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Fuels Planning: Science Synthesis and Integration

Forest Structure and Fire Hazard Fact Sheet: 4 Role of Silviculture in Fuel Treatments



Pacific Northwest
Research Station



North Central
Research Station

*Synthesizing
Scientific Information
for Fire and Fuels
Project Managers*

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Fuels planning: Science synthesis and integration, an interagency research/management partnership to support the Ten-Year Fire Plan, led by Russell T. Graham, RMRS, and Sarah M. McCaffrey, NCRS.

What Is a Fuel Treatment?

A fuel treatment is any management operation implemented to reduce forest fuel accumulation. The principal goals of fuel treatments are to reduce fireline intensities, reduce the potential for crown fires, improve opportunities for successful fire suppression, and improve forest resilience to forest fires. Fuel treatments typically target canopy, ladder, and surface fuels to modify vegetation in each stratum. Thinning and prescribed fire target different components of the fuelbed of a given forest stand or landscape.

Types of Fuel Treatments

Thinning—Thinning is a common silvicultural practice implemented to reduce canopy and ladder fuels. Canopy and ladder fuels are modified by thinning operations that target stem density, stand basal area, canopy base height, or canopy bulk density. There are many types of thinning operations. However, thinning from below (or “low thinning”) is the most common type of thinning used for reducing fire hazard. Thinning from below removes intermediate and suppressed trees from the lower crown strata. This thinning type can be effective at reducing the probability of crown initiation and fire spread and is precise in that manager-designated trees are targeted and removed from the fuelbed. A sample prescription would be to remove all trees under 9 inches in diameter.

Surface Fuel Treatments—Surface fuels, such as woody fuels and litter created from falling branches and thinning operations, can be modified by prescribed fire or other fuel treatments such as pile-and-burn, lop-and-scatter, or crushing and chopping (mastication). The most common operation used to reduce surface fuel loads is prescribed burning. Prescribed burns affect potential fire behavior by reducing surface fuel continuity and loadings, thereby reducing fireline intensity and the likelihood of crown fire initiation. Prescribed fires may also raise live crown base height of a stand by scorching the lower branches of individual trees.

The type and sequence of fuel treatments depend on the amount of surface fuel present; the density of understory and mid-canopy trees; the long-term potential effects of fuel treatments on vegetation, soils, and wildlife; and short-term potential effects of smoke production. In forests that have not experienced fire for many decades, multiple fuel treatments are often required. Thinning followed by prescribed burning reduces canopy, ladder, and surface fuels, including fuels that are created by the thinning operation itself. Given current accumulations of fuels in some stands, multiple prescribed fires as the sole treatment or in combination with thinning may be needed initially, followed by long-term maintenance burning or other fuel reduction techniques to reduce crown fire hazard.



Forest stand before treatment.



After thinning and prescribed fire.



After thinning from below.

Fuel Treatment Challenges

Fuel treatments are most effective in areas that do not have steep slopes, are not typically subjected to extreme winds, and are accessible by firefighting equipment and personnel. A lack of accessibility may limit the possibility of fuel treatment in wilderness and other roadless areas. Areas with steep slopes are also difficult to treat because of the increased challenges and costs of thinning (removing logs and surface fuels), and the increased risk of escaped fire due to the interaction of slope and fire behavior. The presence of threatened or endangered species may also preclude some types of fuel treatments.

Potential secondary effects may also pose management challenges. Prescribed fires may kill individual trees and clumps of trees, which may increase long-term fuel loads. Prescribed fires also create smoke, which decreases air quality in local communities, and chars trees, which creates a potentially undesirable aesthetic loss for some locations with high visitor use. When making decisions, these potential negative outcomes must be weighed against the potential long-term benefits of fuel treatments for restoring fire in Western ecosystems.

Forest Structure and Fire Hazard Fact Sheets

Look for other fact sheet topics from the Forest Structure and Fire Hazard Team with information about fire hazard, visualization, silviculture, uncertainty, and larger scale treatments.

Fuels Planning: Synthesis and Integration

This fact sheet is one in a series being produced as part of a larger project supported by the USDA Forest Service to synthesize new knowledge and information relevant to fire and fuels management. Fact sheets address topics related to stand structure, environmental impacts, economics, and human responses to these factors. Information in the fact sheets is targeted for the dry forests of the Inland West, but is often applicable across broad regions of the country. For more information, please visit our Web site at: www.fs.fed.us/fire/tech_transfer/synthesis/synthesis_index

The Fuels Planning fact sheets are based on preliminary findings. Information from fact sheets will be synthesized in an upcoming publication.