Central Alaska Network

Denali NP & Pres. • Wrangell-St. Elias NP & Pres. • Yukon-Charley Rivers N Pres.

Rivers & Streams Climate Change Resource Brief

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Status & Trends

How will climate change affect rivers and streams in the Central Alaska Network?

The most direct impact of climate change is rising water temperatures. This leads to problems for many aquatic species including salmon, which are very sensitive to warmer temperatures. Other changes are more complex. For example, shifts in the precipitation regime (winter snowpack and summer rains) will alter the timing and magnitude of high and low flows, impacting aquatic species that have adapted their life histories to historical flow patterns, as well as altering channel structure and habitat quality.

The Central Alaska Network (CAKN) is characterized by extensive glaciation, which has a substantial influence on flowing water ecosystems. Warming air temperatures will likely increase glacial melting during the summers, which in turn will increase flows in downstream rivers. The duration of the summer melt season will lengthen as well.

A substantial portion of the Central Alaska Network is underlain by permafrost. As this permafrost thaws, it is causing changes in streams and rivers. Melting permafrost may lead to drying streams or, alternatively, to year-round flow in streams that were once seasonal. Thawing permafrost also causes changes in nutrient dynamics and water quality because large amounts of carbon and nitrogen previously frozen in the permafrost are released into streams. Altered flow and nutrient dynamics will have direct (loss of habitat) and indirect (changing food web) effects on fish and other aquatic organisms.

To detect and quantify these changes, the Central Alaska Network is monitoring stream ecosystems, as well as climate, permafrost and glaciers.

Record flooding occurred in July 2010 in the northern part of WRST. Model projections predict that climate change will lead to more extreme precipitation events in the future

Objectives

What do we want to know about rivers & streams in CAKN?

- Determine long-term trends in chemical and biological measures of water quality.
- Determine long-term trends in the composition and spatial distribution of aquatic communities, including macroinvertebrates and diatoms.
- Monitor changes in the distribution of anadromous and resident fish species in network parks.
- Determine long-term trends in annual and seasonal flow patterns in selected streams and rivers.
- Develop tools for park managers to assess biological water quality in selected streams and rivers.

Rivers and streams are being monitored in all 3 network parks

Importance

Why are rivers and streams important in the Central Alaska Network?

Streams and rivers are vital components of network ecosystems. They provide habitat for fish, including all 5 species of salmon. Fish in turn are important food sources not only for park wildlife, but also for people. For example, the world-famous Copper River sockeye salmon spawn in Wrangell-St. Elias NP & Pres. All 3 parks support subsistence and recreational fisheries as well. The aquatic insects that live in streams are an important food source for both fish and birds.

Streams and rivers are constantly reshaping the landscape, creating a diverse array of landforms and habitats that are important for both terrestrial and aquatic species. These changes can be either gradual, like the slow growth of a river delta, or dramatic, like the destruction of riparian forests during a large flood. The end result of these processes is a dynamic mosaic of habitats that increases the diversity of terrestrial vegetation and wildlife.

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Management Applications

How can monitoring protect rivers and streams in CAKN?

- Assess water quality in park streams and rivers
- Improve management of subsistence and recreational fisheries
- Provide early detection of aquatic invasive species
- Improve modeling and prediction of high flows in park streams and rivers

Long-term Monitoring

How are we monitoring rivers and streams in CAKN?

To monitor ecological change in streams and rivers, the Central Alaska Network uses a wide variety of information. This includes biological, chemical and physical measurements collected during field visits, and also data derived from satellite and airborne instrumentation. Data are collected each year from a small number of easily-accessed sentinel streams in each network park, as well as from a large number of remote streams that are visited only once every 10 years or so.

At each stream, network scientists collect data on the species composition and abundance of aquatic insects, and diatom and fish communities. Because these organisms are in the streams year-round, their responses to the stream environment serve as biological indicators of ecological change that scientists may not be able to detect when collecting other types of data. Detailed chemical and physical information about each stream is collected as well.

By combining these various types of information, network scientists will be able to detect changes in how stream ecosystems are behaving, not just at the small percentage of streams that are being studied, but across all 21 million acres of the vast and remote Central Alaska Network.

CENTRAL ALASKA NETWORK

USING SCIENCE TO PROTECT OUR PARKS

THE CENTRAL ALASKA NETWORK (CAKN) IS ONE OF 32 NATIONAL PARK SERVICE INVENTORY AND MONITORING NETWORKS. EACH NETWORK EXISTS AS PART OF A NATIONAL EFFORT TO BETTER UNDERSTAND AND MANAGE PARK LANDS USING SCIENCE-BASED INFORMATION.

In order to focus this effort, 270 national park units with significant natural resources were grouped into 32 regional networks.

The Central Alaska Network is made up of 3 parks: Denali National Park and Preserve, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve. Together, these 3 parks contain over 21.7 million acres and makeup 25% of all the land in the National Park Service. They represent a great diversity of climate and landform, from temperate coastal rainforests to glaciated mountain ranges. What they share in common are their largely wild and unaltered landscapes.

In order to track the condition of our parks, Central Alaska Network scientists have chosen 35 key indicators, or "vital signs," to represent the overall health of the network. Each vital sign falls into one of 4 categories: animal life, physical environment, human use, or plant life. Underlying these 4 vital sign categories is a focus on habitat change.

CAKN VITAL SIGNS:

Animal Life

Arctic Ground Squirrel
Bald Eagle
Brown Bear
Caribou
Freshwater Fish
Golden Eagles
Macroinvertebrates
Moose
Passerines
Peregrine Falcons
Ptarmigan
Sheep
Small Mammals
Snowshoe Hare
Wolves

Physical Environment

Air Quality
Climate
Fire
Glaciers
Land Cover
Permafrost
Rivers & Streams
Shallow Lakes
Snow Pack
Soundscape
Volcanoes & Tectonics

Human Use

Consumptive Use of Natural Resources
Human Populations
Human Presence/Use
Trails

Plant Life

Exotic Species
Insect Damage
Plant Phenology
Subarctic Steppe
Vegetation Structure/Composition

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