Reducing Hazardous Fuels on Woodland Properties:

MECHANICAL FUELS REDUCTION

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Introduction

A wide range of manual and mechanical methods are used to reduce hazardous fuels on woodland properties. This publication describes three of the most common mechanical fuels treatments:

- Slashbusting
- Mowing & Mastication
- Crushing

Chipping and mechanical slash piling, two other mechanical treatments, are described in a companion publication, **"Reducing Hazardous Fuels on Woodland Properties: Disposing of Woody Material."**

Figure 1. Slashbuster equipped with rotating head.

Mechanical fuels treatments utilize several different types of equipment to chop, chip, crush, or otherwise break apart fuels such as brush, small trees, and slash into small pieces or chips. The processed fuels carpet the ground, forming a relatively dense, compact layer of woody material. Compared to more loosely arranged fuels, the available oxygen supply in this dense fuel bed is reduced. The material is left to decompose, or may be burned or removed from the site.

Mechanical treatments reduce the potential for destructive fires by: 1) reducing ladder fuels and creating a gap between surface fuels and crown fuels; and 2) reducing the oxygen supply to fuels, thus reducing the potential for ignition and fire spread. Mechanical fuels reduction may be used as a stand-alone treatment or to "step down" fuels prior to prescribed burning.

Mechanical fuels reduction equipment generally consists of a "cutting attachment" and a "prime mover." The cutting attachment comes in a variety of forms. Common types include a vertically-mounted rotating head (e.g., the "slashbuster") and a horizontally-mounted cutting drum (e.g., the "brush mulcher"). The prime mover is simply the vehicle that moves the cutting head across the ground, such as an excavator, all-surface vehicle (ASV), or 4-wheel drive tractor. The cutting head may be integral to the prime mover or may be attached with an articulating arm.

Slashbusting/Grinding

The "Slashbuster" *(figure 1)* is a vertically-mounted rotating head or saw blade. The head is typically attached to an articulated arm on an excavator (tracked machine). The Slashbuster's teeth shatter and chop standing fuels into small pieces, creating a dense fuel bed a few inches in depth *(figure 2)*. The largest slashbuster implements are able to handle standing material up to 18" in diameter, though smaller material is more commonly treated. Slashbuster

Figure 2. (left) Variable-sized woody material produced by Slashbuster

Figure 3. (below) Stand thinned by Slashbuster, SW Oregon

implements are available in various sizes to go with a range of excavator sizes, vegetation types and sizes, and terrain. The articulating arm allows slashbusters to process material that is higher off the ground than horizontal-shaft machines, literally grinding standing trees down to stumps. The arm also allows thinning of selected vegetation and trees without damaging adjacent desirable vegetation. Slashbusters are usually limited to 35% slopes. Some excavator-slashbusters have self-leveling cabs, permitting work on steeper terrain.

Slashbusters have been used extensively in SW Oregon for brushfield and oak woodland treatments. They are increasingly used as well for thinning non-commercial sized material trees in mixed stands *(figure 3)*.

Mastication/Mowing

A wide variety of brush-cutting and mowing equipment is available. As with the slashbuster, the material is processed in place into small chunks or chips that lie on the ground surface leaving a relatively light to dense fuelbed depending on the amount of material processed.

Figure 5. Close-up of "Mulched" fuel bed.

The cutting head is usually horizontally-mounted and may be an integral part of the prime mover, or an attachment that is either pulled behind or mounted in front. For example, the "Brush mulcher" *(figure 4)* is a small, tracked machine with a forward-mounted cutting drum. This device walks over brush and small trees (up to 4" diameter) and shreds them up, forming a "mulch" layer *(figure 5)*.

Mowing has been used extensively in central Oregon to treat highly flammable bitterbrush in areas around subdivisions where prescribed burning would be dangerous or socially unacceptable. The mower is a heavy duty brush cutter attached to a tracked machine or 4-wheel drive tractor. *(figures 6 and 7 next page)*.

Figure 4. Brush mulcher treating manzanita and wedgeleaf ceaothus brushfield, SW Oregon. Cutting head is mounted on "Bobcat." Efficiently cuts material up to 4" diameter.

Figure 6. (Below Left) Poderosa Pine forest with bitterbrush understory, recently mowed.

Figure 7. (Below Right) Close-up of mower.

Crushing

This treatment involves use of heavy equipment such as a bulldozer to travel over and crush the fuel bed. Commonly used in brushfields, this method is most effective with relatively brittle brush species, such as manzanita, and/or dead material. It is sometimes followed by prescribed burning. The primary effect of crushing is to compact, and reduce the depth of the fuel layer, to reduce fire intensity and slow fire spread.

