Arctic Network

Bering Land Bridge N Pres. • Cape Krusenstern NM
Gates of the Arctic NP & Pres. • Kobuk Valley NP • Noatak N Pres.

Coastal Erosion Resource Brief

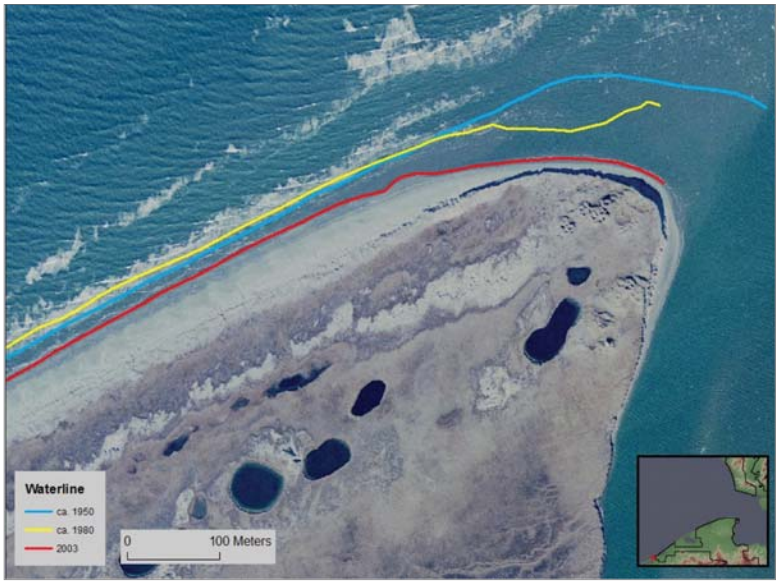
January 2011, no. 07

Actively eroding coastal bluff in Bering Land Bridge National Preserve.

Status & Trends

Coastal erosion in the Arctic Network

The Arctic Network (ARCN) coastal erosion monitoring program has detected significant changes to the coastlines of Bering Land Bridge National Preserve (BELA) and Cape Krusenstern National Monument (CAKR) over the last five decades. These changes were documented through field research, a study on bluff-top erosion, and analysis of high-resolution images and reveal high spatial variability related to coastal morphologies and processes. A comparison of images taken in approximately 1950, 1980 and 2003 suggests variability over time also, with erosion rates holding steady for BELA but decreasing for CAKR after 1980. In general, most of the coast has experienced erosion in the past five decades. Where erosion does occur, long-term rates are higher for BELA than for CAKR, average 0.5 m/yr (1.7 ft/yr), and can reach more than 3 m/yr (10 ft/yr).

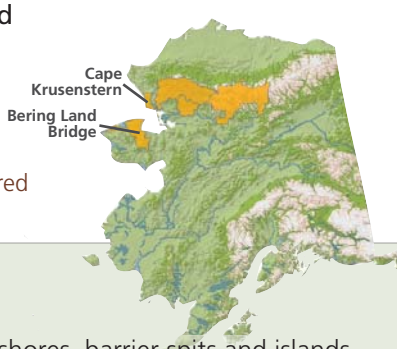


A close-up view of high-resolution imagery from 2003, showing detailed mapping of the coastline as it existed in 1950 (blue), 1985 (yellow), and 2003 (red). This point has eroded over 100 m (330 ft) in five decades.

Objectives

What do we want to know about coastal erosion in the Arctic Network?

- Determine long-term trends in coastline accretion, erosion, and bluff retreat, and how these rates have changed through time.
- Evaluate high spatial variability in erosion rates in relation to local environmental factors.
- Detect areas that are most vulnerable, and assess impacts on ecosystems and habitats.



Coastal erosion is being monitored in 2 of 5 Arctic Network parks:

Importance

Why is coastal erosion important in the Arctic Network?

Coastal environments within Bering Land Bridge National Preserve (BELA) and Cape Krusenstern National Monument (CAKR) are experiencing rapid environmental changes that are observable in the form of coastal erosion, bluff retreat, beach accretion, sediment deposition and permafrost melting. Protected by sea ice for several months each year, the fragile coastal zone may change rapidly as Arctic warming lengthens the ice-free season, causes sea-level rise, increases seawater temperature and alters storm frequency and severity. A variety of near shore marine, terrestrial, and freshwater habitats – including subtidal zones, sandy shores, barrier spits and islands, lagoons, bays and inlets, tundra bluffs, dune systems, rocky bluffs, deltas, and wetlands – are threatened by coastal erosion. Such areas provide critical habitat for unique plant communities, bird nesting, seal haul-outs, potential denning sites, freshwater and anadromous fish, and migratory stopover sites for marine mammals and birds. Coastal zone changes will also impact human activities and cultural resources such as travel routes, subsistence fishing, egg gathering, and hunting of waterfowl and marine mammals as well as altering or destroying archaeological sites.

