

Central Alaska Network

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

Vegetation Monitoring Resource Brief

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Status & Trends

Monitoring Vegetation in the Central Alaska Network

2010 marked the completion of baseline vegetation sampling in Denali National Park. After ten summers of fieldwork, the Central Alaska Network (CAKN) has a landscape-scale baseline dataset for vascular plant, macrolichen and moss species occurrence and abundance in Denali. In concert with the vegetation data we have assembled detailed data on soils, physical landscape attributes and tree species density and abundance. Several more summers of sampling are still needed in Wrangell-St. Elias and Yukon-Charley to have complete baseline vegetation data for the network. A two year hiatus (2011-2012) in sampling is enabling park scientists to analyze the large amount of data collected in Denali.

One of several projects on which park ecologists are currently working during the sampling hiatus involves modeling the distribution and abundance of each of the six tree species in Denali Park: white spruce, black spruce, Alaska birch, balsam poplar, aspen and larch. Park ecologists used statistical models to determine which of the physical variables measured at each vegetation monitoring plot in Denali such as elevation, slope angle, aspect, soil depth, soil moisture, soil organic layer depth are the most important drivers of where and how abundant each tree species is across the Denali landscape. Understanding where these species grow on the landscape

and what variables govern their distributions sheds light on how these tree species may respond to a warming climate. Additionally, these results will be an important reference point in space and time: studies in other regions of the boreal forest can be compared to these data and future studies can assess changes in tree species growth and distribution in Denali with these data as a baseline.

Results from this endeavor show white spruce is the most widely distributed tree within Denali National Park, and suggest white spruce distribution may expand in the Park, by increasing in treeline situations with a warming climate and by invading areas from which they are currently excluded by cold, wet soil conditions relating to permafrost. The distribution of black spruce, other hand is generally limited to permafrost-influenced areas of the landscape where other trees have difficulty growing and is likely to contract as permafrost degrades in a warming climate. Broadleaf forests occur in localized areas in Denali, and these species are strongly associated with disturbance events such as fire and flooding. An increase in the frequency of fires (as predicted by climate change scenarios) may result in increases in the occurrence of Alaska birch and aspen, in particular.

Vegetation is being monitored in all 3 network parks

Objectives

What do we want to know about vegetation in CAKN?

- Establish a baseline state of plant community diversity, composition, structure, distribution and abundance across the Central Alaska Network landscape to which subsequent measurements can be compared.
- Quantify the relationship between individual plant species and environmental attributes to be able to model species occurrence and abundance across the Central Alaska Network landscape and predict how a species distribution could change with changing environmental conditions.
- Measure the density and basal area of all trees species in the Central Alaska Network as well as the patterns of annual growth of spruce at a landscape scale.
- Assess the variation in soil attributes such as carbon and nitrogen content, texture, moisture, temperature and pH as well as thaw depth and thermokarst processes at a landscape scale.



Importance

Why is vegetation important to study in the Central Alaska Network?

The flora of Central Alaska Network's parklands, including vascular plants, bryophytes and lichens contains more than 2000 species, and is thus one of the richest elements of our area's biodiversity. In addition to its intrinsic value, vegetation is important because it forms the foundation of all terrestrial ecosystems, and most other forms of life depend on plants either directly or indirectly. In addition, many plant species (such as trees and shrubs) define physical structure of habitat for other species. Each species plays a unique role in the ecosystems of Central Alaska, and we collect information hundreds of species for our vegetation monitoring program.

Vegetation patterns are controlled by physical factors including topography, climate, substrate type and disturbance. Vegetation

patterns are also influenced by plant-animal interactions such as herbivory. Quantifying the relationships among plant community structure and composition and important environmental attributes is fundamental to understanding why plant species grow where they do and how ecological changes may impact our park resources and wildlife.

Changing environmental conditions that are expected to impact vegetation include a warming climate and increasing climatic variability, shifting atmospheric chemistry and pollutant loads, and increasing variability in plant pathogens and pests. The resulting changes could alter many vital ecosystem functions. Without baseline vegetation information, detecting and managing future changes will be impossible.

Management Applications

How can monitoring vegetation help parks?

There are a myriad of uses for detailed vegetation data collected in a rigorous and repeatable way at a landscape scale, but two fundamental uses are:

1) understanding the relationships between vegetation and environmental conditions will help scientists to understand why certain species grow where they do. This information is invaluable to understanding the dynamics of both the unique botanical resources of these parks and the other species that interact with vegetation there, such as foraging patterns of caribou or the presence of particular song birds in an area. We need the habitat information provided by the vegetation monitoring program to help assess the reasons for any observed patterns in wildlife populations.

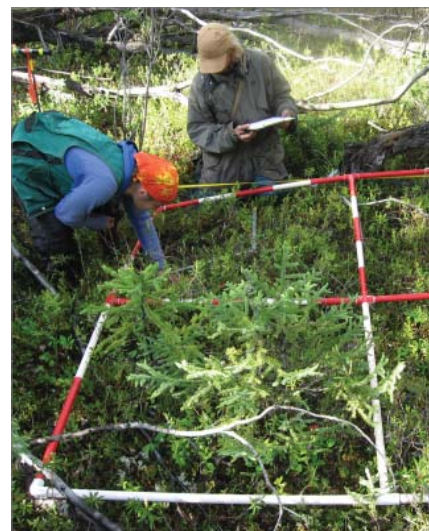
2) having the baseline data is the only way in which scientists can quantify change over time in our parks to help understand the valuable and unique resources in our care. The measurements we make now determine what changes we will be able to detect in the future: measuring the diversity, distribution, abundance and phenology of our vegetation now, will enable us see how these attributes differ in the future. Changes in vegetation may have important and unpredictable consequences for our physical, botanical, and wildlife resources that will need to be managed to ensure that we meet our mission of protecting our wildlands for future generations.

Long-term Monitoring

How do we monitor vegetation in the Central Alaska Network?

We have established permanent vegetation monitoring plots throughout the three parks in the Central Alaska Network following a two-stage systematic grid sampling design: first we generated a “macro-grid” at 10 km intervals using a random starting point and at each grid point we established a secondary “mini-grid” consisting of five rows of five plots spaced 500 m apart. At each plot we measure the physical and vegetation attributes. Physical attributes include slope, aspect, elevation, permafrost status, and soil characteristics. Vegetation attributes include percent cover and frequency of occurrence of each plant species, structure (or height class) of each species, the density and basal area of trees as well as the tree increment

cores from any spruce in the plot area. Once the baseline information is obtained from each of these plots and the results analyzed, the plots will be re-visited (approximately 10 years after the first measurement) to assess the change that has (or has not) occurred.



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 34 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 Eagles
Brown Bear
Caribou
Dall's Sheep
Freshwater Fish
Golden Eagles
Moose
Passerines
Peregrine Falcons
Ptarmigan
Small Mammals
Snowshoe Hare
Wolves

Physical Environment

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

Human Use

Human Populations
Human Presence/Use
Natural Resource Consumption
Trails

Plant Life

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

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