Table 1. Summary of Mechanical Fuels Reduction Options.

Considerations	Slashbusting/Grinding	Mowing/Mastication	Crushing
Objective & effectiveness	Reduce and remove fuels, particularly ladder fuels. Can be very effective.	Reduce and remove fuels, particularly ladder fuels. Can be very effective.	Not as effective as at grinding or mastication.
Other treatment required?	Generally, no. May be followed by prescribed burning, though this is seldom practical on small private woodlands.	Generally, no. May be followed by prescribed burning, though this is seldom practical on small private woodlands.	May be followed by prescribed burning, though this is seldom practical on small private woodlands.
Near home?	Generally, no. Large chunks of wood and sometimes rocks are flung out long distances; a possible safety hazard. Could be done, though, beyond 100 feet from home to reduce fuels.	Maybe, with smaller-scale equipment. Less potential to "throw" material.	No
Riparian zone?	No	No	No
Slope	<35%	<35%	<35%
Contract Cost Range/Acre	$250-$450	$30-$450	$50-$70/hour
Advantages	Relatively low cost. Very effective for some vegetation types. Treated fuels are generally not at risk of beetle infestation due to their small piece size.	Relatively low cost. Very effective for some vegetation types. Treated fuels are generally not at risk of beetle infestation due to their small piece size.	Low cost Easy to implement
Disadvantages	High move in costs. Possible soil compaction; may spread weeds and damage leave trees.	Possible soil compaction; may spread weeds and damage leave trees.	Less effective. Possible soil compaction. Not suitable for green vegetation or larger material.

Mechanical Fuels Reduction Considerations

Move-in costs & parcel size

Mechanical fuels reduction costs range from $30 to $450 per acre, depending on the method and equipment used, terrain, vegetation type and density, the size of job, and other factors. In general, mechanical fuels treatments are cheaper than manual treatments on a per acre basis. However, mechanical fuels reduction entails move-in costs, that is, the expense of moving equipment to the site and setting up. For larger, more costly equipment, such as slashbusters, these expenses may be significant. As a result, mechanical treatments on individual small parcels may not be economically feasible. However, if owners of multiple small parcels join together to create a single job, move-in costs can be reduced by spreading them over a larger number of acres.

Site Impacts

Mechanical fuels reduction treatments have potential to compact soils. Operating when soils are dry, matching the size of equipment to the size and type of vegetation, and making one pass over the material to be treated will help minimize compaction problems. Many of the tracked vehicles are heavy but have low ground pressure due to the wide treads.

A significant issue on many sites is the potential to spread noxious weeds. Tracked vehicles may "capture" weeds seeds in their treads or on small pieces of soil and spread them to other sites. Thoroughly washing equipment between jobs will help minimize this problem.

Figure 8. Since brush and other vegetation may regrow rapidly following an initial mechanical fuels treatment, maintenance treatments are often necessary.

A potential advantage of mechanical fuels treatments is that the heavy surface organic layer shades the ground and reduces weed germination. Other fuels treatments such as mechanical piling and burning that expose mineral soil may result in more weed problems.

The presence of a dense surface layer of woody material may also inhibit the germination and growth of desirable grasses and forbs.

The long term effect on soils of mechanically treating fuels and leaving a dense surface layer of woody material is not well understood. If the material is left on site, it will gradually decompose into the duff layer. The rate of decomposition depends primarily on soil moisture and temperature. On dry sites, experience suggests that slash decomposes very slowly, sometimes over a decade or more.

Potential positive effects on soils include 1) retention of organic matter on site; 2) reductions in soil erosion by leaving a surface organic layer; and 3) increase in soil moisture retention by shading the soil surface. Potential negative effects are unknown but may include leaching of chemicals from the woody material into the topsoil and subsequent effects on soil biota; and tie-up of soil nitrogen due to the high carbon:nitrogen ratio of woody debris. The limited research done on the effects of chipping on soil nitrogen suggests the latter may not be an issue.

Maintenance

Mechanical fuels treatments affect only the above-ground portion of the vegetation. When cut, many brush and hardwood tree species re-sprout vigorously from root crowns and rhizomes. Other species, such as manzanita, have seeds that remain viable in the soil for many years, even decades, and which germinate readily on when soils are disturbed. Thus, while mechanical treatments reduce hazardous fuels, in most cases this effect is temporary. Follow up treatments will be needed to maintain the desired effects (*figure 8*).

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