



## Research Brief for Resource Managers

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### Costs of alternative fuel reduction treatments

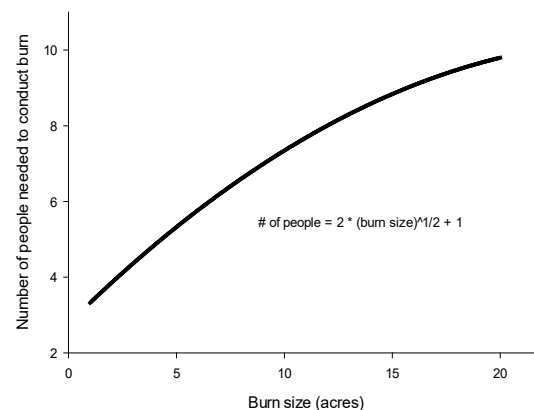
Hartsough, B.R., Abrams, S., Barbour, R.J., Drews, E.S., McIver, J.D., Moghaddas, J.J., Schwilk, D.W., Stephens, S.L. 2008. *The economics of alternative fuel reduction treatments in western United States dry forests: Financial and policy implications from the National Fire and Fire Surrogate Study. Forest policy and Economics 10: 344-354. DOI: 10.1016/j.forpol.2008.02.001*

This study compares the costs of prescribed fire and thinning treatments while putting treatment costs in the context of treatment effectiveness. The researchers used cost information from the National Fire and Fire Surrogate (FFS) Study, which provides data from different forest types across the country. The treatments compared included controls (no treatment), prescribed fire alone, mechanical (mastication and thinning harvests), and mechanical + prescribed fire.

Generally, it was more expensive to conduct mechanical treatments compared to conducting prescribed fires when only considering the costs of treatments. This can be counter-intuitive since prescribed fires generally have lots of people working on them, while a mechanical treatment such as mastication may only have one or two people. Prescribed fires, however, can be much more efficient in terms of acres treated per day since, once a fire is broadcasting, it passively does much of the work on its own. Further, burns improve faster than mechanical treatments in their cost efficiency when increasing treatment area because additional burn acres can be added while adding relatively fewer people. See the Figure 1 for an example.

#### Management Implications

- In mature forests, revenue from thinning treatments designed to reduce fire severity can be a significant factor in covering costs of fuel treatment programs
- While prescribed fire is cheap relative to mechanical surrogates, it does not produce revenue.
- Prescribed fire can be effective in reducing wildfire severity without any pre-treatment preparation of forest structure, even in very dense stands. But economically, it may be advantageous to use it as a low-cost maintenance treatment that follows revenue-generating mechanical treatments



**Figure 1.** Data from burns done at Blodgett Forest Research Station reflect a relationship between burn size and the number of people conducting the burn as non-linear, where increasing total burn area decreases the effort in terms of number of people per acre burned.

Importantly, the mechanical treatments in this study typically resulted in revenues which changed the financial rankings of treatments dramatically compared to just considering treatment costs alone. The study locations were in forest types that were productive enough to support commercial thins as part of the fuel treatments. In other words, even though smaller trees were selected for removal during thins, many of them were still large enough to produce sawlogs. When accounting for this “product recovery,” then mechanical treatments end up being more favorable financially. At many sites, the revenue from mechanical treatments was enough to cover all of the costs of prescribed fires and resulted in net income. When revenues from the treatment were possible, then the cheapest treatment was the mechanical only treatment, which did not involve fire at all. The next cheapest treatment was the mechanical + burn treatment, followed by the control and then burn only treatment. The fact that this study applies to working forests that have potential to produce forest products is an important caveat. For forests without commercial species or low-productivity forests, prescribed fire would likely remain the cheaper option.

While all treatments except controls showed effectiveness in lowering fire severity, those that did include the use of fire were more effective in the short term. This is because mechanical treatments typically do not reduce surface fuels, and often increase surface fuels. Although not reported in this paper, follow up studies of the longevity of fuel treatments have suggested that the mechanical treatment aged well, meaning that fire hazard decreased with time since treatment as the surface fuels decomposed. The treatment that was especially effective immediately following treatments, while also producing revenue, was the mechanical + burn treatment. This conducted a mechanical thinning that made money and followed it with a prescribed burn, the costs of which were covered with revenue from the initial mechanical treatment.

An important consideration that the authors point out is that revenue for landowners can be highly variable depending on treatment location and treatment year. Mechanical treatments may have net costs or net revenue depending on the type harvested material and its market value, which can

fluctuate widely from year to year. Also important is the fact that the type of mechanical treatment influences follow-up prescribed burning costs when taking a mechanical + burn approach. For example, “felling to waste” (cutting and leaving trees to decompose) generated high surface fuel loads which made prescribed burns more difficult. And mastication treatment created high fireline intensities which made holding of prescribed fires more difficult when burning during dry conditions. Whole tree yarding or lopping and piling of the material, on the other hand, reduced prescribed burning costs. Whole tree yarding, which removes entire lengths of trees, can be an especially effective mechanical treatment.

Another important consideration related to the applicability of these results for managers is that the goal of the FFS fuel treatments was to reduce the severity of wildfire behavior, rather than mimic historical pre-settlement conditions or trying to achieve some concept of resilience. In other words, the treatments were focused on specific, measurable objectives. The objective was to create stand structures that were modeled to reduce fire severity to the extent that 80% of the dominant and co-dominant trees would survive a wildfire under the 80<sup>th</sup> percentile fire weather conditions. In reality many of the fuel reduction treatments achieved a much higher standard, approaching 80% survival of dominant and co-dominant trees in a 90<sup>th</sup> or 97.5<sup>th</sup> percentile fire. Hence these results are applicable for managers who would like to be fairly certain that treated stands will be able to have good survival even during extreme fire weather conditions.

**Further reading:**

Stephens, C.W. and R.A. York. 2017. An evaluation of stand age as a factor of mastication efficiency and effectiveness in the Central Sierra Nevada, CA. *Northwest Science* 91(4): 389-298.  
<http://www.bioone.org/doi/full/10.3955/046.091.0408>

Stephens, S.L., B.M. Collins, and G. Roller. 2012. Fuel treatment longevity in a Sierra Nevada mixed conifer forest. *Forest Ecology and Management* 285: 204-212.  
<http://dx.doi.org/10.1016/j.foreco.2012.08.030>