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## Fire-Driven Alien Plant Invasion in a Fire-Prone Community

Disturbance plays a key role in many alien plant invasions. However, disturbance per se is often not the main driver of invasion. As shown in a USGS study published in *Oecologia*, alterations in disturbance regime characteristics are far more critical to the invasion process. In fire-prone shrublands, the natural regime is one of infrequent high intensity crown fires. Such fire regimes are commonly perturbed by short interval fires that may favor alien plant invasions.

USGS fire ecologists Jon Keeley and Teresa Brennan assessed postfire recovery following the 2003 Cedar Fire in San Diego County, California, on sites with a prefire age of 3 years and of 24 years. In addition, the 2007 Witch Fire reburned some of these sites, and plant community response on these reburned plots was assessed. Thus, the researchers were able to investigate native plant recovery and alien plant invasion on immature and mature sites burned by the same fire, as well as on the same sites burned by repeat fires 4 years apart.

Native woody species regenerated well in mature stands, but both seedling recruitment and resprouts declined under short fire intervals and one obligate seeding shrub was extirpated under such conditions. As seen in this study, short intervals between fires greatly facilitated the increase in alien species, all of which are annuals from the Mediterranean Basin.

There are two factors at work. One is the lower fire intensity in young immature shrublands, which enhances alien seed bank survivorship. In addition, short fire return intervals directly inhibit regeneration of native woody species, reducing the competitive inhibition of alien species.

This study showed that fire-adapted shrublands are vulnerable to changes in fire regime, leading to loss of native diversity and setting the community on a trajectory

### Management Implications

- Species are not adapted to fire per se, but rather to a particular fire regime. Many western U.S. shrublands are adapted to infrequent fires, 30- to 100-year-apart, and are negatively impacted when fire frequency increases.
- Repeat fires 3- to 4-years apart drastically reduced dominant native shrub species and resulted in greater alien plant cover and lower overall diversity in plant species.
- Short-interval fires are the first step in type conversion from native shrublands to alien dominated annual grasslands.

#### THIS BRIEF REFERS TO:

Keeley, J.E., T.J. Brennan. 2012. Fire-driven alien invasion in a fire-adapted ecosystem. *Oecologia* 169(4): 1043-1052. doi: 10.1007/s00442-012-2283-8

<http://www.werc.usgs.gov/ProductDetails.aspx?ID=4638>

<http://www.werc.usgs.gov/keeley>

towards type conversion from a woody to an herbaceous system. Such changes result in altered proportion of natives to non-natives; changes in functional types from deeply rooted shrubs to shallow rooted grasses and forbs; increased fire frequency due to the increase in flashy fuels; and changes in carbon storage.



Aggressive alien grass invasion two years after the Cedar Fire on a site 3 years old at the time of the fire.