



Wetland Ecological Integrity Data Report for Rocky Mountain National Park: 2007–2017

Overview

Because wetlands are biodiversity hotspots and provide valuable ecosystem services, the NPS Rocky Mountain Network has been monitoring them at Rocky Mountain National Park since 2007. This brief describes a 2019 report¹ that presents 10 years of wetland data. The data were used in a separate analysis² to model the relationship between wetland integrity and human activities in the park, revealing that historical and select ongoing human disturbances, lack of beaver, and overuse by elk and moose can degrade wetland condition. As park managers work to improve wetland conditions, including by introducing simulated beaver structures and controlling ungulate populations, these data will help track resulting changes in wetlands over time.

Sampling Sites and Strategies

Between 2007 and 2017, we sampled fens, wet meadows, and riparian wetlands at 154 sites throughout the park. Our sampling design included a mix of randomly and nonrandomly selected sites. Results that use the randomly selected sites allow inference to all of the park's wetlands with known confidence. Because wetland communities are a complex mix of plants and animals shaped by many factors, including soil type, groundwater dynamics, and climate, we measured a wide variety of wetland characteristics, including disturbance factors.

Metrics and High-Level Results

Vegetation

Of the 3 wetland types, riparian wetlands had the highest plant diversity. The most frequent species across all sites were two sedges (*Carex aquatilis* and *C. utriculata*),

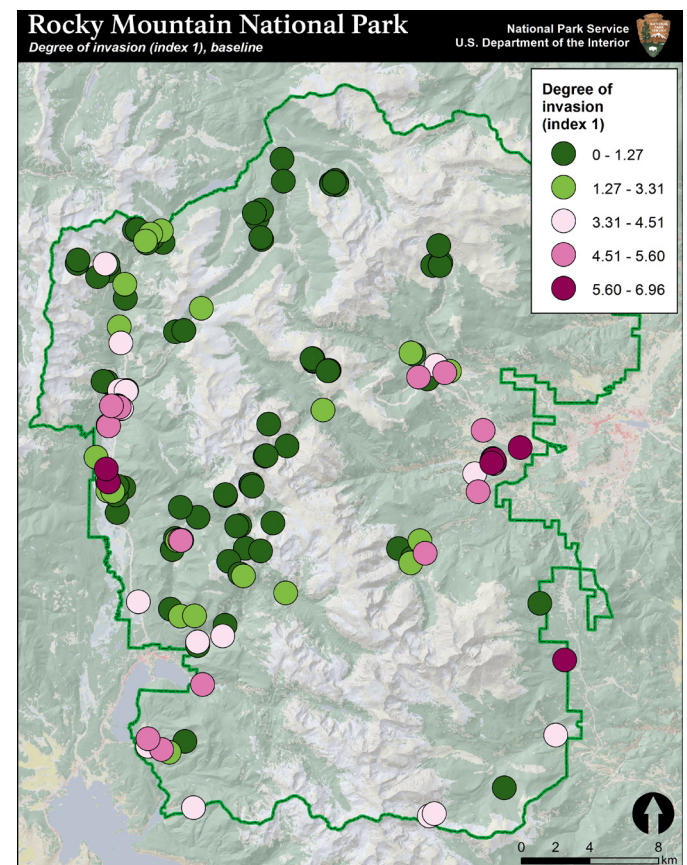


Figure 1. Invasiveness of plants at sampling sites in the park between 2007 and 2011. Higher scores mean increasingly high cover of invasive species.

a willow (*Salix planifolia*), and two wetland grasses (*Deschampsia cespitosa*, *Calamagrostis canadensis*). Common invasive species were dandelion (*Taraxacum officina-*

le), Kentucky blue grass (*Poa pratensis*), and timothy (*Phleum pratense*). Figure 1 is an example of maps in the report showing spatial patterns in a metric—in this case, degree of invasion.

Human Disturbance

Wetlands are highly sensitive to human disturbances. Because park wetlands are influenced by both current and historical disturbances, we developed an index that integrates hydrologic alterations, landscape disturbance, and physical/chemical alterations into an overall estimate of human disturbance. In the park, riparian wetland sites had higher median levels of human disturbance and slightly more variation than the other 2 wetland types. In general, front country, low elevation sites were more disturbed.

