2001, Coastal landslide hazards in the Orrs Island quadrangle, Maine: Maine Geological Survey, Open-File Map 01-530.

Smith, G. W., 1977, Surficial geology of the Bath 15' quadrangle, Maine: Maine Geological Survey, Open-File Map 77-8.

Locke, D. B., 1999, Surficial materials of the Orrs Island quadrangle, Maine: Maine Geological Survey, Open-File Map 99-57.

Other Sources of Information

Berry, H. N., IV, and others, 1996, The April 1996 Rockland landslide: Maine Geological Survey, Open-File Report 96-18, 55 p.

Kelley, J. T., Kelley, A. R., and Pilkey, O. H., 1989, Living with the coast of Maine: Duke University Press, 174 p.

Osberg, P. H., Hussey, A. M., II, and Boone, G. M., 1985, Bedrock geologic map of Maine: Maine Geological Survey, map, scale 1:500,000.

Thompson, W. B., and Borns, H. W., Jr., 1985, Surficial geologic map of Maine: Maine Geological Survey, map, scale 1:500,000.

Additional information and products are available through the Maine Geological Survey publications mail-order catalog or via the Survey's web site (address shown in title block). The web site includes fact sheets about coastal processes, hazards, sea-level rise, and geologic history.