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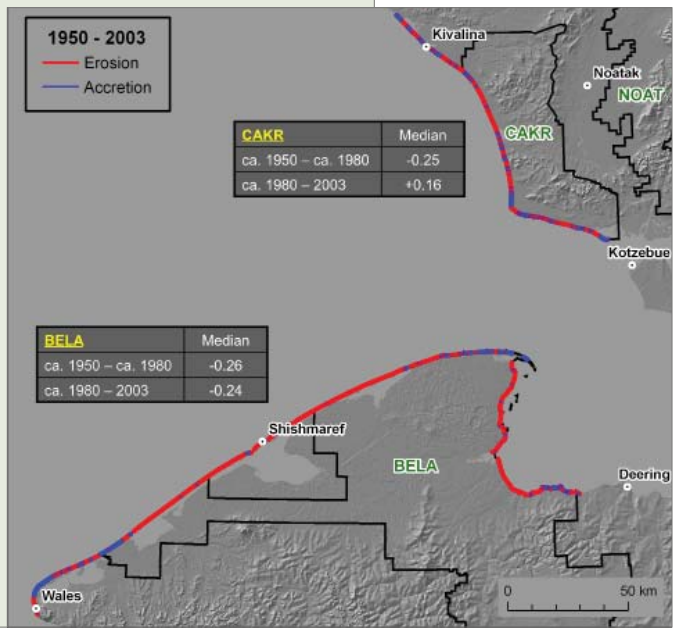
Management Applications

How can monitoring coastal erosion help protect parks in the Arctic Network?

- The coastal zone in BELA and CAKR harbors a substantial number of important subsistence species, including fish, migratory birds, and mammals. Tracking coastal change over time and space will allow park managers to better manage vulnerable subsistence species.
- CAKR and BELA were established to protect, among other things, archeological sites. Many of the important archeological sites within these park units occur on the coast and are threatened by rapid coastal changes.
- Subsistence users rely on the coastline as a transportation corridor and, in some cases, as the foundation of their community. Changes in the coastline in BELA, for example, threaten the very infrastructure of the community of Shismaref.



Map showing portions of the coastline that have experienced erosion (red) or accretion (blue) from 1950 to 2003. Inset tables show median rates of coastal change (both erosion and accretion) in m/yr. Most of the coastline for BELA and CAKR has eroded over recent decades.

Long-term Monitoring:

How will we monitor coastal erosion in the Arctic Network?

Coastal erosion and accretion will be assessed primarily through remote sensing of the coastline coupled with field mapping and measurements at long-term monitoring sites along the BELA and CAKR coasts. Remote sensing methods will involve repeated acquisition (approximately every 5-10 years) and analysis of finely detailed imagery. High-resolution, orthorectified imagery is required to measure erosion or accretion at rates of typically 0.1 to 5 m/yr. Precise digital elevation models are required to calculate volumetric loss or gain, as well as sediment and carbon fluxes to near shore marine ecosystems. Specialized software packages are then used to digitize the base imagery and determine erosion and accretion rates along the coast at various "timeslices". Spatial and temporal patterns can be related to coastal geomorphology and processes, and can quantify impacts on plant communities and habitats.

ARCTIC NETWORK

USING SCIENCE TO PROTECT OUR PARKS

THE ARCTIC NETWORK (ARCN) IS A MAJOR COMPONENT OF THE NATIONAL PARK SERVICE'S STRATEGY TO BETTER UNDERSTAND AND MANAGE PARK LANDS USING SCIENTIFIC INFORMATION. IT IS ONE OF FOUR INVENTORY AND MONITORING NETWORKS IN ALASKA AND 32 NATIONWIDE.

The Arctic Network provides scientific support to five parks covering more than 19 million acres. Bering Land Bridge National Preserve and Cape Krusenstern National Monument share similar coastal resources and biogeographic ties to the former land bridge between North America and Asia. Kobuk Valley National Park, Noatak National Preserve and Gates of the Arctic National Park and Preserve span extensive, mountainous terrain at the northern limit of treeline.

The Arctic Network is developing long-term monitoring protocols for 28 'vital signs', or physical, chemical and biological indicators that were selected to represent the overall health of these parklands. Many of these vital signs are expected to show change due to regional and global stressors including climate change and deposition of industrial contaminants. Many vital signs also have important human values including for subsistence.

ARCN VITAL SIGNS:

- Air Contaminants
- Brown Bears
- Caribou
- Climate
- Coastal Erosion
- Dall's Sheep
- Fire Extent & Severity
- Fish Assemblages
- Invasive/Exotic Diseases
- Invasive/Exotic Species
- Lagoon Communities & Ecosystems
- Lake Communities & Ecosystems
- Landbird Monitoring
- Moose
- Muskox
- Permafrost
- Point Source Human Effects
- Sea Ice
- Small Mammal Assemblages
- Snow & Ice
- Stream Communities & Ecosystems
- Subsistence/Harvest
- Surface Water Dynamics & Distribution
- Terrestrial Landscape Patterns & Dynamics
- Terrestrial Vegetation & Soils
- Visitor Use
- Western Yellow-billed Loons
- Wet & Dry Deposition

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