



Checking Glacier's Vital Signs

Rocky Mountain Network Science in the Park

National parks are the guardians of our unique American natural and cultural history. But perhaps more than ever before, parks exist in a rapidly changing landscape. Urban growth, replacement of native species by exotics, air and water pollution, increasing visitor use, and climate change all impact the natural web of life. This leads us to ask:

How healthy are our parks?

How are they changing?

To answer these questions, the National Park Service clustered parks into 32 Inventory and Monitoring Networks. In 2007 at Glacier and nearby parks, the [Rocky Mountain Network](#) began monitoring natural resources, called "vital signs," that serve as red flags if conditions deteriorate. We support park managers' efforts to make *science-based management decisions*.



Mike Britten, Program Manager, leads snow chemistry monitoring



Billy Schweiger, Ecologist, leads stream and wetland monitoring



Erin Borgman is our Plant Ecologist and Field Coordinator



Kirk Sherrill, Data Manager, leads climate and landscape monitoring



Kristin Long is our Assistant Data Manager

What do we monitor at Glacier National Park?

Stream Ecological Integrity



Collecting a water sample at Reynolds Creek.



Caddis fly (*Dicosmoecus* sp.), an aquatic insect from Camas Creek

Glacier's streams are vital resources. They anchor the hydrology (the water cycle) of the park, recycle nutrients like carbon, and provide habitat for wildlife. Visitors fish and recreate along Glacier's pristine streams. However, they are also sensitive to a variety of stressors. Excessive nutrients, sediment, and air pollution degrade them. Climate change results in lower streamflow and higher stream temperatures by shrinking the glaciers and snowpacks that feed them. Because streams signal the effects of multiple stressors, we monitor their status and long-term trends to inform park resource managers.

Learn more about our stream monitoring:

- Resource Brief: [2014 Stream Ecological Integrity, Glacier National Park](#)

Some resources we measure:

- Water chemistry, like pH and nitrogen concentration
- Physical habitat, like woody debris and the size of sand and cobble along the streambed
- Algae and aquatic insects

Network research:

Schweiger, EW, Ashton, IA, Muhlfield, CC, Jones, LA, and LL Bahls. 2011. The distribution and abundance of a nuisance native alga, *Didymosphenia geminata*, in streams of Glacier National Park. *Park Science*. 9:78-81.

Alpine Wetland Ecological Integrity



Purple monkeyflower
(*Mimulus lewisii*)

Network research:

McKernan, CM, D Cooper,
and EW Schweiger. *In review*.
The effect of glacial loss on
riparian vegetation of alpine
streams, Glacier National
Park, Montana, U.S.A. *Global
Change Biology*.

For thousands of years, glaciers have fed and shaped alpine wetlands in the park. The retreat of glaciers we are now observing changes both the amount and timing of water flowing above- and belowground through these wetlands. We monitor alpine wetlands at Glacier to help park resource managers understand what may change. How will key species, like willows and the purple monkeyflower, be impacted? How will water temperatures, quality, and availability change? We also collaborate with park staff to monitor several low elevation wetlands with important and rare plants.

Some resources we measure:

- Water temperature
- The different plant species and forms (sedges, forbs, shrubs) in the riparian community
- Groundwater levels and the pattern of water flow across the ground surface
- Changes in the shape of stream channels (geomorphology)

Learn more about our alpine wetland monitoring:

- Information Brief: [Monitoring Alpine Wetland Ecological Integrity in Glacier National Park](#)

Landscape Dynamics

Glacier lies at the heart of the 18 million acre Crown of the Continent Ecosystem. This ecologically diverse region spans the US–Canada border and is governed by multiple landowners and uses. Along with the park, we are part of a collaborative landscape initiative led by the Crown Managers Partnership to monitor the ecosystem’s health. We analyze landscape patterns in specific “areas of analysis” in and around Glacier. This serves both our park managers as well as our ecosystem-scale partners. For example, we can compare specific conditions inside the park with adjacent lands, such as wilderness areas.

We draw from a nationwide dataset of landscape variables collected through the National Park Service NPScape program. NPScape produces GIS data, maps, reports, web viewers and other tools for multiple uses. GIS specialists use the geospatial data and tools. Ecologists and resource managers gain access to landscape conditions within their local and regional context. Park superintendents can incorporate the maps and graphics into reports or briefings.



GIS roads layer for Glacier

We study change in the following measures over time:

- Human population
- Housing
- Roads
- Land cover
- Landscape pattern
- Climate
- Conservation status

Learn more about landscape monitoring:

- [NPScape](#)
- [Crown Managers Partnership Trans-boundary Conservation Initiative](#)

Snow Chemistry



Digging for snow samples.

High mountain snowpack acts like a collection basket for air pollution. Particles of nitrate, ammonium, sulfate, and mercury dissolve into falling snow and concentrate in the snowpack. Each winter we sample the snowpack. Partnering with the park and US Geological Survey scientists, we decipher the chemistry to track current conditions and long-term trends. Our work also supports studies of how these pollutants affect the park and regional ecosystems.

Some resources we measure:

- Dissolved concentrations of air pollutants, including nitrate, ammonium, and sulfate
- Total mercury concentration
- Snow depth and the amount of water contained in the snowpack (snow water equivalent)

Learn more about our snow chemistry monitoring: [USGS Rocky Mountain Regional Snowpack Chemistry Monitoring](#)

Explore the [Rocky Mountain Network website](#)

Learn about inventory and monitoring in the park and play with:

- [species lists](#) for your park (Home>Inventories>Species Lists)
- [interactive visualization tools](#) for learning about climate, water quality, snowpack, and landscape patterns (Home>Data Visualization)

Contact us!

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