



Stream Ecological Integrity, Grant-Kohrs Ranch NHS

Streams are fundamental components of every park in the Rocky Mountain Network (ROMN). They support a broad spectrum of ecological services including hydrologic cycling, nutrient processing, and wildlife habitat as well as recreation, fisheries, and cultural context. Streams are sensitive to stresses such as excessive sediment and nutrient inputs, withdrawal for agricultural use, and climate change, making them ideal for long-term monitoring of ecological health. The general objectives of stream ecological integrity monitoring are to document the status and long-term trends in condition of streams and rivers in a park, and to use this information to help understand why stream conditions may have changed.

The following is a summary of results from pilot monitoring of Stream Ecological Integrity (SEI) of the Clark Fork River at Grant-Kohrs Ranch National Historic Site (GRKO) from 2008-2010.

Methods

The SEI protocol includes a broad spectrum of indicators to help evaluate the ecological integrity of the Clark Fork River at GRKO. Core indicators include multiple measures of water and sediment physiochemistry (nutrients, metals, temperature); physical habitat (substrate composition, riparian cover, channel geomorphology); and community-level assays of two important biological assemblages: macroinvertebrates and algae. The latter provide an integrated aspect for assessing ecological integrity, because these organisms respond to environmental conditions over time and space. We include measures of drivers (or stressors) and ecological responses, so that we may better understand the linkages among them and help parks apply these results to resource management. SEI methods are documented in a protocol and are largely derived from well-established and existing protocols developed by ROMN partners, including the Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS), and the Montana Department of Environmental Quality (MT DEQ). The application of standardized protocols across ROMN and partner stream monitoring sites facilitates the comparison of streams and rivers within an ecoregion. SEI data were analyzed following well-established methods. Biological response was emphasized, because the presence and health of populations of key taxa are indicative of overall stream health.

We interpret results using a variety of assessment mechanisms including regulatory criteria and other thresholds, including reference values derived from state and federal monitoring reference sites in the Middle Rockies ecoregion. Because SEI monitoring is not regulatory in nature, we can consider thresholds that may have more of an ecological basis or relevance to a specific Grant-Kohrs Ranch NHS resource management need.



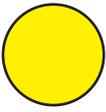
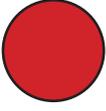
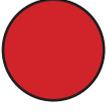
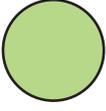
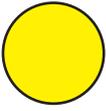
NPS, B. SCHWEIGER

ROMN SEI field crew collect data on stream physical habitat in the Clark Fork River in 2008. The area in the photo shows good examples of woody debris, complex off-channel habitats, overhanging banks, and riparian cover.

Results

In general, the river and its riparian corridor was largely intact and medium to high in quality. A few areas of concern include residual elevated metal concentrations in water and sediment (although these have been dropping over time), variable and sometimes elevated nutrient concentrations with evidence of an episodic nutrient signal in benthos and diatoms, a suggestion of rising water temperatures, a somewhat elevated level of fine embedded substrates, and reduced riparian vegetation cover with some invasive plants of concern. However, the majority of the other measures and metrics, including the synthetic biological indices of ecological condition, suggest that most aspects of the Clark Fork in GRKO were in a reference or near reference state in 2008-2010. With this combination of results we determine the overall condition to be “Intermediate” (Caution).

The following summary table describes each SEI indicator and measure and symbolizes the status, trend, and level of confidence. This information is a considerable simplification of the detail in the full report and should be used with caution.

