Rising Seas at Acadia: Implications and Strategies for A Changing Landscape

By Catherine Schmitt

Part I—Migration

Acadia's salt marshes are drawing increased scrutiny from land conservation organizations and park staff. While eastern Maine lacks the large, extensive marshes characteristic of southern Maine, small individual pockets and fringes of marsh are more numerous here, and Acadia has the major tidal marsh systems of Northeast Creek and Bass Harbor. But the future of even these areas is in question.

Marshes exist in the narrow space between low and high tides; they have developed over hundreds of years of slowly rising sea levels. With the rate of sea level rise accelerating, salt marshes could disappear within decades. Why care? Marshes are as productive as agricultural cropland, supporting the coastal food web of fish, shellfish, birds, and other animals. Marshes act like a filter, helping to clean coastal waters. They absorb the energy of storm surges and floods, protecting property. With their grasses shimmering silvery green in the breeze and their buzz of life and bird song, marshes offer sensory texture and delight to the human mind and soul.

So people are trying to find ways to prevent marsh loss. One option is to make sure they have room to "migrate" or spread inland as the high tide rises higher. Maine Coast Heritage Trust, the National Park Service, and other partners have identified where land protection can help provide for marsh migration.

Northeast Creek is mostly tidal freshwater marsh, but in the future it will be saltier. As rising sea levels raise the tide, the salt marsh plants creep up into coastal forests and bogs as the seaward edge of the marsh sloughs off into the water. Conservation specialists with Maine Coast Heritage Trust, Misha Mytar and Jeremy Gabrielson, pay attention to areas that can accommodate this shift. They look at topography, elevation, soil type. "Northeast Creek and Bass Harbor Marsh are two really significant estuaries," said Mytar. "We've been involved, in partnership with Acadia, in quite a bit of conservation work in both marshes. At Bass Harbor Marsh, most of the current and future marsh areas are conserved, and so right now we've been focusing more on the marsh and adjacent uplands at Northeast Creek and Jones Marsh, a smaller but important marsh near the head of the island."

Using mapping software and field reconnaissance, they look for low, gradual slopes, and undeveloped buffers adjacent to existing salt marsh.

Areas within only a couple of vertical inches of the highest annual tide, where cranberries and bog laurel now grows, they expect vegetation to shift.

"We don't know what the rate of sea-level rise is going to be, but one of the things we look at is existing salt marsh vegetation, plants and their seeds that are surviving and doing well, and helping to trap soil to build the marsh over time. Hopefully that process will continue, even as sea levels rise," said Gabrielson.

"We are keenly watching the shifts in salt marshes—gathering data on how they are moving, forecasting plausible future scenarios, and working with scientists and other stakeholders to discuss our goals and test management responses, such as helping plant species move upland," said Rebecca Cole-Will, Acadia National Park chief of re- source management. "Most of our resource managers were trained to prevent change to the extent possible—managing change is new for most of us, but necessary. We are taking a deliberate and thoughtful approach as we learn.

Part II—Disappearance

The glaciers that created Maine left behind a varied coastal landscape. Salt marsh filled in the low-lying areas adjacent to the sea. In other parts of the coast, ice scraped the bed- rock to bare stone and cliff. Elsewhere, glacial meltwater deposited piles of gravel, sand, and clay that became beaches and soft bluffs. These features, exposed to waves and currents, have been gradually eroding ever since. When a big storm comes, like a late winter nor'easter or a fall hurricane, surging waters can swallow whole sections of coast.

Now, warming temperatures have accelerated the rate of sea-level rise, boosting storms to new levels of damage. Flooding reaches farther inland. Storm waves grow taller, stronger, hungrier. Climate change is slow, until it isn't. Storms have a way of turning the creeping into the catastrophic, the subtle becomes obvious.

For the most part, the National Park Service does not intervene in these processes, but there are exceptions. For example, at Thompson Island, which the ocean has been eroding for the last 20 years, the Park Service has moved some fire pits inland but otherwise allowed picnic sites and trees to be washed away. "In this case, retreat seems to be the most reasonable alternative," said Cole-Will. Response is different where human safety is threatened. After large storms, roads like those on the Schoodic Peninsula need to be cleared of rocks and debris. The roads are preventing shifts in the cobble coastline that would happen were they not there. The Park Service is starting to think about the long-term future of these roads and other vulnerable coastal infrastructure.

Culturally important sites are another exception. The southern end of St. Croix Island, a tall bluff made of soft sediment, is eroding, a case of gradual weathering that has been occurring for hundreds of years, now worsened by higher sea levels and stronger storms. Listed as an international historic site, the only such designation in the National Park System, St. Croix represents the early attempt by France to colonize the region known as "Acadia" in 1604. Today, the island is man- aged as a cultural landscape, with significant historic resources related to the colony. De- tailed maps by French cartographer Samuel de Champlain from 1604, and another by Canadian historian William Francis Ganong in the 1800s, show how the outline of the island has changed over the centuries. The Park Service is conducting research and survey work to document erosion in order to assess the vulnerability of the island. In 2016, to begin a planning process for management, they assembled a team of experts—natural and cultural resource managers, interpreters, and consulting scientists, including Alice and Joseph Kelley from the Climate Change Institute and School of Earth and Climate Sciences at the University of Maine. They followed up with a ground-penetrating radar survey, a non-invasive method that sends an electrical signal down into the earth. The signal is reflected back to varying degrees depending on the subsurface material and structure. Irregularities could indicate the remains of floors or walls, soil disturbance, and other signs of human activity. They are still analyzing the data, assembling and interpreting hundreds of two-dimensional sample slices into a comprehensive picture.

The Kelleys are using the same radar technique to assess shell middens, complex coast- al archaeological sites that document thou- sands of years of Native American history. "These sites contain evidence of ancestral Wabanaki occupation, use of marine resources, and changes in material culture that provide one line of evidence about their history," said Cole-Will. Most middens are at the very edge of shore; many have already disappeared.

By calibrating the process on excavated portions of middens, the Kelleys and graduate student Jacque Miller have been able to ground-truth the depth, layers, and extent of middens. Now they are using the method to map out other sites, in the hopes of developing a way to quickly assess areas without having to do an expensive, time consuming archaeological dig. The Park Service protects and manages coastal sites within its boundaries, and consults closely with Wabanaki tribal historic preservation officers. The Kelleys' research may contribute to understanding the impacts of coastal erosion on archaeological sites.

Temperature will continue to warm; sea levels will rise. Those charged with stewardship of public land and waters want to pre- serve what they can of our shared human and natural history, so that not all is lost to the sea.

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