

Western Ecological Research Center <http://www.werc.usgs.gov>

Impact of Fire and Grazing on Plant Diversity and Invasion in Sierran Forests

Two important disturbance factors in the Western United States are grazing and fire, and both have been linked to plant invasions. Disturbances often create an imbalance in distribution of resources, which may alter species composition through shifts in resource availability. These in turn may create conditions favoring invasion of nonnative species and deletions of native species.

In the foothill grasslands and savannas of California, nonnative grasses and forbs dominate due to a history of over-grazing coupled with extreme droughts. These ecosystems have already been so heavily invaded by nonnative grasses and forbs that present livestock grazing at low to moderate stocking densities is not tied to shifts in the native/nonnative dominance. However, recent U.S. Geological Survey (USGS) research in California's southern Sierra Nevada shows that grazing by different types of livestock in foothill woodlands may alter species composition and distribution of plant functional types or growth forms.

In the higher elevation coniferous forests, invasive plants have not previously posed a significant threat. However, the recent reintroduction of fire to these forests may provide conditions conducive to the invasion and spread of some weeds. USGS research in the southern Sierra Nevada has shown that gaps created by high-intensity fires are particularly susceptible to invasion by nonnative plant species. Such invasions may be controlled by



Open ponderosa pine forest with cheatgrass-dominated understory. Photo: courtesy National Park Service.

Research is still needed on:

- The types of fire regimes conducive to plant invasions
- Forest types most at risk of plant invasion
- Management strategies needed for reintroducing fire to its natural role

managing for low-intensity fires, but this may not be desirable because native species richness and tree seedling recruitment were also found to be favored by high-intensity fires.

In these Sierran ecosystems, the threat of invasive species is most profound in the lower elevations and decreases with elevation. Part of the explanation for this pattern is the fact that most invasives in this region are annual plants and this growth form declines in both species number and dominance with elevation. The lower elevation ponderosa pine forests are potentially most susceptible to new invasions, and particularly troublesome is the apparently recent expansion of cheatgrass (*Bromus tectorum*) in these forests in Kings Canyon National Park.

As is the case with species diversity in general, the invasion of cheatgrass is strongly correlated with localized gaps produced by high-intensity burning. Because of this apparent relationship between fire and cheatgrass, prescribed burning has been temporarily halted in these forests. Early control of this apparent invasion is of concern to resource managers in Sierra Nevada parks, and a more detailed study of fire and other concerns regarding cheatgrass invasion are currently being investigated by the USGS.

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