

## Western Ecological Research Center

# Publication Brief for Resource Managers

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## Alien Plant Invasion Following Fire in California Shrublands

Non-native grasses and forbs have displaced shrublands over a significant portion of the California landscape and this process continues today. Researchers are divided as to the factors most responsible for this invasion. Some contend that it is primarily driven by increased disturbance from fire and grazing, and others maintain that it is the result of atmospheric pollution from ozone and nitrogen oxides. In the December 2005 issue of *Ecological Applications*, USGS research scientist Jon Keeley and colleagues report on recent studies that address this issue.

They studied alien plant invasion in chaparral and sage scrub ecosystems over a period of five years after fire across a six-county area in southern California. They tested different path models to evaluate factors hypothesized to determine alien dominance. Models that included pollution effects such as nitrogen deposition were not significant. Their only significant model found that the factors most directly affecting alien dominance were the speed of woody plant recovery after fire and the level of alien seed banks present at the time of fire.

These two direct factors were affected indirectly by fire intensity, fire history, prefire shrub composition, aridity, and community type. Fire history, specifically the frequency of past fires, is one of the most important factors because it affects the prefire stand structure. Frequently burned shrublands tend to be more open and encourage the establishment of alien plants. As alien invasion increases, it alters the structural characteristics from woody native shrublands to mixtures of woody and herbaceous plants. This has profound impacts on the ecosystem processes and in particular it reduces fire intensity, which favors survival of alien seed banks.

### Management Implications:

- Sage scrub is much more vulnerable to alien plant invasion than chaparral.
- Regional differences in air pollution do not explain patterns of invasion since serious alien plant invasions are occurring in coastal as well as interior basins.
- Frequent fire is currently the most important disturbance factor responsible for displacing native shrublands with alien-dominated grasslands.
- Prescription burning is not a viable management practice for controlling alien species on these semi-arid landscapes.

This research raises serious issues about the use of prescription burning and other fuel manipulations in these shrubland ecosystems. These landscapes currently experience an unnaturally high frequency of fire, and thus much of it is at risk for alien invasion. Fire managers need to consider this risk, and the potential effects of prescription burning and other prefire fuel manipulations, which decrease woody plant cover and expose sites to alien invasion. In managing these landscapes it might be helpful to consider the fact that the vast majority of alien species in California are opportunistic species that capitalize on disturbance. Adding additional disturbance through prescription burning (or grazing) will only exacerbate the alien problem.

*Keeley, J. E., M. Baer-Keeley, and C. J. Fotheringham. 2005. Alien plant dynamics following fire in mediterranean-climate California shrublands. Ecological Applications 15:2109–2125.*