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Spatial Patterns of Large Natural Fires in Sierra Nevada Wilderness Areas

Natural fire plays a critical role in shaping landscapes by promoting heterogeneity among vegetation types and age class patches. In the absence of fire throughout much of the California Sierra Nevada, and more generally the western United States, landscapes have become homogenized. The results from a study published in the April edition of *Landscape Ecology* by researchers at the University of California, Berkeley and USGS characterize the spatial properties and factors driving the patterns of more natural fire-induced vegetation change. Based on these factors, managers can anticipate the effects of management ignited and naturally ignited fires.

The scientists used satellite imagery and geospatial analysis to study fire severity (the extent of fire-induced change in dominant vegetation) of two natural wildland fires in wilderness areas of two Sierra Nevada national parks. These fires provide recent examples of fire-caused change over large areas composed of several different vegetation types.

The 2001 Hoover fire, which burned over 2,100 ha in Illilouette Creek basin of Yosemite National Park, and the 2003 Williams fire, which burned nearly 1,400 ha in Sugarloaf Creek basin of Kings Canyon National Park, were both lightning-ignited fires that were allowed to burn as part of the natural fire programs (now referred to as wildland fire use). As a result of repeated burning over the last 30 years, Illilouette Creek and Sugarloaf Creek basins have as close to natural fire regimes as any place in the western United States, despite having over half a century of fire exclusion prior to wildland fire use.

In each basin, forests of Jeffrey pine, lodgepole pine, white fir, and red fir are interspersed with meadows and shrublands. Weather and vegetation, but not topography, proved important factors in explaining fire severity patterns between the two fires. The scientists found that fir stands tended to burn at lower severities. In addition, higher relative humidity and lower temperatures corresponded with lower or moderate fire severity. On the other hand, lodgepole pine stands burning under low wind speeds tended to experience the highest mortality.

The arrangement and sizes of patches burned at different severities differed between the two fires. However, the patterns of each fire were within the historic range of variability for mixed severity fire regimes. Unchanged and low-severity patches were much larger (one order of magnitude) in the Williams fire, while higher severity patches were larger (two to four times) in the Hoover fire. The dominant vegetation appeared to be primarily responsible for the observed fire severity patterns.

Management Implications:

- The dominant vegetation was the primary factor in explaining fire severity patterns in these natural Sierra Nevada forest fires.
- Many of the landscapes throughout the Sierra Nevada are not in a state at which large-scale fire will mimic the effects associated with more natural fire.
- Wildland fire managers can use these findings to aid in implementing wildland fire use and prescribed fire programs.
- The factors identified in this study can help determine expected change in the landscape pattern of vegetation resulting from allowing wildland fires to burn in various conditions.

Collins, B. M., N. M. Kelly, J. W. van Wagtendonk, and S. L. Stephens. 2007. Spatial patterns of large natural fires in Sierra Nevada wilderness areas. Landscape Ecology 22: 545–557.