

Rocky Mountain Network RESOURCE BRIEF

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Rocky Mountain Inventory & Monitoring Program



Stream Ecological Integrity at Glacier National Park *Condition Status in 2007–2009*

Monitoring Stream Condition

Streams and rivers are vital resources in Rocky Mountain Network parks. Their ecology is both intimately linked with and reflective of the watersheds they drain. Streams provide ecological services like wildlife habitat and nutrient processing, while also meeting human needs for water sources, fisheries, and recreation. Since streams are typically sensitive to stressors at both local and landscape scales, we have been monitoring them as a vital sign of Glacier's health since 2007¹.

We assign different levels of ecological condition to streams (reference = intact; intermediate = moderate condition; non-reference = degraded) using assessment points established with park staff. Depending on availability, these cutoff points were derived from 1) state water quality criteria, 2) comparable ecoregional stream reference sites, or 3) models of how human disturbance affects habitat or biota in Glacier's streams.

From 2007 to 2009, we sampled 40 randomly selected stream sites that represent park conditions as a whole (Figure 1). We also sampled 9 hand-picked sites that represented 1) "gradient" sites targeting streams at extreme ends of a gradient between disturbed and pristine, and 2) 4 "sentinel" sites sampled 4 times every year. In 2018, we published detailed monitoring results describing the status of park streams at these sites in 2007–2009². This brief summarizes results from that report.

Key Findings

Overall, the ecological integrity of streams and rivers in Glacier was excellent, with a majority in reference or pristine reference condition in 2007–2009.

Human Disturbance

The majority (almost 60%) of streams had no evidence of human disturbance. About 11% of park streams had major disturbance, often from visitor service facilities and/or road corridors. The more disturbed

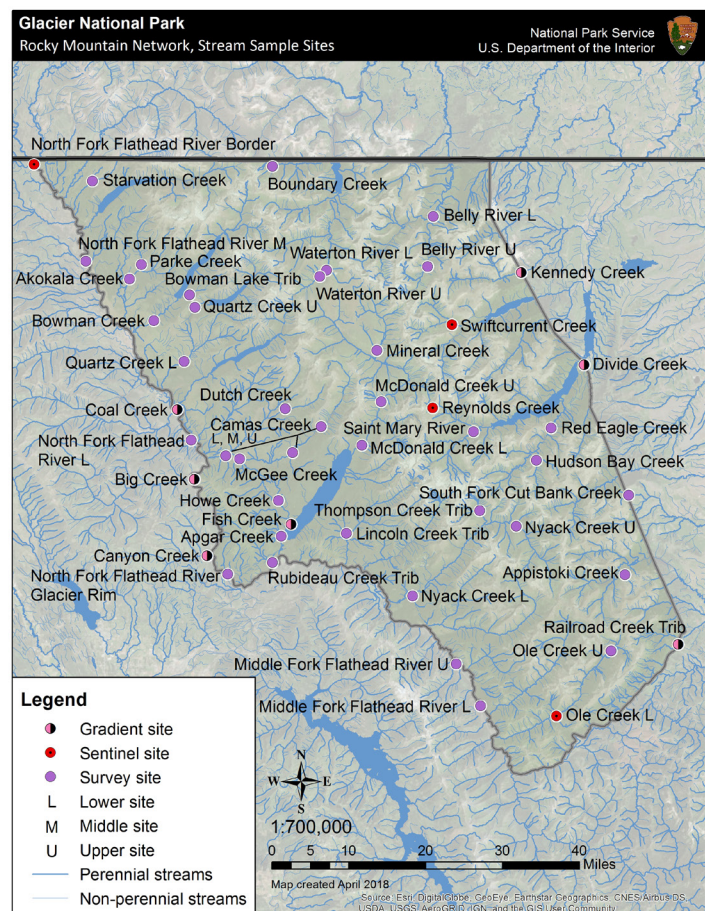


Figure 1. Stream Ecological Integrity monitoring sample sites, Glacier National Park. Note the North Fork of the Flathead Border site is both a survey and sentinel site.

streams were all in the front country, and included select tributaries to the North Fork of the Flathead, Rubideau Creek near park headquarters, Divide Creek near St. Mary, and Railroad Creek near East Glacier.

¹ Schweiger B., and M. Britten. 2014. Long-term monitoring of stream ecological integrity in Glacier National Park. Resource Brief.

² Schweiger, et al. 2018. Glacier National Park stream ecological integrity: 2007–2009 status report. Natural Resource Report NPS/ROMN/NRR—2018/1699. National Park Service, Fort Collins, Colorado.

Water Chemistry

Water chemistry showed little cause for concern, as measured by indicators including pH, major ions, nutrients, metals, and suspended sediments. Streams in a few areas (front country below lower Lake MacDonald Creek and Railroad Creek near East Glacier) had some minor water chemistry issues, but we cannot yet determine if they affect ecological condition in any meaningful way. Patterns in stream water temperature across our monitoring sites were complex, with some sites having relatively elevated temperatures. Because of the connections we and other collaborators have seen between stream water temperature, climate change, and ecological response, we will watch this carefully into the future.

Physical Habitat

Nearly all physical habitat indicators, such as cover of riparian vegetation, presence of invasive/exotic plants, and hydrologic regime, suggest only minor disturbance in the majority of the park's streams. Front country streams below Lake MacDonald, Divide Creek near St. Mary, and Railroad Creek near East Glacier showed some minor sediment and pool habitat volume issues, potentially caused by human disturbance. Invasive/exotic plants were also found at several sample sites, but again mostly in the front country.