Ungulate and Beaver Use

Elk and introduced moose can outcompete beaver and degrade wetlands when their numbers exceed carrying capacity in the park. Beaver historically were key drivers of wetland hydrology, but have functionally disappeared since the mid-1990s. All wetland sites had at least some ungulate use, especially in riparian valley bottoms. Conversely, very few sites had beaver use (Figure 2).

Hydrology

We measured depth to groundwater at all sites because groundwater dynamics fundamentally control wetland habitat. It is also a useful indicator of disturbance at multiple scales. As expected, most fens had saturated groundwater depths and riparian wetlands and wet meadows were more variable.

Woody Vegetation

Woody vegetation, primarily *Salicaceae* (willow, aspen, cottonwood) and *Betulaceae* (alder, birch), influence which understory plants occur in a wetland and how animals use it. Results varied, but few sites had high woody stem density or escaped woody stem damage.

Soil Properties

We monitored wetland soil because wetland vegetation is influenced by the chemical reactions that occur in soil

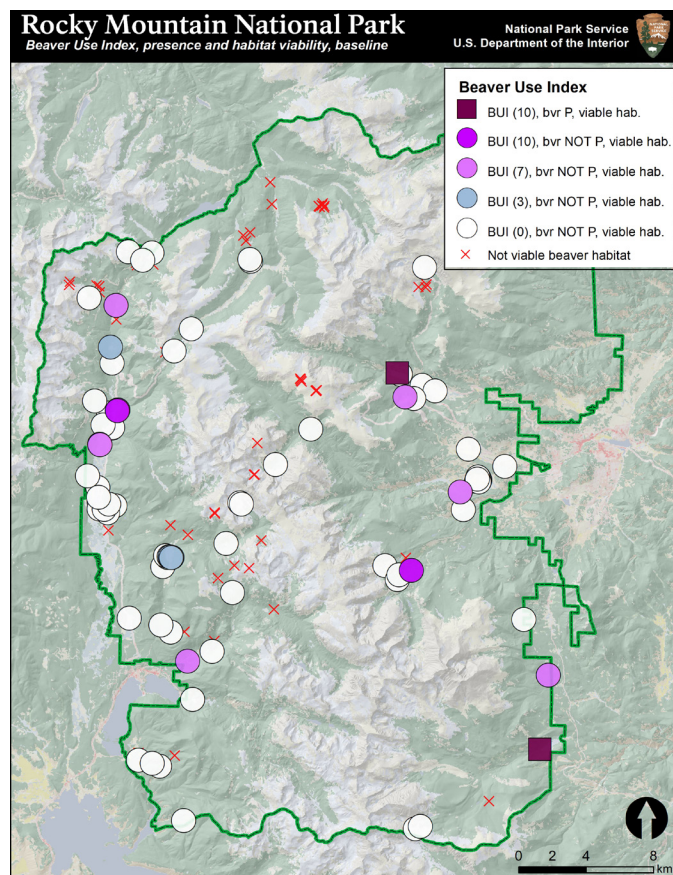


Figure 2. Beaver Use Index at sampling sites in the park between 2007 and 2011. Scores are estimated from observations of dams, food caches, animal tracks, spoor, browse evidence, and actual animal observations. bvr = beaver, P = present, hab. = habitat.

and the nutrients it stores. In fens, peat thickness and organic content are key indicators of the health of the peat body. Ammonia and nitrate concentrations may also be indicators of nitrogen deposition in the park.

Water Chemistry

We measured 2 key components of groundwater chemistry that are useful indicators of local or large scale disturbance. pH influences plant species occurrence and determines the solubility of heavy metals and many salts. Specific conductance (the ability of water to conduct an electric current) affects important chemical reactions and reflects dissolved ion concentrations.

Applications

Quality-controlled datasets³ are publicly available from the NPS Integrated Resources Management Portal. In addition to their published use in modeling drivers of wetland integrity², these data will support future status and trend analyses. Having comprehensive wetland monitoring data can also prove useful when comparing conditions before and after management actions, such as the current proposal to create simulated beaver structures in the park to help improve wetland integrity.

More Information

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1 [Schweiger et al. 2019. Rocky Mountain National Park wetland ecological integrity: 2007–2017 data summary report.](#)

2 [Schweiger et al. 2016. Using structural equation modeling to link human activities to wetland ecological integrity.](#)

3 [Rocky Mountain National Park Wetlands Ecological Integrity \(WEI\) 2007-2017 data series report products and data package](#)