

Western Ecological Research Center

Publication Brief for Resource Managers

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Spatial Variability, Pseudoreplication, and the Assessment of Fire Effects

Fire is a defining feature of many forest ecosystems, although quantifying its effects is difficult because fire can be unpredictable and may occur at very large scales. The effects of fire (forest fuel combustion, tree mortality, etc.) are often characterized from several small study plots within a larger burned area. This practice, while operationally convenient, may provide data that are difficult to analyze and interpret. Study plots subsampled from a larger burned area may be correlated both spatially and temporally, which could lead to overestimations of fire effects (i.e., the subsampled data underlying these tests are “pseudoreplicated”). In a recent publication in *Fire Ecology*, USGS scientist Dr. Phil van Mantgem and Dr. Dylan Schwilk (Texas Tech University) demonstrated that forest conditions and fire effects were extremely heterogeneous so that the effects of spatial correlation among samples did not influence measurements of fire effects in a mixed conifer forest in the Sierra Nevada of California.

Using long-term data from six different prescribed fires (and three unburned areas) van Mantgem and Schwilk showed little evidence for strong spatial correlation either before or after burning for eight measures of forest conditions important to managers (i.e., fuels [woody material on the forest floor], forest density, and understory community characteristics). They further demonstrated that explicitly considering the effects of spatial correlation among plots did not change assessments of the difference between early versus late season burning in this forest type.

The high degree of variability in pre- and post-fire forest conditions has important implications for an ongoing debate concerning the need for mechanical thinning

Management Implications:

- Spatial correlation of forest structure among plots was weak in Sierran mixed conifer forests, and had trivial effects in assessments of fire effects.
- High patch scale heterogeneity implies that one or even several small monitoring plots within a burned area might provide a poor overall assessment of the effects of a given fire.
- The high degree of patch scale variability in Sierran mixed conifer forests suggests that treatments designed to encourage further heterogeneity in forest conditions prior to the reintroduction of fire are unnecessary.

prior to the reintroduction of prescribed fire in Sierran mixed conifer forests. Arguments in favor of pre-fire thinning are based on idea that fire exclusion has led to the homogenization of previously heterogeneous stands, and the application of fire without preceding silvicultural treatments will perpetuate unnatural changes in forest structure. These new results imply that even following a century of fire exclusion forest conditions are far from homogeneous either before or after prescription fire. Thus, the application of treatments prior to prescribed burning to encourage further stand heterogeneity either in fuels or vegetation would be unnecessary.

van Mantgem, P.J., and D.W. Schwilk. 2009. Negligible influence of spatial autocorrelation in the assessment of fire effects in a mixed conifer forest. *Fire Ecology* 5:116–125.

Free download of this publication at: <http://fireecology.net/Journal/pdf/Volume05/Issue02/116.pdf>