CALIFORNIA FIRE SCIENCE CONSORTIUM

Research Brief for Resource Managers

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Shrub control associated with reforestation in high-severity burn areas promotes understory diversity

Bohlman, G.N., North M.E., and Safford, H.D. 2016. Shrub removal in reforested post-fire areas increases native plant species richness. Forest Ecology and Management ***374****: 195-210.*
h*ttp://dx.doi.org/10.1016/j.foreco.2016.05.008*

Management Implications

- Shrub control associated with post-fire reforestation increases native plant species richness for over 40 years after fire.
- Reduction of shrubs using herbicide causes an initial increase in richness and cover of exotic species but the effect is no longer apparent several decades after fire.
- While shrub removal may benefit understory species diversity, some level of shrub presence is essential for recovery of burned areas.
- The unchecked infilling of shade tolerant trees in older conifer plantations may lead to dense, fire-prone stands.
- Reforestation may be used as a tool to reintroduce heterogeneity into severely burned areas, promoting both structural and biological diversity.

The increased prevalence of large, high-severity fires in Sierra Nevada mixed conifer forests has amplified the need for land managers to determine how best to promote forest re-establishment in large high-severity patches. These areas often lack sufficient seed sources to support natural regeneration. High intensity fire in the Sierra Nevada also stimulates the germination and establishment of highly competitive shrub genera such as *Ceanothus* and *Arctostaphylos* that quickly monopolize the available resources.

While reforestation can involve a variety of management practices, the survival and growth of tree seedlings often depends on the successful control of competing vegetation. Because forest management is typically focused on the health and survival of trees, the impact of reforestation efforts on the understory plant community often goes overlooked. Bohlman *et al.* conducted a study looking at the effects of post-fire reforestation on understory plant species richness and composition, as well as stand structure.

Three different aged fires were selected to assess the role of time since fire on the different stand components. All three fires were located in the canyon of the South Fork of the American River and had large areas of severely burned forest that were subsequently reforested. In addition to these reforested areas, there were patches that were left to regenerate on their own for a variety of management reasons.

Bohlman *et al.* found that planted areas where there was effective control of competing

vegetation had significantly higher native plant species richness than areas left untreated 10, 22, and 41 years after fire despite the overall decline in richness as time since fire increased. This effect of treatment was largest in the 22-year-old fire where differences in shrub cover were the most extreme. Similar to findings in other studies, competition for light and water were found to be the major drivers of richness levels in the fires studied.

The authors stress the fact that although they show the benefit shrub control surrounding planted conifers can have on understory diversity, managers should not forget the importance of keeping shrubs in the system, especially after fire, as they provide benefits such as soil stabilization, nitrogen fixation, and wildlife habitat. The authors also discuss concerns regarding the increase of exotic grasses as a result of herbicide use but note that although their data show an initial increase of richness and cover of exotic species in treated areas. This effect decreased with time since fire and was no longer apparent in the oldest fire.

This study suggests that post-fire reforestation may help to increase biodiversity on landscapes that have experienced extensive high-severity fire. The increasing size of high-severity patches in Sierra Nevada wildfires makes reforestation an important restoration tool but managers need to be strategic when selecting sites to plant. Allowing shrubs to dominate more xeric sites might be important while targeting more mesic areas for promoting species diversity associated with planting and shrub control.

Further reading:

McDonald, P.M., Everest, G.A., 1996. Response of Young Ponderosa Pines, Shrubs and Grasses to Two Release Treatments. Pacific Southwest Research Station Forest Service, U.S. Department of Agriculture, Albany, CA (Res. Note PSW-RN-419).

McGinnis, T.W., Keeley, J.E., Stephens, S.L., Roller, G.B., 2010. Fuel buildup and potential fire behavior after stand-replacing fires, logging fire-killed trees and herbicide shrub removal in Sierra Nevada forests. For. Ecol. Manage. 260 (1).

North, M., Oakley, B., Fiegener, R., Gray, A., Barbour, M., 2005. Influence of light and soil moisture on Sierran mixed-conifer communities understory. Plant Ecol. 177 (1), 22–35.

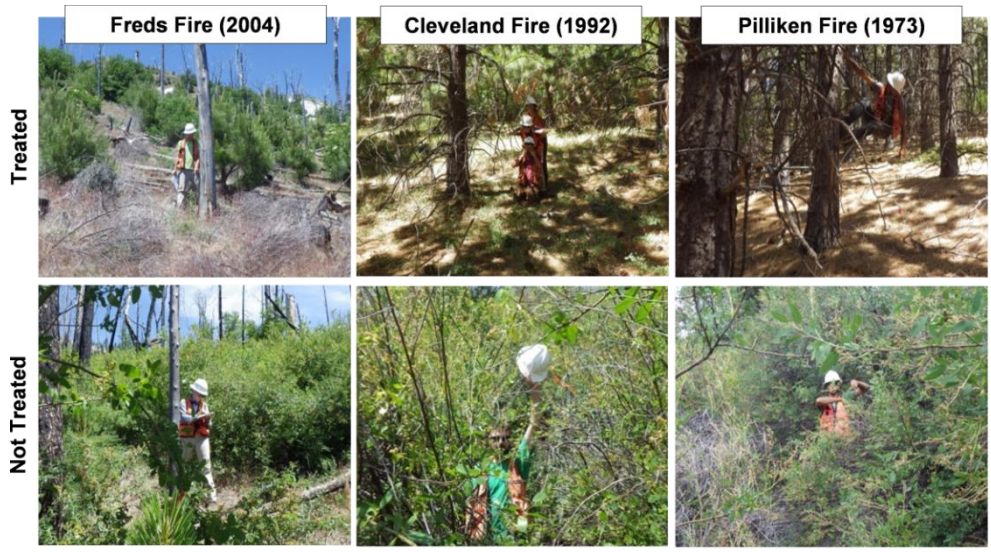

Figure 1: Plot photos showing adjacent treated and untreated areas in the three fires included in the study.