Stream Biota (bioassessment)

Based on the condition of macroinvertebrate and diatom communities, Glacier's streams had mostly reference or pristine ecological integrity.

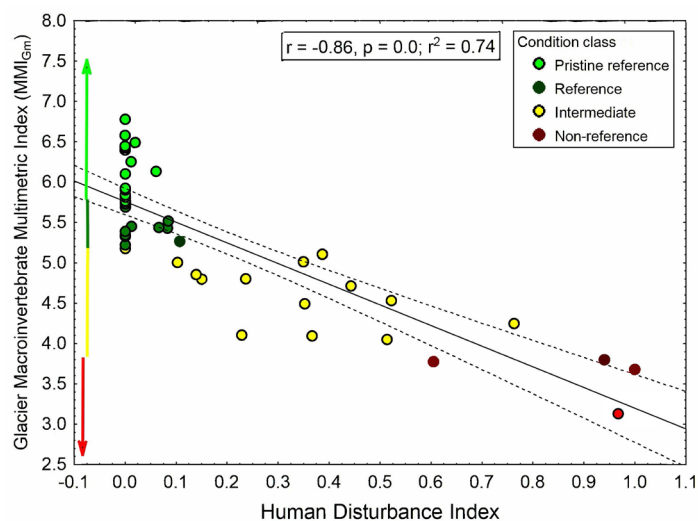


Figure 2. Modeled relationship between Glacier macroinvertebrate community health (as represented by the multimetric index, MMI_{Gm}) and human disturbance (as represented by the Human Disturbance Index) at Glacier National Park, 2007–2009. Linear fit and its 95% confidence intervals area indicated by black solid and dashed lines, respectively. At increasing values of human disturbance, ecological condition deteriorates from pristine to non-reference.

These communities were largely intact and sometimes included previously undescribed species, suggesting high biological distinctiveness for the park's streams. Local stressors—sediments, nutrients, or metals—had minor impact. Front country streams were in worse condition, likely caused by human disturbance. Figure 2 shows the modeled effect of human disturbance on macroinvertebrate communities as an index of ecological integrity. Figure 3 shows the estimated ecological condition of macroinvertebrate communities across the park.

Future Monitoring

This assessment of stream condition in Glacier from 2007 to 2009 serves as a baseline to compare with future conditions. We continue long-term stream monitoring in the park, and a trend analysis is currently in progress. Streams in Glacier will likely be affected by climate-driven changes to glaciers and hydrologic regimes, underscoring the need for ongoing monitoring to inform park managers.

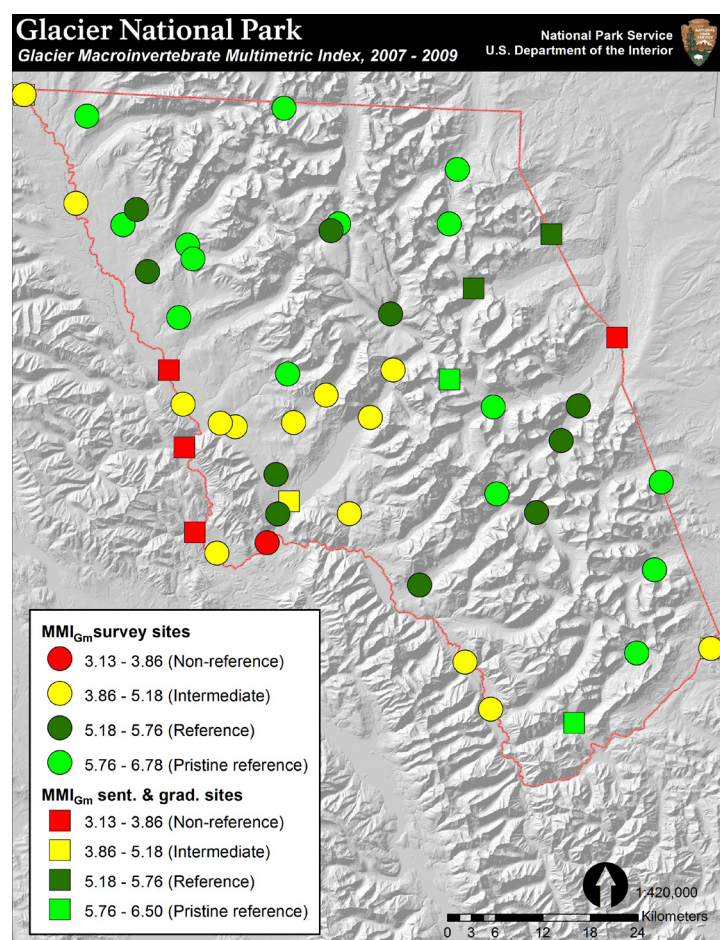


Figure 3. Glacier macroinvertebrate community health (as measured by the multimetric Index, MMI_{Gm} , at survey, sentinel (sent.), and gradient (grad.) sites in Glacier National Park, 2007–2009.

More Information

Billy Schweiger
Mike Britten
NPS Rocky Mountain Network Inventory & Monitoring Program
billy_schweiger@nps.gov, 970-267-2147
mike_britten@nps.gov, 970-267-2150

About ROMN

The Rocky Mountain Network is one of 32 vital signs monitoring networks across the National Park Service. It monitors status and trends in upland vegetation and soils, wetlands, streams, alpine vegetation, and other systems at six parks throughout Montana and Colorado.