USGS
science for a changing world

Western Ecological Research Center

Publication Brief for Resource Managers

Release: April 2007

Contact: Dr. Jon E. Keeley

Phone: 559-565-3170

Email and web page: jon_keeley@usgs.gov
http://www.werc.usgs.gov/seki/keeley.asp

Sequoia and Kings Canyon Field Station, USGS Western Ecological Research Center, 47050 Generals Highway #4, Three Rivers, CA 93271

The Role of Fuel Breaks in the Invasion of Nonnative Plants

Reduction of hazardous fuels has become a priority for federal, state, local, and private land managers in the United States. Federal initiatives, including the National Fire Plan and the Healthy Forests Restoration Act of 2003 (HR 1904), have extended the scope of pre-fire fuel manipulations to include a wide range of vegetation types and treatment prescriptions, and have dramatically increased the number of acres treated to reduce fuels. In U.S. Geological Survey Scientific Investigations Report 2006-5185, USGS scientists Kyle Merriam (currently with the USFS) and Dr. Jon Keeley and USFS colleague Dr. Jan Beyers report that an unintended result of these fuel modification programs can be the introduction and spread of nonnative invasive plant species. Their study focused on forests and shrublands throughout California and included fuel breaks in sage scrub, chaparral, oak woodland, and coniferous forest vegetation types. Their study also included a range of construction methods, maintenance regimes, and fire histories.

Management Implications:

- Fuel breaks are more likely to be invaded by nonnative plants than are undisturbed landscapes.
- Fuel breaks play an important role as a seed source for the establishment of nonnatives in adjacent areas and corridors for nonnatives into wildland areas.
- Variation in relative nonnative abundance is related to different fuel break construction methods.

Ridgeline fuelbreak in southern California chaparral dominated by nonnative plants. Photo: K. Merriam.

The scientists reported that cover and diversity of nonnative species were significantly higher on fuel breaks than in surrounding wildland areas. They found that elevation and vegetation type had a marked influence on nonnative plant abundance, and the problem was most pronounced in the lower foothill chaparral and sage scrub. In addition, wildland areas adjacent to fuel breaks were more likely to be invaded by nonnative species when the wildlands had been subject to grazing or recurrent fires.

The establishment of nonnative annual grasses, the most common nonnatives in this study, is of importance to fire managers because it can alter fuel characteristics such that fires become less intense but more frequent. Increased fire frequencies can kill native plants even in fire prone ecosystems, because native species develop life histories in response to specific fire frequencies; these native species may be extirpated when fires occur more frequently. Also, reduced fire intensity on fuel breaks may increase the survivorship of nonnative seeds.

Variation in nonnative abundance was related to different fuel break construction methods (hand crews, bulldozers, mechanical equipment). Fuel breaks constructed by bulldozers had higher nonnative cover, lower overstory canopy cover, and lower litter cover than fuel breaks constructed by other methods. Altering the type of machinery used to construct and maintain fuel breaks was also found to influence patterns of invasion by nonnative plants. In relatively uninvaded vegetation types, such as conifer forests, use of bulldozers significantly increased the abundance of nonnative plants. Bulldozers have large blades specifically designed to remove surface soil layers, and may be more likely to introduce nonnative seeds into fuel breaks by disrupting soil seed banks and transporting seeds between sites.

These data suggest that fuel breaks could provide establishment sites for nonnative plants, and that nonnatives may invade surrounding areas, particularly after disturbances such as fire and grazing. Fuel break construction and maintenance methods that leave some overstory canopy and minimize exposure of bare ground may be less likely to promote nonnative plants.

The report is online at http://pubs.water.usgs.gov/sir20065185.

Merriam, K.E., Keeley, J.E., and Beyers, J.L., 2007, The role of fuel breaks in the invasion of nonnative plants: U.S. Geological Survey Scientific Investigations Report 2006-5185, 69 p.