



Natural Resource Monitoring at Bighorn Canyon National Recreation Area



The Greater Yellowstone Network (GRYN)



The GRYN provides inventory and long-term monitoring information for a carefully selected subset of natural resources in Bighorn Canyon National Recreation Area (NRA), Grand Teton and Yellowstone National Parks, and the John D. Rockefeller, Jr. Memorial Parkway. GRYN monitoring efforts in Bighorn Canyon NRA focuses on water resources, upland vegetation, land use, and climate. The 39,000-acre Pryor Mountain Wild Horse Range (PMWHR), about one-fifth of which lies within Bighorn Canyon NRA, provides habitat for bighorn sheep and for approximately 160 wild horses managed by the Bureau of Land Management (BLM). Long-term vegetation monitoring will help compare areas inside and outside the PMWHR, and water resource monitoring will yield information about the valuable surface water sources in this semi-arid landscape.

About Bighorn Canyon



Bighorn Canyon NRA includes approximately 68,000 acres between the Pryor and Bighorn mountain ranges on the Montana-Wyoming boundary. Yellowtail Dam was constructed by the Bureau of Reclamation on the Bighorn River between 1961-1967. The resulting Bighorn Lake extends for approximately 71 miles at full pool; the depth of Bighorn Canyon is approximately 1,000 feet at Devil Canyon and 2,500 feet on Bull Elk Ridge. The park was established in 1966 to preserve the scenic, scientific, and historic features contributing to public outdoor recreational use and enjoyment of such lands and waters.

Bighorn Canyon has impressive geologic formations and abundant wildlife. It includes ecologically diverse landscapes of forest, mountains, upland prairie, deep canyons, broad valleys, streams and rivers, and wetlands. These diverse ecosystems provide habitat for bighorn sheep, hundreds of bird species, and many other species of wildlife.

Water Resources



Working together with park staff, the GRYN has monitored water quality in Bighorn Canyon since 2005. The goal of monitoring is to assess condition and trends in water resources relative to the Clean Water Act, human health, and ecological function. Studying and monitoring surface water quality and composition within Bighorn Canyon is essential for understanding and managing the health of the park's stream, river, and spring ecosystems.

Some of Bighorn Canyon's waters are threatened by excess sediments and *Escherichia coli* bacteria from both natural and anthropogenic sources. Sulfate levels in springs are typically high, resulting from the natural components of the underlying geology. Recent levels of nitrogen and phosphorus were low and below detection levels during many monitoring visits, but *E. coli* levels in the Shoshone River are high and exceed state water quality standards during summer months. High among-year variation in annual cumulative river flow has been documented for rivers in this region, but decadal flow summaries show current discharge patterns are lower than historic records.

Upland Vegetation



Across the West, shrublands and grasslands, in particular, have been extensively modified by human activity. Healthy soils and vegetation communities are critical to maintaining watershed function, as well as providing habitat for wildlife. GRYN upland vegetation monitoring is designed to detect changes in vegetation and soil cover.

Since the initiation of this program in 2011, we have observed widespread occurrence of soil crust (including lichen and moss), which impede erosion and keep soils stabilized. Four species of invasive plants have been documented; cheatgrass (*Bromus tectorum*), a common invader of sagebrush-grasslands in the Bighorn Canyon area, is the most abundant. Many plants in Bighorn Canyon have drought-tolerant characteristics that help them survive during abbreviated periods of low precipitation, but not for extended dry periods. Depending on the frequency and duration, drought can cause changes in species composition and abundance.

A new vegetation classification map and report will be available in 2015.

Land Use



A change in housing density, and associated roads, can fragment the landscape, decrease the size of the functional ecosystem, reduce connectivity among native habitat patches, isolate species in small patches, and increase the contrast in vegetation structure and function along park boundaries. Such changes outside park boundaries can have major implications to structural and functional ecosystem properties including fire frequency, species distributions, water quality, air quality, habitat fragmentation, soil erosion, and introduction of invasive exotic species.

Approximately 33% of the land in and surrounding Bighorn Canyon NRA is public land managed by federal agencies. The Crow Indian Reservation comprises nearly 40% of the area; private lands make up approximately 25%, with the remainder of the lands under state or local management. From 1990 to 2010, the population of the six counties near Bighorn Canyon grew by 20% to nearly 240,000 residents; however, most of the population is in and near Billings, Montana. Agriculture in the region continues to be a significant human use of the landscape. In 2007, the National Agriculture Statistics Service classified between 20-95% of the land within the six counties near Bighorn Canyon as farmland. A new land use report is scheduled to be completed in 2015.

Climate



Climate exerts strong controls over almost all physical and ecological processes and is a major determinant in the distribution of vegetation and animal habitats. Higher temperatures are linked to droughts of greater duration and frequency and drought cycles are linked to fire activity and weakened plant communities susceptible to insects and disease.

The climate of Bighorn Canyon is characterized by cold dry winters and dry hot summers. Precipitation is locally affected by the Bighorn and Pryor Mountains that create a rain shadow effect at lower elevations. Bighorn Canyon also has a very strong north-south precipitation and temperature gradient. In the north, Yellowtail Dam receives 2.5 times the amount of annual precipitation (17.2 inches) than at Lovell, which receives only 6.4 inches. Annual average temperatures are 4°F warmer at Yellowtail (49°F) than they are at Lovell (45°F). Temperatures in the Big Horn (NOAA climate division 4) have risen steadily since the 1980s and average temperatures have increased 2°F in the last century. The year 2012 was the second-warmest annual average temperature on record at Lovell and the second driest on record. To learn more, climate data are easily accessible through the climate analyzer website at: www.climateanalyzer.org.

For more information

Greater Yellowstone Inventory & Monitoring Network
2327 University Way, Suite 2
Bozeman, MT 59715
406.994.7734
<http://science.nature.nps.gov/im/units/gryn/>
<http://science.nature.nps.gov/im/units/gryn/parks/bica.cfm>

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