Vital Sign (Example Indicators)	Summary Condition Table Description	Symbol
Overall ecological integrity	The ecological integrity of the Clark Fork from 2008 to 2010 was largely intact and of medium to higher quality— somewhat surprising result given the history of intensive land uses in the watershed. However, there are lingering issues with metals in water and sediment from historical mining in the watershed, and select aspects of in channel and riparian habitat are in a non-reference condition. In general the condition of the system may be slowly improving. We have medium confidence in our interpretation.	
Water physiochemistry (nutrients, major ions, metals)	Most major ion concentrations were in an acceptable range yet chloride and sulfate concentrations were often higher than in ecoregion reference sites. Arsenic, cadmium, copper and lead exceeded State of Montana water quality criteria. Nutrient concentrations were occasionally high but we currently lack sufficient data to apply the complete MT DEQ nutrient assessment protocol. There is evidence that the long-term trend in several parameters is improving. We have medium confidence in our assessment of major ions, nutrients, metals at GRKO.	
Water <i>in situ</i> chemistry (pH, conductivity, DO, temperature)	All of the core NPS parameters were in an acceptable range. The long-term trend in stream temperature suggests rising temperatures—or a deteriorating condition (but the period of record is short at only around nine years). We have medium confidence in our assessment of <i>in situ</i> parameters at GRKO.	
Sediment chemistry (metals)	Arsenic , copper, and zinc in sediment concentrations were often above their non-reference assessment points. Total mercury concentrations were intermediate but because the primary toxic form of mercury is methylmercury, these data are somewhat inconclusive. We currently lack data to assess trends, but work by partners suggests there is an improving trend in many metals found in sediments. We have medium confidence in our of sediment chemistry at GRKO.	
Habitat, in stream and riparian (complexity, cover, disturbance)	Riparian cover was patchy on the Clark Fork and there were more adjacent potential stressors in the GRKO floodplain than at ecoregion reference sites. Invasive plants were fairly common, and some occurred with higher frequency than in ecoregion reference sites. The park's best management practices likely mitigate most local habitat stressors, but upstream disturbance at GRKO likely has a complex impact on habitat in the park. We need more data to confirm these issues and assess trend in these responses. We have lower confidence in our assessment of in stream and riparian habitat at GRKO (due to a small sample size).	
Habitat, sediment (size, stability)	Fine substrates in the Clark Fork were more prevalent and had higher levels of embeddedness than select species of sediment intolerant macroinvertebrates and bull trout prefer. Bed load was also relatively substantial and mobile, but we need additional investigation to link sediment load/source to biotic condition at the site. We have lower confidence in our assessment of sediments at GRKO (due to a small sample size).	
Habitat, stream flow (amount and timing)	Stream flow during 2008 to 2010 relative to the period of record suggest SEI monitoring occurred in somewhat wet years. Seasonal patterns were fairly typical for mountain valley streams, but there was a suggestion of higher and earlier spring runoff. Over the long term, total annual stream flow may be decreasing, but more data are needed. We have medium confidence in our assessment of stream flow at GRKO.	
Biological communities, macroinvertebrates (MMI and RIVPACS metrics)	Although there are several stressors impacting the Clark Fork at GRKO, they may not be having a strong effect on the overall integrity of the macroinvertebrate community as most synthetic metrics were in a reference state relative to MT DEQ and reference assessment points from across the ecoregion. Some nutrient metrics may suggest a small biological response to increased nutrients. We lack data to assess trends, although longer-term monitoring by USGS and MT DEQ suggests there have been marginal improvements in macroinvertebrate communities in the Clark Fork. We have medium confidence in our assessment of benthos communities at GRKO.	
Biological communities, diatoms (increaser metrics, MMI)	Like macroinvertebrates, most diatom metrics were above MT DEQ criteria (or in a reference state). Diatoms are the base of the food chain and the intact diatom community at GRKO may be one of the reasons why we also see fairly high-quality macroinvertebrate assemblages. There were subtle suggestions in some sediment metrics that the high level of fine sediments in the channel might be impacting diatom communities. Likewise, nutrient metrics were variable with some suggestion of issues, especially in 2008. We lack data to assess trends in diatom communities. We have medium confidence in our assessment of diatom communities at GRKO.	

Red=significant concern/nonreference, Yellow=caution/intermediate, Green=good condition/reference
Thick border=high confidence, dashed border=low confidence

Arrows: up=improving trend, down=decreasing trend; flat=stable trend; empty=unknown trend due to insufficient data