

Western Ecological Research Center

Publication Brief for Resource Managers

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Fire and Grazing Impacts on Plant Diversity and Alien Plant Invasions in the Southern Sierra Nevada

Nonnative plants have historically been viewed as nuisance species that readily invade roadsides and other disturbed areas, but in recent decades there has been increasing focus on invasions of natural communities, where aliens are recognized as threats to ecosystem functioning. Land management practices affect alien invasions. Thus it is becoming increasingly important for resource managers to be able to predict which species are likely invaders, which communities are most at risk, and how land management practices influence the invasion process.

In the western United States, two important disturbance factors that appear to play a role in promoting alien plant invasions are grazing and fire. In a recent publication in *Ecological Applications*, USGS scientist Dr. Jon Keeley and colleagues examined patterns of native and alien plant diversity in response to disturbance along an elevational gradient in the southern Sierra Nevada. Their results failed to support the theory that native plant diversity would inhibit alien invasion. Instead, they found that sites of alien invasion were often hotspots of native diversity.

Livestock grazing in blue oak savannas increased the number of alien plants only slightly over sites free of livestock grazing for more than a century, indicating some level of permanency to this invasion in these foothill habitats. These oak woodlands typically have more aliens than native species, and the mosaic distribution of this type provides a ready source of propagules for alien invasion into associated chaparral stands following fire. In these shrublands, the speed at which alien propagules reach a burned site relative to the speed at which the shrublands return to their former

Management Implications:

- Native diversity and alien invasions decline with elevation.
- Environmental factors that favor native biodiversity also favor alien species.
- Removal of grazing in the foothill grasslands only slightly diminishes the dominance by alien grasses and forbs.
- Native plant diversity in conifer forests is promoted by gaps resulting from high-intensity fires.
- Fire restoration of conifer forests carries with it the risk of alien invasion.

closed canopy condition determines alien invasion success. Frequent burning of this vegetation alters the balance in favor of alien invasion.

In the higher-elevation coniferous zone, unburned forests were largely free of alien species, whereas some burned sites had a significant alien presence, which presents a challenge for fire restoration of these forests. In general, aliens were not a problem where there had been low-intensity surface fires, and aliens were more likely to invade into gaps generated by high-severity fires. Although fire managers could potentially inhibit alien invasions by minimizing fire severity, much of the native biodiversity in these forests is also dependent upon such gaps.

Keeley, J. E., D. Lubin, and C. J. Fotheringham. 2003. Fire and grazing impacts on plant diversity and alien plant invasion in the southern Sierra Nevada. Ecological Applications 13:1355-1374.