



# Alpine Vegetation and Climate Change

## Background

Alpine habitats cover approximately 85 million acres in Alaska and support unique plant communities and many species of wildlife. These cold-adapted plant communities are sensitive to climate and thus, are excellent indicators of climate change. Recent studies have shown significant changes in species richness, composition and frequency in alpine communities consistent with changes in species' ranges in response to warming (Pauli et al., 2007; Michelson et al, 2011). Upper limits of treeline are rising and species richness is increasing within this zone, presumably due to the upward expansion of mid-elevation species. *As part of the Climate Change Response Strategy developed by the National Park Service in September 2010, the Alaska Inventory and Monitoring program is currently enhancing several existing monitoring programs.* This enhanced effort, which includes vegetation monitoring, will use existing protocols to document changes in alpine communities in the high latitude region.

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## Proposed Enhancements to Monitoring

The Alaska Inventory and Monitoring Program is evaluating alpine monitoring strategies, including the Global Observation Research Initiative in Alpine Environments (GLORIA) network, an international program with established protocols for monitoring alpine vegetation. The GLORIA approach would build on existing partnerships with other agencies and would enable NPS to compare ecosystem changes occurring in the parks to changes occurring in alpine areas around the world.

GLORIA sites have already been established by the US Fish and Wildlife Service at two locations in Alaska, and by NPS in seven national parks in the contiguous U.S. Globally, the network is represented in 77 mountain regions across five continents. GLORIA protocols outline criteria for the establishment of permanent sampling sites on mountain summits and include complete species inventories and soil temperature monitoring as part of their sampling design. This and several other protocols are being considered based on factors that include the ability to collect robust data while being as efficient as possible.



Photo: Amy Miller/NPS

**This small primrose, *Douglasia alaskana*, is a species found in alpine habitats of Kenai Fjords National Park.**

## Potential Results

Due to the vast and remote nature of many parks in Alaska, large areas within several parks have never been surveyed botanically. Conducting ground-level species surveys in alpine areas will increase overall understanding of the ecosystems. To date, monitoring efforts within Alaska Inventory and Monitoring have focused on characterizing vegetation change at the landscape level or in focal community types. Monitoring objectives associated with proposed GLORIA sites would include a determination of status and trend in species composition, including presence/absence of exotic species, and in soil temperature, which is a driver of nutrient status and turnover. Monitoring data collected by NPS would be uploaded to the GLORIA archives and made available to other GLORIA collaborators. NPS will determine the feasibility of collaboration with GLORIA over the next 3-5 years.

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Pauli H, Gottfried M, Reiter K, Klettner C, Grabherr G. 2007. Signals of range expansions and contractions of vascular plants in the high Alps: observations (1994-2004) at the GLORIA master site Schrankogel, Tyrol, Austria. *Global Change Biology* 13:147-156.

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