



Arctic Network

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

Climate Change Resource Brief



Walker Lake in Gates of the Arctic National Park and Preserve.

Climate Change and Arctic Alaska

The NPS Arctic Network (ARCN) is designing programs in Bering Land Bridge National Preserve, Cape Krusenstern National Monument, Gates of the Arctic National Park and Preserve, Kobuk Valley National Park and Noatak National Preserve to monitor various ecosystem components including the deposition of contaminants, coastal erosion, permafrost extent, water quality and aquatic systems, wildlife, vegetation, and terrestrial processes such as wildland fire patterns that are likely to be altered by climate change. For the five national park units in ARCN, scientists are predicting that the average temperature may rise 10°F by 2080. Winter temperatures are expected to increase more than summer temperatures. Predicted increases in precipitation are not expected to keep pace with the increases in evaporation caused by the warmer temperatures. This may have drastic effects on the region's landscapes and waterways. Below we describe some key vital signs that will give us insight with respect to climate change.

Air and Climate

Climate and Snowpack Monitoring – Climate monitoring will be critical to understanding the changing conditions in the Arctic Network of parks as global climate models indicate that climate change and variability will be greatest at high latitudes. In an attempt to better understand climate variation as well as long-term changes in park ecosystems, several new climate monitoring stations are being proposed throughout the network. We will also track changes in duration of snow through instrumentation at the weather stations and through satellite imagery.

Wet and Dry Deposition and Air Quality – ARCN parks can act as sinks of air pollution because of their cold climates and the trans-continental air masses that flow over them. Changes in global circulation patterns associated with climate change will alter how contaminants are deposited in the environment. ARCN is tracking long-term trends in environmental deposition of a few key contaminants by monitoring uptake by a moss species and in the tissue of freshwater fish to determine how current contaminant levels fit into established thresholds and to document how climate change will influence deposition patterns. In addition, in July 2008, ARCN installed an air quality monitoring station in Bettles, Alaska to track changes in air quality.

Geology and Soils

Coastal Erosion – ARCN contains approximately 250 miles of shoreline including bay and barrier island ecosystems. Nearshore coastal water and shoreline habitats are currently experiencing dramatic changes that may be accelerated with climate change including changes in seasonal sea ice coverage, melting permafrost, increases in storm intensity and frequency, and sea-level rise. Coastal change is one of the most observable and sensitive indicators of environmental change that ARCN is monitoring.



A winter landscape in Bering Land Bridge National Preserve.



Coastal erosion can be very rapid when frozen sediments thaw and collapse.

Permafrost – ARCN is underlain by permafrost (ground that has been frozen for two or more years). Unusually warm weather can thaw permafrost, which in turn can cause landslides and subsidence that expose bare soil and shed sediment into lakes and streams. Detailed satellite images of ARCN have allowed us to make comprehensive surveys of slump features in Cape Krusenstern National Monument and Bering Land Bridge National Preserve. In Cape Krusenstern we found seven fresh landslides that result from the thaw of permafrost, covering just 0.95 ha (2.3 ac) in the 267,000-ha National Monument. In Bering Land Bridge (which covers over a million hectares) we found 21 of these landslides, covering a total area of about 3 ha (7.4 ac), including ten active-layer detachments along one 4-km (2.5 mile) stretch of creek. ARCN is applying this and other methodologies to other areas in the network where more slumping due to permafrost melt has been noted.

Water

Coastal Lagoons, Lakes and Streams – ARCN contains a variety of brackish and freshwater aquatic systems including coastal lagoons, shallow lakes, large lakes and streams. These aquatic ecosystems are important to wildlife, subsistence users and the scenic quality of the parks. Aquatic systems are sensitive indicators of climate change because they act as integrators of water shed level processes. ARCN is tracking changes in coastal erosion rates, water body depth and surface area, water chemistry, and aquatic insect and plant communities in coastal lagoons, lakes and streams.

Biological Integrity

Wildlife – ARCN contains a number of unique northern and arctic species of wildlife that may be threatened by habitat shifts associated with climate change. Species such as yellow-billed loons, muskoxen and some landbirds are found nowhere else in the National Park System. Dall's sheep, an alpine species at the northern end of their distribution may be affected by elevational changes in habitat. Brown bears and caribou may also be affected by habitat shifts from tundra-dominated ecosystems to shrublands and forest. ARCN is monitoring population size and distribution of these species which may be affected by climate change.

Terrestrial Vegetation, Soils and Landscape Patterns – Studies in northern Alaska, including ARCN, have already shown changes in arctic and subarctic vegetation in response to climatic warming. Vegetation is affected through changes in the length and warmth of the growing season, through more rapid nutrient cycling and changes in soil wetness, and through the frequency of occurrence, extent and severity of fires. Lichens, the primary forage for caribou and a cornerstone of arctic biodiversity, may be extirpated from much of its current range under climate change scenarios in which tundra yields to shrub or forest dominated system. Hydrology will be affected by changes in permafrost, snowpack persistence, freezing and thawing of lakes and streams, and the persistence and distribution of water on the landscape. By using on-the-ground vegetation measurements at index sites and low altitude aerial photography, ARCN will be able to track changes in vegetation such as expansion of shrubs. We will also track changes in growing season length using weather stations and satellite imagery. Baseline monitoring of vegetation, soils, fires and landscapes will inform managers about the complex relationship between climate, ecological disturbance and northern landscapes.



A permafrost rich landscape in Bering Landbridge National Preserve.



Muskoxen are an arctic adapted species that may be affected by climate change. Within the NPS muskoxen are only found in ARCN.



NPS employees sampling tundra vegetation in Bering Land Bridge National Preserve. Shrubs are expanding in tundra landscapes such as this.

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