REDUCING HAZARDOUS FUELS ON WOODLAND PROPERTY

M. Bennett and S. Fitzgerald

EC 1575-E • August 2008

Mechanical Treatments

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

- Slashbusting and grinding
- Mowing and mastication
- Crushing

Mechanical methods use several 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. The material then is left to decompose or is burned.

Figure 1. Slashbuster equipped with rotating head. Photo: Ed Reilly, Bureau of Land Management.

Figure 2. Woody material of varying sizes, produced by a Slashbuster-type machine.

Mechanical treatments can reduce the potential for destructive crown fires by:

- Reducing "ladder" fuels, due to the gap created between surface fuels and crown fuels
- Reducing the oxygen supply to fuels, thus reducing the potential for ignition and fire spread

Mechanical fuels reduction may be used either as a stand-alone treatment or to "step down" fuels before prescribed burning.

Mechanical fuels reduction equipment generally consists of a cutting attachment and a prime mover. The cutting attachment comes in various forms. Common types include a vertically mounted rotating "cutting" 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, an all-surface vehicle (ASV), or a four-wheel-drive tractor. The cutting head may be integral to the prime mover or may be attached with an articulating arm.

Two other mechanical treatments, mechanically piling slash and chipping, are described in *Reducing Hazardous Fuels on Woodland Property: Disposing of Woody Material* (EC 1574-E).

Slashbusting and grinding

The Slashbuster-type machine (Figure 1) has a vertically mounted rotating head with metal teeth or sawblade. The head typically is attached to an articulated arm on an excavator (a tracked machine). The Slashbuster's teeth shatter and chop standing or horizontal fuels into small pieces, creating a dense fuel bed a few inches deep (Figure 2). The largest Slashbuster implements can handle standing material up to 18 inches in diameter, though smaller material is treated more commonly. Slashbuster implements are available in various sizes to go with a range of excavator sizes, vegetation types and sizes, and terrain. The

Max Bennett, Extension forester, Jackson and Josephine counties; and Stephen Fitzgerald, Extension silviculture and wildland fire education specialist, Deschutes County; both of Oregon State University.

Oregon State University | Extension Service

Figure 3. Southwest Oregon stand thinned by Slashbuster.

articulating arm allows Slashbusters to process material that is higher off the ground than horizontal-shaft machines can handle; it can grind standing trees down to stumps. The arm also allows thinning of selected vegetation and trees without damaging adjacent, desirable vegetation. Slashbusters usually are limited to slopes of 35 percent or less; however, some excavators / Slashbusters have self-leveling cabs, permitting work on steeper terrain.

Slashbusters have been used extensively in southwest Oregon for brushfield and oak woodland treatments. They are used increasingly to thin precommercial-size trees in mixed stands (Figure 3).

Figure 4. Brush Mulcher treating manzanita and wedgeleaf ceanothus brushfield in southwest Oregon. The cutting head, here mounted on a Bobcat-type tracked vehicle, efficiently cuts material up to 4 inches in diameter. Photo: Paul Howell.

Mowing and mastication

A wide variety of brush-cutting and mowing equipment is available. Like the Slashbuster, these machines process material into small chunks or chips that make a dense or relatively light fuel bed, depending on the amount of material processed. The cutting head usually is mounted horizontally; it may be an integral part of the prime mover, or may be an attachment that either is 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 moves over brush and small trees (up to 3-inch diameters) and shreds them, forming a mulch layer (Figure 5).

Mowing (Figures 6 and 7) has been used extensively in central Oregon to treat highly flammable bitterbrush around subdivisions, where prescribed burning would be dangerous or would create unacceptable smoke. The mower is a heavy-duty brush cutter attached to a tracked machine or four-wheel-drive tractor.

Crushing

This treatment uses 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 with dead material. Crushing sometimes is followed by prescribed burning. The primary effect of crushing is to compact the fuel layer, which in case of fire would slow its rate of spread.

Figure 5. Close-up of mulch fuel bed.

Considerations in using mechanical fuels reduction

Move-in costs and parcel size

Costs of mechanical fuels reduction range from $40 to $600 per acre or more, depending on the method and equipment used, terrain, vegetation type and density, and the amount of acreage to be treated (Table 1, page 4). Mechanical fuels treatments often are cheaper, per acre, than manual treatments. However, the expense of moving equipment to the site and setting it up may be significant, especially for larger, more costly equipment such as Slashbusters. As a result, mechanical treatments on individual small parcels may not be economically feasible. If owners of multiple small parcels join together to create a single job, move-in costs can be spread over a larger number of acres.

Site impacts

Slashbusting and other mastication treatments are relatively new and not well studied. There is evidence that, while these treatments can decrease the potential for crown fire, they may increase *surface* fire intensity in the short term, due to the greater surface fuel load. Especially when the masticated fuel bed is deep and soils are dry, surface fires may result in high temperatures that damage soils as well as the trees and shrubs left on the site.

Another concern is that machinery can compact soils. Many tracked vehicles are heavy but have low ground pressure due to their wide treads. To help minimize compaction problems, operate equipment when soils are dry, match the size of equipment to the size and type of vegetation, and make one pass over the material to be treated.

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

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, which expose mineral soil, may result in more weed problems. On the other hand, a dense surface layer of woody material may inhibit the germination and growth of desirable grasses and forbs, as well as of weeds.

Figure 6 (above). Ponderosa pine forest with bitterbrush understory, recently mowed.

Figure 7 (below). A closer view of the mower.

Potentially beneficial effects on soils include:

- Retaining organic matter on site
- Reducing soil erosion by leaving organic material on the surface
- Increasing moisture retained in the soil by shading the soil surface

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 decompose gradually 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. Adding a dense layer of woody material to the forest floor is unlikely to tie up soil nitrogen unless the material is thoroughly mixed into the soil.

Maintenance

Mechanical fuels treatments affect only the aboveground portion of the vegetation. When

cut, many brush and hardwood tree species resprout vigorously from root crowns and rhizomes. Other species, such as manzanita and ceanothus, have seeds that remain viable in the soil for many years, even decades, and that germinate readily when soils are disturbed. Thus, while mechanical treatments reduce hazardous fuels, in most cases the effect is temporary (e.g., 5 to 15 years). Follow-up treatments will be needed to maintain the desired effects.

Table 1.—Summary of mechanical fuel-reduction options.

Considerations	Option		
	Slashbusting and grinding	**Mowing and mastication**	**Crushing**
Objective and effectiveness	Reduce fuels, particularly ladder fuels. Can be very effective.	Reduce and remove fuels, particularly ladder fuels. Can be very effective.	Not as effective as grinding or mastication.
Other treatment required?	Generally, no. May be followed by prescribed burning, though this seldom is 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 seldom is practical on small, private woodlands.
Use near home?	Generally, no. Large chunks of wood and sometimes rocks are flung out long distances, a safety hazard. Beyond 100 ft from home, though, this could be practical.	Maybe, with smaller equipment that is less likely to throw material.	No
Use in riparian zone?	No	No	No
Slope	Less than 35%	Less than 35%	Less than 35%
Contract cost range	$250–$600+/acre	$40–$600+/acre	$50–$70/hour
Advantages	• Relatively low cost. • Very effective for some vegetation types such as brushfields. • Treated fuels generally not at risk of beetle infestation, because pieces are small.	• Relatively low cost. • Very effective for some vegetation types • Treated fuels generally not at risk of beetle infestation, because pieces are small.	• 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.

Published August 2008.