



Research Brief for Resource Managers

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Effects of forest thinning, chipping, and prescribed fire on surface fuel loads

Walker, RF, Fecko, RM, Frederick, WB, Johnson, DW, Miller, WW. 2011. Fuel bed alterations by thinning, chipping, and prescription fire in a Sierra Nevada mixed conifer stand. *Journal of Sustainable Forestry* 30: 284-300.

<http://dx.doi.org/10.1080/10549811.2010.490110>

Prescribed fire is commonly applied to reduce surface fuel loads following forest thinning for wildfire hazard mitigation. While retaining tree tops and limbs onsite can protect soils from disturbance during harvest, large-diameter woody fuels can increase prescribed fire intensity, causing soil damage and residual tree mortality. Masticating slash material onsite before burning leads to a more continuous fuel arrangement that may also promote fuel consumption.

A study published in the *Journal of Sustainable Forestry* by scientists from the University of Nevada, Reno evaluated the effects of cut-to-length harvesting with slash chipping on dead and downed surface fuels in a mixed conifer stand in California's Lake Tahoe Basin. Fuel loads in an untreated control site were compared to loads in sites treated with prescribed fire only, thinning with slash mastication, and thinning with slash mastication plus prescribed fire.

The total post-treatment fuel load and the combined load of 1- and 10-hour fuels was lowest for treatments that included prescribed fire, and highest where mechanical treatment was not followed by burning. Fuel loads in the untreated site were intermediate between those of the burned and unburned sites.

Management Implications

- While forest thinning to reduce fire hazard contributes activity fuel to the surface fuel bed, slash chipping can boost fuel consumption during prescribed burning enough to offset additions from harvesting.
- In fact, prescribed burning in conjunction with thinning and slash mastication may achieve greater surface fuel reductions than burning in the absence of mechanical treatment.

Cut-to-length harvesting can greatly increase loading of large-diameter fuels (e.g. by 350% in Walker et al. 2006). Since many 1000-hr fuels in the present study were masticated, the increase in total fuel loads was restricted to the 1-, 10-, and 100-hr timelag categories. While thinning with slash chipping increased the total fuel load by 6% and fuel bed depth by 14%, applying prescribed fire after chipping removed the harvest-generated increase in fuel load as well as a significant portion of pre-existing fuels (26 t acre⁻¹).

When chipping preceded burning, the net reduction in fuel load was nearly doubled relative to burning in the unthinned stand. Thinning activities and chipping of woody fuels together increase both the quantity and continuity of small-diameter surface fuels, and likely promoted greater fuel consumption during burning.

This study also developed predictive relationships between stand characteristics and fuel loads. For example, both total fuel load and loading of combined 1- and 10-hr fuels were positively associated with pretreatment basal area. With respect to effect of treatment on fuels, the number of trees removed during thinning was a significant predictor of the net increase in surface fuel load.

Suggestions for further reading:

Agee, JK, Lolley, M.R. (2006). Thinning and prescribed fire effects on fuels and potential fire behavior in an eastern Cascade forest, Washington, USA. *Fire Ecology* 2(2), 3-19.

Battaglia, MA, Rocca, ME, Rhoades, CC, Ryan, MG (2010). Surface fuel loadings within mulching treatments in Colorado coniferous forests. *Forest Ecology and Management*, 260 (9), 1557-1566.
<http://www.treearch.fs.fed.us/pubs/37453>

Fecko, RM, Walker, RF, Frederick, WB, Miller, WW, Johnson, DW (2008). Effects of mechanized thinning and prescription fire on stand structure, live crown, and mortality in Jeffrey pine. *Journal of Sustainable Forestry*, 26(4), 241-283.

Stephens, SL, Moghaddas, JJ (2005). Experimental fuel treatment impacts on forest structure, potential fire behavior, and predicted tree mortality in a mixed conifer forest. *Forest Ecology and Management*, 215, 21-36.
<http://firecenter.berkeley.edu/docs/StephensMoghFFSfirebehavior.pdf>

Walker, RF, Fecko, RM, Frederick, WB, Murphy, JD, Johnson, DW, & Miller, WW (2006). Thinning and prescribed fire effects on forest floor fuels in the east side Sierra Nevada pine type. *Journal of Sustainable Forestry*, 23(2), 99-115.