A Comprehensive Guide to Fuel Management Practices for Dry Mixed Conifer Forests in the Northwestern United States

United States Department of Agriculture
Forest Service
Rocky Mountain Research Station
Research Note
RMRS-RN-61
April 2014

Mechanical, Chemical, and Biological Fuel Treatment Methods

Several mechanical approaches to managing vegetation fuels hold promise when applied to the dry mixed conifer forests in the western United States. These are most useful to treat surface, ladder, and crown fuels. There are a variety of techniques to remove or alter all kinds of plant biomass (live, dead, or decomposed) that affect forest resilience. It is important for managers to understand when (e.g., relative to stage of succession or time of year) and where (e.g., with respect to forest type or proximity to values at risk) each technique will best accomplish management objectives. This summary addresses three fuel treatment approaches: mechanical, herbicides, and targeted grazing.

Mechanical

Mechanical removal or alteration of biomass, the most commonly deployed fuel treatment approach, may raise the canopy base height, reduce surface fuel loadings, or create separation among overstory crowns.

Removing Biomass: Benefits of removal include better managerial control to accomplish objectives related to tree spacing and species composition, avoidance of negative impacts on air quality, and reduced damage to soils and trees in the residual stand. Removal can also produce revenue generating forest products such as saw logs and fuel wood. Integrated harvesting systems, where recovery of roundwood and biomass occurs as part of the same operation, are now quite commonly associated with fuel reduction. Revenue from products can help offset expenses of treatments in other stands that lack revenue-generating potential. Unmerchantable woody biomass can be removed without recovery of saw logs, using fuels reduction treatments with ground-based skidders, skyline yarding, or helicopter yarding. Helicopter yarding may be considered desirable for environmentally sensitive areas where road access is limited and timing is critical; however, its substantial costs are a major limitation that make helicopter yarding rarely feasible for small treatment areas.

Retention and Rearranging Biomass: Woody biomass rearrangement and retention can be attractive when optimal equipment is available to masticate (grind and shred) the harvested material or when hand thinning (lop and scatter) is feasible (for example, due to availability of low-cost labor) and soil nutrient retention is a consideration. Mastication is an alternative treatment when the treatment area cannot be burned, removal of excessive fuels is not economically feasible, or potential negative impacts of disturbance on soil integrity or sediment production are paramount. Hand thinning can be the best choice when it is impractical to remove excessive fuels (trees and shrubs) due to poor markets, inadequate road access or slopes that are too steep to allow mastication machinery.

A systematic approach can be helpful in identifying the equipment that best matches the requirements and constraints of a fuel treatment task. Jain and others (2012) provide one such approach via a comprehensive flow chart that identifies potentially appropriate mechanical treatments (figure 1). Optimal equipment selection is challenging because several considerations are involved: requirements of and objectives for the treatments, working conditions under which treatment operations will be implemented, and efficient use of a limited budget, and any one of these may be critical to the point that it trumps the others.

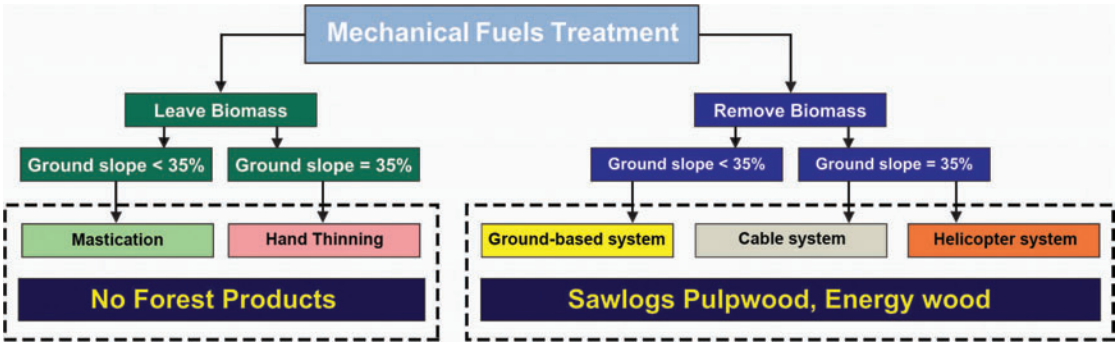

Figure 1—An overview of mechanical fuels treatment options as a function of slope.

Herbicides

Fast growing vegetation that requires frequent re-treatment and presence of aggressively invasive plant species are two situations in which herbicides are a compelling and practical alternative. Implementation success of an herbicide approach depends on several aspects at the planning stage, including accessibility (e.g., slopes), soil type, effectiveness of contemplated herbicides on the target vegetation, and treatment cost. Because herbicidal conversion of live biomass to dead does not constitute immediate removal, planners must consider that a short to medium term result may be an increased likelihood of unwanted fire outcomes. However, combining herbicidal treatment with prescribed fire or other forms of biomass removal may achieve better results and still cost less than mechanical treatment alone. Herbicide applications may also be the best option in areas where there is insufficient recoverable product and energy value to offset the significant expense of implementing mechanical treatment.

Targeted Grazing

Targeted grazing by goats, sheep, cattle, and horses is an effective biological option for treating surface fuels under some conditions. Feasibility depends on availability of livestock appropriate for the vegetation that needs to be reduced, availability of qualified personnel with expertise in herding and managing livestock, and timing of livestock and personnel availability that coincide with the phonological stage at which the target plants are most conducive to control. Patience and commitment are required because it can take as long as 3 years of targeted grazing before fuel reduction accomplishment is significant enough to be noticed. As with any fuel treatment method, a successful target grazing prescription requires substantial preparation and knowledgeable planners with experience using this technique.

Figure 2—There are several options for treating understory vegetation, including biological means through targeted grazing; goats can be used to graze on palatable shrubs. The photograph was taken by Scott Bauer, USDA Agricultural Research Service (photograph online at bugwood.org).

Source

Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2012. A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States. Chapter 8. Gen. Tech. Rep. RMRS-GTR-292. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 331 p. Available online at www.treesearch.fs.fed.us/pubs/42150 [2012]. For a hard copy, contact Theresa Jain at tjain@fs.fed.us.

Citation

Jain, Theresa B.; Battaglia, Mike A.; Han, Han-Sup; Graham, Russell T.; Keyes, Christopher R.; Fried, Jeremy S.; Sandquist, Jonathan E. 2014. **A comprehensive guide to fuel management practices for dry mixed conifer forests in the northwestern United States:** Mechanical, chemical, and biological fuel treatment methods. Res. Note RMRS-RN-61. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 2 p.