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Western Ecological Research Center
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Fire Treatment Effects on Vegetation Structure, Fuels, and Potential Fire Severity in Western U.S. Forests

Forest structure and species composition in many western U.S. coniferous forests have been altered through fire exclusion, past and ongoing harvesting practices, and livestock grazing over the 20th century. The effects of these activities have been most pronounced in seasonally dry, low- and mid-elevation coniferous forests that once experienced frequent, low-moderate intensity fire regimes. In a recent article in *Ecological Applications,* USGS scientist Dr. Jon Keeley and USFS, University of California, and University of Montana colleagues report the effects of Fire and Fire Surrogate (FFS) forest stand treatments on fuel load profiles, potential fire behavior, and fire severity under three weather scenarios from six western U.S. FFS sites.

Management Implications:

- These forests differed greatly in stand density and other structural characteristics and this contributed to some treatments being more successful at some sites than at others.
- Mechanical, burning, and the combination, all were effective at reducing potential fire severity under severe fire weather.
- Mechanical treatments without burning resulted in surface fuel loads greater than controls on many sites.
- Models predicted that the combination of mechanical and burning provided the greatest reduction in crown fire potential.

This replicated, multisite experiment provided a framework for drawing broad generalizations about the effectiveness of prescribed fire and mechanical treatments on surface fuel loads, forest structure, and potential fire severity. Mechanical treatments without fire resulted in combined 1-, 10-, and 100-hour surface fuel loads that were significantly greater than controls at three of five FFS sites. Canopy cover was significantly lower than controls at three of five FFS sites with mechanical only treatments, and at all five FFS sites with the mechanical plus burning treatment; fire only treatments reduced canopy cover at only one site. For the combined treatment of mechanical plus fire, all five FFS sites with this treatment had a substantially lower likelihood of passive crown fire as indicated by the very high torching indices. FFS sites that experienced significant increases in 1-, 10-, and 100-hour combined surface fuel loads utilized harvest systems that left all activity fuels within experimental units. When mechanical treatments were followed by prescribed burning or pile burning, they were the most effective treatment for reducing crown fire potential and predicted tree mortality because of low surface fuel loads and increased vertical and horizontal canopy separation. Results indicate that mechanical plus fire, fire only, and mechanical only treatments using whole tree harvest systems were all effective at reducing potential fire severity under severe fire weather conditions. Retaining the largest trees within stands also increased fire resistance.

Stephens, S.L., J.J. Moghaddas, C. Edminster, C.E. Fiedler, S. Haase, M. Harrington, J.E. Keeley, E.E. Knapp, J.D. McIver, K. Metlen, C.N. Skinner, and A. Youngblood. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. Ecological Applications 19:305–320.
[Complete article can be downloaded from web site above.]