

**Assessment of Bluff Erosion,
St. Croix Island International Historic Site
Washington County, Maine.**

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A visit to the St. Croix Island Historic Site was made by Alice R. Kelley on June 14, 2007, at the request of Rebecca Cole-Will, Acadia National Park. Accompanied by Ms. Cole-Will and Meg Scheid, St. Croix Island Historic Site, Kelley visited the mainland portion of the site, as well as St. Croix Island to observe and comment upon recognized bluff erosion problems at both locations. Following is a summary of the visit and recommendations relative to bluff erosion within the historic site.

Mainland:

The mainland portion of the park is located on a small peninsula composed of glaciomarine silt and clay overlying glacially polished and striated bedrock. The banks along the peninsula are steep, and are a mixture of rip-rap, vegetation, and exposed sediments. Several bluff locations along the north-facing portion of the peninsula showed evidence of slumping. Slump blocks ranged in size from .5 m to over a meter in diameter, and were composed of fine-grained sediment topped with vegetation sitting at the base of the bluff. Several other locations also were characterized by steep banks hosting trees with curved trunks, evidence of creep - a slow down slope movement of sediment.

Creep is common on steep slopes composed of fine-grained material. It occurs in response to the movement of individual soil particles as a result of freeze-thaw activity. This type of soil movement takes place slowly, and is generally not considered a problem on undeveloped slopes. Slumping is also common along steep slopes composed of fine-grained sediment. Slumps move as a block of sediment along a curved, rotational surface, with the top surface of the blocks ranging in size from .5 m to 10's of meters. Slumping occurs in response to undercutting by wave action in exposed coastal settings, and to the accumulation of groundwater and loading. Large slumps, sometimes called landslides, have occurred in glaciomarine sediments in a number of locations in Maine: Rockland in 1973 and 1996, Gorham in 1983, Brunswick in 1997, Wells in 2005, and Greenbush in 2006.

The slumps observed at the Mainland portion of St. Croix International Historic Site are relatively small, with block widths generally less than 1-2 m. However, in at least one location, slump surfaces are close to the footpath and a large statue. Due to the protected nature of the small cove to the north of the mainland site, it is unlikely that the slumping is due to undercutting by waves. It is probably the result of groundwater accumulation, exacerbated by the removal of vegetation on the bluff and peninsula surface, as well as the loading created by the installation of structures, walkways, and statues. The practice of dumping brush, grass clippings and debris over the edge of the bluff exacerbates the problem by killing bluff slope vegetation that helps to hold bluff

material in place and absorbs water. Social paths from the park to the water also provide conduits for surface runoff, and add to localized erosion.

Bluff erosion along these slopes will occur episodically, and with little warning. Precursors to a slump may include crescent-shaped cracks in the ground surface along the developing rotation surface. Areas with the thickest accumulations of glaciomarine sediments, the least vegetation and greatest ground-loading (structures and/or statues) have the highest potential for slumping.

St. Croix Island:

Bluff erosion is occurring on the south-facing portion of the island, which is composed of sand and silt. The bluff is not vegetated, and removal of material from the base by waves and ice abrasion will result in down slope movement of sediment. Disturbance by foot traffic will also create erosion. The southwestern portion of the Island, known as "Bone Point", has been the site of bluff erosion in the past. Currently, the bluff face is lightly vegetated, and appears moderately stable.

Both of these locations are somewhat protected from wave attack by smaller islands to the south. While these features provide some obstruction from waves, high tides combined with storms may cause episodic erosion at both bluff locations.

Recommendations:

Mitigation of bluff erosion can be accomplished by: armoring the bluff with rip-rap or attempting to slow bluff erosion through sound landscape management practices and moving structures that contribute to the problem. For the reasons described below, armoring of the bluff is considered to be the least responsible and environmentally-friendly alternative.

Bluff erosion in both of these locations is a natural geological process that maintains the coastal features seaward of the bluff. Erosion of the sand/silt bluff on St. Croix Island produces the sediment that creates the small beach on the southern portion of the island. In the mainland portion of the historic site, sediment produced by slumping contributes to the small beach at the base of the bluff and the adjacent tidal flats. Because this contribution of sediment is considered a vital part of the natural cycle of landscape creation, armoring of the bluff is not considered to be an ecologically sound alternative. It will provide a short-term solution, but as the beach at the base of the bluff diminishes due to lack of sediment, the wall will lose its supportive base and fall. Anticipated sea level rise will exacerbate this problem.

Rip-rap on an intertidal bluff is considered a seawall by the State of Maine, and the State Shoreland Zoning Ordinance requires a member of the public to obtain a permit to build an intertidal seawall. A federal consistency determination is required for federal action of this type.

A more ecologically responsible alternative would be to manage park resources in such a way as to minimize loading and groundwater retention of the potentially unstable areas in the mainland portion of the site. Encouraging shrubs on and near the bluff edge will help hold the sediment in place and aid in removal of groundwater. Heavy objects, such as statues, should be moved away from identified slump locations.

At present, the bluffs on St. Croix Island require no mitigation. Monitoring of bluff retreat rates and vegetation status, particularly after storms, is suggested to protect cultural resources. An emergency plan should be developed for culturally sensitive areas, should erosion begin to be a problem.

Summary:

Bluff erosion is occurring within the St. Croix international Historical Site at the southern end of St. Croix Island and along the northern portion of the mainland peninsula. Monitoring and the development of an emergency action plan is suggested for the culturally sensitive portions of the island. Park management that includes vegetation of the bluff edges and slopes with shrubs and removal of heavy objects near the bluff edge may slow this natural process. Rip-rap of the bluffs is not recommended, as it will deprive nearby beaches and tidal flats of sediment.

