CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Research Brief for Resource Managers

Release:	Contact:	Phone:	Email:
June 2023	Kathryn Low	(530)-880-7385	katlow@ucanr.edu
	Ryan Tompkins	(530)-283-6125	retompkins@ucanr.edu
	Dr. Brandon Collins	(510)-664-7027	bcollins@berkeley.edu

California Fire Science Consortium | 130 Mulford Hall MC #3114, Berkeley, CA 94720

Shaded fuel breaks create wildfire-resilient forest stands in the Sierra Nevada

Low, K.E., J.J. Battles, R.E. Tompkins, C.P. Dillingham, S.L. Stephens, B.M. Collins. 2023. Shaded fuel breaks create wildfire-resilient forest stands: lessons from a long-term study in the Sierra Nevada. Fire Ecology 19: 29. https://doi.org/10.1186/s42408-023-00187-2.

Management Implications

- The combined application of structural thinning and prescribed fire may offer greater treatment longevity and restoration efficacy that can last two decades.
- Wildfires can enhance treatment longevity, so fuel reduction treatments could facilitate the use of managed wildfire to better meet restoration goals.
- Treatments that modify forest structure, reduce forest density and reduce surface fuel loads in concert may have greater longevity and utility compared to surface fuel only treatments that, may require more frequent maintenance.

In high fire hazard forests, the application of thinning treatments followed by prescribed fire can reduce wildfire impacts on forests, aid in fire management efforts, and improve firefighter safety. Depending on the treatment type, intensity, and maintenance, fuel treatments in dry, conifer forests in the Sierra Nevada can have a lifespan of approximately 10-20 years. Ideally, initial treatments would create forest conditions that facilitate the use of ecologically beneficial fire (prescribed or managed wildfire). However, the impacts of time and wildfire on treatment efficacy lacks robust empirical evidence.

This study leveraged data collected from 20-year-old forest monitoring plots within fuel treatment units that captured a range of wildfire occurrence (i.e., not burned, burned once, or burned twice) following application of initial thinning treatments and prescribed fire. By assessing the impacts of treatment and wildfires on forest structure in the short- and long-term, the study evaluated the ability of real-world treatments to meet stated objectives. The study aimed to 1) evaluate how shaded fuel breaks impact forest stand structure post-treatment and post-wildfire and 2) determine if wildfire occurrence extends the effective lifespan of a shaded fuel break.

Data was collected from long-term forest monitoring plots located within a network of shaded fuel breaks established by the Herger-Feinstein Quincy Library Ground Forest Recovery Act and Pilot Project. Researchers gathered plot-level information about overstory trees in 2001 (pre-treatment), 2003-2009 (1-year post-treatment), and in 2021 (approximately 20 years post initial-treatment). Woody fuels data was also collected in the 2021 measurement year. Plot-level overstory and fuels data were used to calculate the modeled probability of torching (P-Torch) to assess fire behavior for each plot at each measurement year.

Treatments effectively achieved desired structural conditions with effects persisting

throughout the 20-year study period (Figure 1). Initial treatments decreased live basal area by an average of 35% while live basal area increased by 24% between initial post-treatment measurements and 2021. Similarly, treatments initially increased live quadratic mean diameter (QMD) by an average of 32% and live QMD continued to increase by 10% in the time between initial post-treatment and 2021 measurements.

Wildfire occurrence had the greatest impact on coarse woody debris (CWD). In 2021, units that burned once and units that burned twice had 9% and 70% less CWD than unburned plots, respectively. Averaged wildfire severity influenced fine fuels and duff, which is consistent with findings that wildfires of low-to moderate severity can maintain fuel loads initially created by shaded fuel breaks. Plots that burned at an average of low severity had 46% less fine fuels and 76% less duff than unburned plots while plots that burned at an average of moderate severity had 26% less fine fuels and 77% less duff than unburned plots.

Treatments also successfully reduced the modeled probability of torching in the near- and long-term. Average P-Torch estimates per plot per measurement year was 39% pre-treatment, 2% one-year post-treatment, and 4% twenty years post-treatment. Though we did not model torching potential beyond 2021, average P-Torch estimates remained well below pre-treatment estimates 20-years later.

These results echo similar findings that treatments that restore forest structure and reduce surface fuels may better meet restoration goals and maximize longevity of treatment impacts. The structures and fuel conditions created by the treatments allow forests to persist through repeated unplanned wildfires. The reburns of low to moderate severity wildfire enhance ecological resistance by continued surface fuel reduction and promote forest resilience by maintaining low density forests. Study results suggest that the continued application of these treatments at far greater scales would better facilitate the use of ecologically beneficial fire across landscapes.

***Suggested Reading**:*

Stephens, S.L., Battaglia, M.A., Churchill, D.J., Collins, B.M., Coppoletta, M., Hoffman, C.M., Lydersen, J.M., North, M.P., Parsons, R.A., Ritter, S.M. Stevens, J.T., 2021. Forest restoration and fuels reduction: Convergent or divergent? Bioscience, 71(1), 85-101.

Stevens, J.T., Safford, H.D. Latimer, A.M., 2014. Wildfire-contingent effects of fuel treatments can promote ecological resilience in seasonally dry conifer forests. Canadian Journal of Forest Research, 44(8), 843-854.

Figure 1: Photo comparison of treatment units in the Antelope Border shaded fuel break by measurement year and wildfire count. All units shown were mechanically thinned followed by prescribed fire. The 5-yrs post-treatment photos capture stand conditions less than one-year post-wildfire (2006 Boulder Complex Fire for 1 Wildfire unit and 2007 Antelope Complex Fire for 2 Wildfires unit). The 20-yrs post-treatment photos capture 15-years post-fire for the 1 Wildfire unit and 2-years post-fire (2019 Walker Fire) for the 2 Wildfires Unit.