

Resource Brief

High Elevation Parks of the

Greater Yellowstone, Rocky Mountain and Upper Columbia Basin Networks

National Park Service
U.S. Department of the Interior
Inventory & Monitoring Program



Invasive Species and Climate Change

Invasive species are currently a management issue for many parks and are expected to persist or worsen with changing climates. Furthermore, the potential for synergistic interactions involving invasives and other ecosystem factors means we must prepare for the possibility of devastating and unpredictable surprises that could have significant impacts on park resources.

The National Park Service defines exotic or non-native species as “those that occur in a given place as a result of direct or indirect, deliberate, or accidental actions by humans.” Some of these out-of-place species are likely to be invasive, and will rapidly colonize areas, displace natives, alter community composition, and reduce natural diversity. Many environmental and anthropogenic variables can contribute to shifts in species distribution. Climate change is one such factor.

Looking ahead - invasive species in a new climate

As precipitation and temperature patterns change, experts predict the suitability of geographic regions to support specific plant species or suites of species will, in turn, be affected. Although high elevations have previously been less vulnerable to invasion, there is general agreement that with warmer temperatures, we will see exotic species expand into alpine and subalpine environs. In other habitats changes may not be so clear or unidirectional. We may see ranges of both native and exotic species expand, decrease, or shift.

Invasion dynamics

Federal lands and other protected areas are vulnerable to invasion – over 3,700 non-native plant species are known to have become established in 216 US national parks. The Rocky Mountain and Upper Columbia Basin region is less invaded than areas such as California and Hawaii, but the impacts and extent of invasive species can be severe. For instance, the native bunchgrasses of the Upper Columbia Basin and intermountain region have proven particularly vulnerable to over-grazing, allowing large areas to become invaded by cheatgrass (*Bromus tectorum*). Millions of acres are at risk of being converted to cheatgrass monocultures with increased risk of frequent wildfire.

The invasive species of greatest management concern in the western United States fall into three general categories: pests and pathogens, aquatic invaders, and invasive plants. Pests and pathogens, such as whirling disease and



White pine blister rust

Phyllis Pineda Bovin, NPS



Spotted knapweed

David G. Anderson, Colorado Natural Heritage Program

the fungus responsible for white pine blister rust (*Cronartium ribicola*), have had devastating impacts on native species. Lake trout (*Salvelinus namaycush*), brook trout (*S. fontinalis*) New Zealand mud snails (*Potamopyrgus antipodarum*), quagga (*Dreissena bugensis*), and zebra mussels (*D. polymorpha*) are some of the most troublesome aquatic invaders. Invasive bullfrogs (*Rana catesbeiana*) have contributed to the decline of native frogs in the region. Plants of the greatest concern are yellow star thistle (*Centaurea solstitialis*), cheatgrass, tamarisk (*Tamarix ramosissima*), leafy spurge (*Euphorbia esula*) and spotted knapweed (*Centaurea maculosa*). These and many other invasive species have contributed to loss of biodiversity, localized extinctions, and changes in ecosystem processes such as fire, hydrologic regimes, and nutrient cycling.

Observed trends

The spread of invasive species in the West has recently accelerated. For example, from 1986 to 2008, the number of exotic plant species documented in Yellowstone National Park nearly doubled from 105 to 208. Invasive aquatic species such as quagga and zebra mussels, once known only from the Great Lakes area, have recently been sighted in Colorado and on boat trailers in Montana, and are expected to continue to increase in numbers. While there is a correlation between the spread of invasives and warming temperatures, it is hard to pinpoint climate as the cause because of the many other factors such as lag times, deliberate introductions, and dispersal vectors. Nonetheless, it is suspected that climate is a major driver of the spread of invasive warm-water fishes and some warm-season grasses.

In fact, there are signs that one species of concern, cheatgrass, is already expanding in at least one higher-elevation park in the Southern Rocky Mountains. In the late 1980s, cheatgrass was rarely found above 8,500 ft. at Rocky Mountain National Park, but it is now found nearly as high as 9,600 ft. The impact of cheatgrass on the landscape and fire effects is well documented in sagebrush steppes but is not well known in high elevation areas in ponderosa pine and lodgepole pine. Further research regarding the mechanisms of invasion and susceptibility of these high elevation communities is needed.



Sage grouse, a species vulnerable to the invasion of cheatgrass. Craters of the Moon National Monument & Preserve.

Predicted changes

We may not be able to predict exact species responses to global warming, but community patterns are bound to change. Fast growing, weedy species are predicted to do well with the concurrent increases in CO₂ and soil nitrogen as global temperatures rise. Benefitting from these increased resources, weedy species may outcompete slower growing native species and thereby escape the pressure of their natural enemies.



Monitoring a meadow infested with leafy spurge in Glacier National Park.

Climate change is likely to increase biological invasions. Models suggest that there will be changes in invasion dynamics with a warmer climate in the Rocky Mountain and Upper Columbia Basin region:

- Plant and animal species, both native and invasive, will migrate upslope and northward.
- Changes in precipitation will likely drive the expansion and contraction of invasive plants.
- Warmer stream temperatures and a reduction in ice cover will facilitate the spread of aquatic invasives and may increase their impacts.
- Changes in the timing of snowmelt and a subsequent increase in disturbance caused by spring floods may increase the risk of aquatic and riparian invasions.
- Warmer temperatures may change human visitation patterns to natural areas and increase the pathways of spread for many invasives.

Monitoring the most probable areas for new invasions aids managers with timely information for implementation of control measures. Further, evaluating the effectiveness and accuracy of predicted invasion areas helps refine our understanding of what makes communities good targets for invaders, and promotes long-term protection of vulnerable protected areas as we move into the climate of the future.

For more information:

Natural Resource Reports:

<http://www.nature.nps.gov/publications/NRPM/nrr.cfm>

2010/260 Climate and Terrestrial Ecosystem Change in the U.S. Rocky Mountains and Upper Columbia Basin: Historical and Future Perspectives for Natural Resource Management

2010/220 Observed and projected ecological response to climate change in the Rocky Mountains and Upper Columbia Basin: A synthesis of current scientific literature.

Greater Yellowstone Inventory and Monitoring Network

<http://science.nature.nps.gov/im/units/gryn/>

Rocky Mountain Inventory and Monitoring Network

<http://science.nature.nps.gov/im/units/romn/>

Upper Columbia Basin Inventory and Monitoring Network

<http://science.nature.nps.gov/im/units/ucbn/>