Resource Brief
Alaska

National Park Service
U.S. Department of the Interior

Inventory and Monitoring Program
Alaska Region

Arctic Network | Central Alaska Network | Southeast Alaska Network | Southwest Alaska Network

Enhanced Monitoring in a Changing Climate

Background

The four Inventory and Monitoring networks in Alaska cover over 54 million acres of park lands, which include diverse ecosystems and some of the most remote and pristine natural and cultural resources in the country. All of the parks in Alaska include areas that have been identified by scientists as vulnerable to the effects of climate change. They include high latitude, coastal and high elevation areas or some combination of all of these features. *As part of the Climate Change Response Strategy developed by the National Park Service in September of 2010, the Alaska Region has been identified as one of the key areas within NPS to focus resources aimed at understanding, mitigating, applying adaptive science and communicating information related to climate change*. Specifically, Alaska is representing the high latitude environments in this effort.

The Alaska Region Inventory and Monitoring Program will obtain, analyze and communicate scientific information on variables related to climate change in an efficient and productive way by utilizing existing programs, established networks and enhanced partnerships. In particular, regional efforts will focus on enhanced monitoring of glaciers, permafrost, alpine plant communities and seasonal processes. Climate change science is complex and dynamic. Because of this, the regional areas of focus are subject to change as more information develops.

> I believe climate change is fundamentally the greatest threat to the integrity of our national parks that we have ever experienced. The current science confirms the planet is warming and the effects are here and now.
>
> Jonathan B. Jarvis
> Director, National Park Service
> Climate Change Response Strategy

Photo: Kent Miller

Dall's sheep depend on alpine plant communities for their survival. NPS is currently monitoring Dall's sheep in several Alaska parks.

Photo: Brendan Moynahan/NPS

Marjorie Glacier in Glacier Bay National Park is one glacier being monitored by the National Park Service in Alaska.

Enhanced Glacier Monitoring

Approximately 25% of Alaska's glaciers are located within national parks. Glaciers serve as major water reservoirs, and recent findings suggest that most glaciers are receding at an increasing rate. Receding glaciers may result in changes in hydrology, habitat and coastal and aquatic food webs that are not yet fully understood. Glacial monitoring efforts are being targeted in two key areas: extent mapping and change in glacial volume. Extent mapping using aerial photography and satellite imagery (Landsat) is being conducted to determine change between two time periods (1950s and current). Profiles detailing the physical characteristics of each glacier, such as length, width, slope, area and volume, will also be created. Volume change analysis is being conducted using existing altimetry data. The altimetry provides elevation profiles along the center flowline of glaciers, and elevation is projected across the surface of the glacier. Volume change will be calculated for glaciers with multiple elevation profiles.

Additionally, approximately 20 focus glaciers from national parks within Alaska will be selected and analyzed in greater detail to determine trends and variations throughout the region. An interpretive guide to Alaska's glaciers will be created using the detailed profiles, volume change analyses and historical information summarized in this project. Results will also be summarized in technical reports to be used by researchers and natural resource managers. Data collected and analyzed as part of this effort will be made available online for use by the scientific community.

Enhanced Permafrost Monitoring

Permafrost is ground that remains frozen for two or more consecutive years. It is the foundation of the Arctic and exists in 10 of the 16 national parks within Alaska. Thaw is a natural process, but recent data and forecasting models suggest that the rate of thawing has increased in recent decades and will continue to increase. The impacts of thawing range from changing landscapes and shifts in hydrology to potential impacts to wildlife. To monitor permafrost and to better prepare for responding to thaw-related impacts, ground temperatures and landform features are being measured. This multi-tiered approach builds on existing efforts by NPS and partner agencies. Temperature sensors are being installed at existing climate monitoring stations to measure near surface ground temperatures (0 to 2 m). The temperature data gathered is being incoporated into models that will result in maps of permafrost location and condition in the Arctic parks.

Rapid mapping of land features and cover currently experiencing active thaw will be conducted using satellite imagery. In areas likely to experience the greatest changes, three-dimensional models will be applied to track changes in landforms and vegetative cover over time. Data will be analyzed and summarized in technical and interpretive reports.

Developing Enhancements

In addition to enhanced glacier and permafrost monitoring efforts, protocols and plans are currently being developed to monitor seasonal processes using satellite imagery, remote cameras and on-site monitoring. Plans are also underway to enhance alpine vegetation monitoring efforts by joining the Global Alpine Research Initiative in Alpine Environments (GLORIA), an international program with established protocols for alpine vegetation monitoring.

Providing Decision Support

The data collected through monitoring efforts will be summarized and made available to the scientific community, park managers and the public. Park managers will have sound science to guide them on decisions related to managing natural and cultural resources in a rapidly changing climate. To support the expanded climate change monitoring effort in an efficient manner, remote sensing and science communications capabilities are being expanded at the regional headquarters.

Climate change response efforts for the Alaska Inventory and Monitoring Program focus on enhancing existing monitoring, partnerships and protocols as well as communicating summaries in ways that are useful to a wide range of audiences. For more details about each of the enhanced monitoring efforts, see all six resource briefs in the Enhanced Monitoring in a Changing Climate series. For more information on the Inventory and Monitoring programs in Alaska, refer to the Arctic, Central Alaska, Southeast Alaska and Southwest Alaska Networks' websites.

Photo: NPS

Climate monitoring stations are located throughout national parks in Alaska and provide essential data for tracking changes.

Climate Change at High Latitude Parks

The National Park Service is focusing efforts to understand and respond to the effects of climate change in four key areas. The Alaska region is serving as the high latitude representative while parks in other regions are serving as representatives of coastal, arid and high elevation areas. These four areas are considered particularly responsive to climate change because of the sensitivity of these ecosystems to climate drivers (e.g., temperature, precipitation, sea level).

Networks within the Alaska Inventory and Monitoring Program have identified over 30 vital signs to monitor long-term trends and conditions of park ecosystems through the collection and analysis of robust, high-quality data. These monitoring efforts began in 1992 and have been expanded and improved whenever feasible. They include vital signs in the areas of air and climate, geology and soils, water, biological integrity, human use and landscape patterns. While all of the vital signs are relevant to understanding and responding to climate change, monitoring efforts for glaciers, permafrost, seasonal processes and alpine vegetation are being enhanced as part of the Climate Change Response Strategy.

National Park Service. 2010. National Park Service Climate Change Response Strategy. National Park Service Climate Change Response Program, Fort Collins, Colorado.

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