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Publication Brief for Resource Managers

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Forest Heterogeneity and Prescribed Burning

Prior to European settlement and modern-day fire exclusion, vegetation in the mixed-conifer zone of the Sierra Nevada was likely a mosaic of early- and late-successional stages. This heterogeneity is believed to have been produced by and maintained through spatial and temporal variation in fire regime (including severity, frequency, and size), as well as local environmental and topographic variability. Spatial heterogeneity is a vital component of forests, promoting a greater diversity of flora and fauna. Heterogeneity may also play important ecological roles by providing unburned refugia from which plants and animals can recolonize severely burned forests.

The abundance of fuels that have accumulated in many Sierra Nevada forests has led to a concern that fire effects generated by prescription burning might now overwhelm mechanisms that historically generated heterogeneity in fire severity, leading to greater than desired landscape uniformity. Research by USGS scientists shows that substantial heterogeneity in two measures of fire severity—percentage of area burned and scorch height—can be produced by both early season and late season prescribed burns. Drs. Eric Knapp (now with the U.S. Forest Service, Pacific Southwest Research Station) and Jon E. Keeley report their findings in the March issue of the *International Journal of Wildland Fire.*

Prescribed burns conducted by the Sequoia National Park fire management staff were done in replicated 37-acre (15-ha) mixed-conifer forest stands with over a century of fire exclusion. Following early season burns the percentage of ground surface burned ranged from 24% to 96%, but late season plots burned somewhat more uniformly, with 47% to 100% of the plots being burned. Scorch height ranged from 3 m to 25 m in early season plots and 3 m to 39 m in late season plots, suggesting substantially greater fire intensities created by late season burns.

Management Implications:

- By manipulating burning prescriptions, it is possible to burn the heavy fuel loads in productive mixed-conifer forests without generating uniformly high-severity fires.
- Patchiness of prescribed burns is greatest in early season burns, whereas the range of scorch heights is greatest in fall burns.
- Research is needed to evaluate whether prescription burning using strip headfires and other multiple point of ignition techniques reduces the heterogeneity in fire severity relative to natural fires.

In addition to season effects, bare ground and rock cover reduced fuel continuity and increased burning patchiness. Scorch height was greatest in areas with steeper slopes, higher basal area of live trees, high percentage of basal area composed of pine, and more small woody fuel. Thus, topographic and biotic factors still contribute to the abundant heterogeneity in fire severity with prescribed burning, even under the current high fuel loading conditions.

Although both early and late season prescribed burns in this study produced heterogeneity in fire severity and patchiness in the percentage of area burned, a clear baseline is lacking on what the historical burning patterns were in these forests. The extent to which strip burning and other prescribed burning techniques reduce heterogeneity of burning over natural wildfires is unknown.

Knapp, E. E. and J. E. Keeley. 2006. Heterogeneity in fire severity within early season and late season prescribed burns in a mixed-conifer forest. International Journal of Wildland Fire 15:37–45.