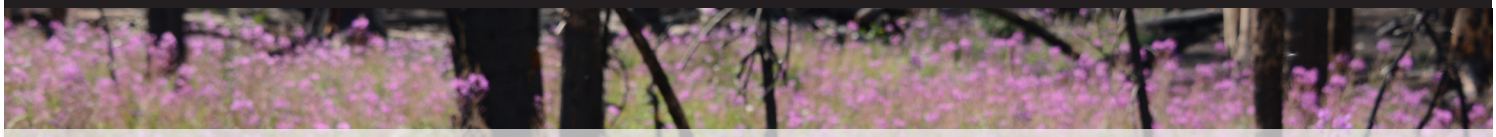
National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Inventory & Monitoring Division



Understanding Dynamic Ecosystems

Science for Parks in the Greater Yellowstone Network

National parks are the guardians of our unique American natural and cultural history. But perhaps more than ever before, parks are part of a rapidly changing landscape. Urban growth, replacement of native species by nonnatives, air and water pollution, increasing visitor use, and climate change all impact the natural web of life. This leads us to ask:

How healthy are our parks? How are they changing?

To help answer these questions, the National Park Service clustered parks into 32 Inventory and Monitoring Networks. In 2004, with data from baseline inventories, the Greater Yellowstone Network began monitoring selected natural resources, called "vital signs," to track current conditions and detect changes. Through our vital signs monitoring, we support park managers' efforts to make science-based decisions.

Who Are We?

We are a small staff of scientists with a wide range of responsibilities, based in Bozeman, Montana. Working closely with park managers, park scientists, and other partners, we collect, integrate, and investigate data from area parks and other public lands and share our results with land managers, other researchers, and the public. The four parks we serve are within the Bighorn Basin and the 18-million-acre Greater Yellowstone Ecosystem, where the Yellowstone, Snake, Bighorn, and Shoshone rivers originate:

- Bighorn Canyon National Recreation Area (Montana, Wyoming)
- Grand Teton National Park (Wyoming)
- John D. Rockefeller, Jr. Memorial Parkway (Wyoming)
- Yellowstone National Park (Idaho, Montana, Wyoming)

What Qualifies as a Vital Sign?

We chose a wide range of vital signs that are measurably sensitive to stressors and could therefore alert us to changes. Some examples include focal species (whitebark pine), taxonomic groups (frogs and salamanders), physical resources (water quality and quantity), natural ecosystems and associated communities (sagebrush grasslands), and environmental drivers (climate).

How Do We Monitor Vital Signs?

Following scientifically rigorous protocols (a recipe for science), we collect data seasonally, annually, or every few years. We resample sites using the same methods every visit to reliably detect change over time.

How Do We Use Vital Signs?

Long-term monitoring of vital signs improves our understanding of the complex and dynamic nature of park ecosystems. It helps us identify what stressors and drivers may be leading to ecosystem change and overall park health, and is therefore critical to the conservation of park resources over time. We apply this information in ways that include

- providing park staff with readily available science to manage resources
- helping improve public understanding of these treasured resources
- helping address congressional mandates

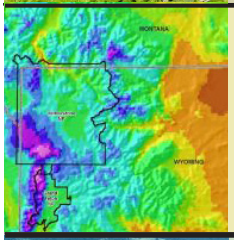
What Vital Signs Do We Monitor?

Alpine Ecosystems and Ecological Response to Climate Change

The Greater Yellowstone Ecosystem and Bighorn Basin are projected to become warmer, and possibly, drier, over the next 100 years. We follow a global strategy targeting high-elevation parks to monitor climate, snowpack, the timing of seasonal vegetation changes, as well as specific climate-influenced resources. Since 2011, we've been monitoring alpine plants and soil characteristics as one component of this strategy.

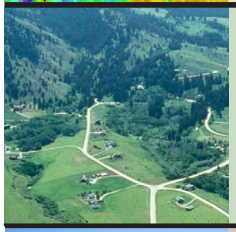
Amphibians and Wetlands

Amphibians need water for breeding, but their wetland homes are threatened by global climate change. Disease (caused by Ranavirus or chytrid fungus), pollution, and nonnative species also take a toll. Since 2005, we have been monitoring which amphibian species show up to breed at park wetlands each year. We also track changes in the availability of suitable breeding habitat.



Climate

Plants and animals are closely adapted to their local climate. Climate thereby influences where species occur, but also controls ecosystem processes, like the water cycle. Since 2010, we've been reporting on daily air temperature and precipitation data from park weather stations to monitor climate and its effect on all the other park vital signs, such as how snowmelt runoff affects wetlands or how drought affects whitebark pine trees.



Land Use

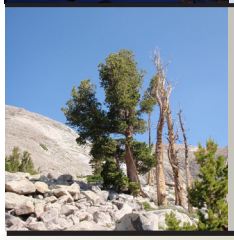
Parks may look like islands on a map, but they are not. Activities in and around parks, like wildland fires, the spread of nonnative species, and fragmentation of natural areas by roads and urban growth may affect park resources. We study changes in neighboring land cover and land use to inform park managers and prepare them to address complex issues that cross administrative boundaries, such as migratory wildlife, wildland fire, invasive species, and climate change.

Upland Vegetation

In the high-desert West, pinyon-juniper woodland, grassland, and sagebrush shrubland communities shelter and feed wildlife, stabilize soil, cycle nutrients, and sequester carbon. Extensively modified by humans, and currently threatened by invasive nonnatives, like cheatgrass, they are easily damaged and slow to recover. In 2011, we began monitoring native and nonnative plants, as well as soil characteristics, in upland vegetation plots in parks.

Water Resources

Springs, wetlands, and rivers in our region support a wide variety of life, shape visitor experiences, and supply water to downstream farms and towns. But climate shifts make water less available, and human use is growing. Since 2006, we've been monitoring water quality and quantity in parks in relation to the Clean Water Act, human health, and ecological function. We also monitor snowpack for airborne pollutants, like nitrogen, as part of a Rocky Mountain-wide effort.



Whitebark Pine

Whitebark pine is a keystone species of subalpine forests in the northern Rocky Mountains and the Pacific Northwest. Its high-energy seeds feed grizzly bears and other wildlife. Its shade regulates snowmelt and helps new plants establish. But drought, insects, and disease threaten its survival. Since 2004, we have been monitoring tree size, mortality, seedlings and saplings, cone production, and evidence of stressors as part of a multiagency effort.

Explore the Greater Yellowstone Network website

Learn more about each vital sign and explore:

- species lists for a park (Home>What We Inventory>Species Lists)
- interactive visualization tools for learning about climate, vegetation, and landscape dynamics (Home>Reports & Publications>Data Visualizers)

Contact us!

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