Natural Resource Monitoring at Yellowstone National Park

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 Yellowstone National Park focus on whitebark pine, amphibians and wetlands, water resources, land use, and climate. Many additional research studies and resource management activities take place in the park.

About Yellowstone National Park

In Yellowstone National Park, natural processes operate in an ecological context that has been less altered by human activity than most others throughout the nation, and indeed throughout the world. Research conducted in Yellowstone ranges from large-scale studies of landscape changes affecting local ecosystes to studies of microorganisms that have the potential to change the lives of people the world over. Yellowstone also has a rich history that includes an archaeological record of more than 11,000 years of human use, with twenty-six American Indian tribes recognizing ties to the park and surrounding lands.

Whitebark Pine

Whitebark pine (*Pinus albicaulis*) occurs at high elevations and in subalpine communities in the Pacific Northwest and Northern Rocky Mountains. It is a key component in the upper ranges of these ecosystems where it provides a variety of ecological roles, including regulating snowpack and providing high-energy food sources to birds and mammals. Currently, whitebark pine is impacted by multiple ecological disturbances. White pine blister rust (*Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosae*), wildfires, and climate change all pose significant threats to the persistence of healthy whitebark pine populations. In 2004, an interagency whitebark pine long-term monitoring program was established to detect and monitor changes in the health and status of whitebark pine populations across the Greater Yellowstone Ecosystem (GYE).

Substantial declines in whitebark pine populations have been documented throughout its range. White pine blister rust infection remains widespread and variable across the ecosystem with an estimated 20% to 30% infection rate among whitebark pine in the GYE. Recent data indicate that the annual rate of whitebark pine mortality in response to mountain pine beetle has decreased compared to the past several years.

Amphibians

Wetlands and amphibians are among the most sensitive to climate change. In Yellowstone, amphibians depend on limited shallow wetland habitat. The GRYN has been monitoring four native amphibian species found in the park—Columbia spotted frog (*Rana luteiventris*), boreal chorus frog (*Pseudacris triseriatamaculata*), tiger salamander (*Ambystoma tigrinum melanostictum*), and boreal toad (*Bufo boreas boreas*)—since 2005. A recent multi-year analysis of amphibian breeding across the GYE indicate that only four monitored watersheds (out of 31 watersheds) contained all four native amphibian species. Three of these watersheds occurred in Yellowstone's Northern Range, a region highly susceptibile to drying.

Water Resources

Working together with park staff, the GRYN has monitored water quality in Yellowstone since 2002. The goal of monitoring is to assess condition and trends in water resources relative to the Clean Water Act, human health, and ecological function.

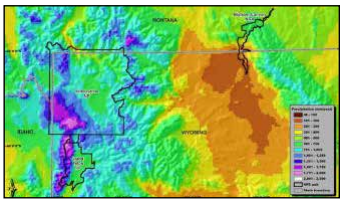
Within Yellowstone, Soda Butte Creek is listed as impaired due to metals contamination from previous mining activity upstream of the park. Reese Creek was previously listed as impaired for flow alteration which could affect native fish passage. Soda Butte and other monitored rivers occasionally exceeded state of Montana and Wyoming state water quality criteria in recent years. With the exception of Soda Butte which has rich mining legacy in its watershed, exceedances likely resulted from natural, rather than anthropogenic factors. The GRYN will continue monitoring these impaired streams as well as other select rivers and streams.

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 exotic species.

Approximately 67% of the land within the GYE is public land managed by federal agencies. The USDA Forest Service manages nearly 50% of the area while the National Park Service manages roughly 10%. Private lands make up about 30% of the area with the remainder of the lands under tribal, state, or local management. Population in the GYE was sparse at the turn of the 20th century, but has been steadily increasing. From 1990 to 2010, the population of the 34 counties in and surrounding the GYE grew by nearly 35% to over 930,000 residents.

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 can exacerbate drought conditions and fire activity, which stress plant communities and make them more susceptible to insects and disease.

The climate of Yellowstone and Grand Teton national parks is characterized by cold, snowy winters and warm, mostly dry summers. The mountainous topography of the GYE produces a complex climate that is largely dominated by two large-scale precipitation regimes. Grand Teton and southern Yellowstone generally have the greatest precipitation during the winter months as snow, and are among the wettest regions in the GYE.

Temperatures in the Upper Yellowstone and Snake River have increased 1.6°F to 1.2°F, respectively, in the last century. Temperatures have risen steadily since the 1980s, and 2012 was the warmest annual average temperature on record. To learn more, climate data are easily accessible through the climate analyzer website at: www.climateanalyzer.org.

Alpine Ecosystems

Alpine ecosystems are some of the most sensitive to climate change and disturbance. In coordination with the Rocky Mountain Inventory & Monitoring Network, the GRYN is monitoring alpine ecosystems through the Global Observation Research Initiative in Alpine environments (GLORIA). Monitoring includes sampling of vascular plants, soil temperature, and temperature at a set of four alpine summits along an elevation gradient. There are GLORIA sites in Rocky Mountain, Great Sand Dunes, Glacier, and Yellowstone national parks in addition to many others across the Rocky Mountains.

For more information

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