

## **APPENDIX D**

### **FUEL TREATMENT TECHNIQUES**

## APPENDIX D:

### FUEL TREATMENT TECHNIQUES

This appendix provides a detailed discussion of the following fuel treatment methods and techniques:

- Hand Labor;
- Mechanical Treatment;
- Chemical Treatment and;
- Grazing.

#### 1. Hand Labor Techniques

Hand labor techniques vary significantly and can include pulling weeds and shrubs from the under-story, cutting saplings and chaparral, removing ladder fuels, and conducting mosaic thinning (which entails the removal of fuels within specific physical spaces to inhibit wildfires from torching trees). More common hand labor techniques to manage fuel loads are described below.

##### **Weed Whipping**

This technique uses a hand-held tool (normally gas-powered) that cuts grass and very small shrubs with a plastic line or cutting blade. Weed whipping is typically used annually after grasses have dried or cured so that the grass does not grow back. This technique reduces the height of the fuel, but does not create areas of bare soil, as the vegetation is not completely removed. However, while most large woody stems are not cut by the treatment (which limits its application on vines such as vinca, ivy, and Himalayan blackberry) seedlings can be severely damaged by the cutting line. Weed whipping is often the only type of "mowing" treatment possible in steep wooded areas or landscaped slopes. Heavier weed-whipping machines can be fitted with plastic or steel knives or serrated saw blades, such as brush cutters or brush saws. Utilizing a cutting blade enables the mulching of cuttings in a single process and allows treatment of woody stems, but this option is limited to pieces under 1 inch diameter in size.

##### **Brush Removal**

Hand labor can also involve the use of chainsaws and other instruments to masticate or remove brush and break apart brittle materials that can act as ladder fuels. Fallen branches and material cut from brush can then be further broken into compact mulch and distributed across the site or removed for disposal.

### **Ladder Fuel Reduction**

Ladder fuel reduction entails removing or reducing the amount of under-story shrubs, small trees, and small lower limbs of trees to create a vertical separation (i.e., discontinuity) between surface fuels and the tree canopy overhead. Ladder fuel reduction lowers ignitability, decreases available fuel, decreases the potential for spotting, and reduces heat output from under-story fires, which in turn reduces the potential for fires to move from the ground up to “ladder” fuels and into the tree crown.

### **Thinning**

Thinning dense stands of trees by removal of trees up to 10” dbh is a common hand labor technique. Such thinning is done to improve the health and vigor of the residual stand, including desirable understory components, by reducing inter-tree competition for water, light and nutrients, and to make the stand more resilient to future fires by reducing the quantity and continuity of live and dead fuels that would otherwise contribute to rapid rates of spread, high intensity burning and extreme fire behavior.

Several types of thinning techniques exist to reduce the overall amount of fuels in an area, and can include (among others) low, crown, mechanical, mosaic, and drip-line thinning. Low thinning involves the removal of smaller, less vigorous trees in a stand. Crown thinning removes stems and branches to increase light penetration and air movement throughout the crown of a tree or stand. Mechanical thinning removes a selected number of trees according to a predetermined spacing amount or pattern and is particularly useful prior to harvesting or yarding operations. Mosaic thinning is a hand removal technique for fuel reduction where retained trees are variably distributed throughout the treatment area; rather than removing saplings, shrubs, and grasses evenly across an area. Tree “clumps” are alternately thinned to varying degrees to create a mosaic of plantings.

Drip-line thinning is a technique that involves removing shrubs and smaller trees that exist within the drip lines of overhead trees to prevent torching. In both cases removing smaller trees and shrubs, such as poison oak or coyote bush, is usually done with a hand-held chain saw; trees smaller than 3 inches in diameter may be removed with loppers as well. Because the material removed during these operations typically consists of smaller trees and shrubs that result in larger debris sizes, chipping or offsite hauling is usually required.

### **Mulch Application**

The application of mulch, such as wood chips from pruning operations, can slow the growth of grasses, shrubs, and saplings for up to one full season and acts as an effective temporary fuel reduction method. Mulch at depths of 2 inches or more increases the growth necessary for seedlings to reach the sunlight, thereby suppressing the number of plants that actually reach the surface.

## **2. Mechanical Treatment Techniques**

Mechanical treatments tear or cut vegetation, rearranging the fuel's structure and compacting the debris that is left behind. Specific techniques, such as those described below, can break apart or cut up vegetation into small pieces, tear up and bury the resulting debris, or remove plants entirely and pile the debris for burning or removal.

### **Grading**

This technique is often used to maintain fire trails through wildlands, creating a strip of land absent of fuel. A tractor with an attached blade can effectively produce a firebreak 8 to 12 feet wide with one to two passes of the vehicle. Treatment is usually done in the spring after the ground is fairly dry but before grass is entirely cured (so that a fire cannot occur before the scraping is done).

Removal of all vegetation in the area disturbs water drainage patterns where the side banks of the graded land interrupt cross-slope water travel, and may also accelerate water travel inside the graded lane. The disturbance created by annually graded fire trails can result in excellent establishment sites for weed species, which also should be taken into consideration when considering this technique.

### **Mowing**

Mowing using a tractor or similar equipment with a mower attachment, such as a rotary or flail mower, reduces fuel height which in turn reduces the flame length and possibly the rate of spread in a grass fire. Timing of mowing has an impact on the type of grasses promoted; late mowing after annual grasses have cured enhances growing conditions for perennial native grasses, provided mowing does not occur during seed production. Mowing at the appropriate time to a height of approximately 4 inches minimizes weed and brush encroachment and reduces the amount of manual work needed to maintain the site, but should be avoided when birds are actively ground nesting in the area. Mowing of weeds and native grasses is typically required annually. Mowing may be used in conjunction with other techniques, such as disking, to require a thinner strip of disked area.

### **Mechanical Tree Removal**

Feller-bunchers can be used to harvest or remove trees in a short period of time. The main advantages of using this equipment include a higher production rate, improved safety, reduced residual stand damage due to controlled felling, higher skidding productivity, and lower remaining stump height. Their disadvantages include distinct limits of stem size capability, higher initial capital investment, stability limitations on steep slopes, and limitations on operational areas due to rough terrain, boulders, or dense residual stand spacing. Feller-bunchers may need to be supported by skidders to move trees and materials

to a landing, and by loaders and log trucks to remove trees and other materials from the site.

### **Landings**

For tree or brush removal an area will typically be needed to sort, store, and load materials onto trucks or to chip them into mulch and remove the material. A flat landing area is typically used for yarding operations, temporary stacking, loading, and trucking logs or brush off the treated site. Important considerations for selecting landing sites are size, location, and rehabilitation requirements.

### **Skidding and Yarding**

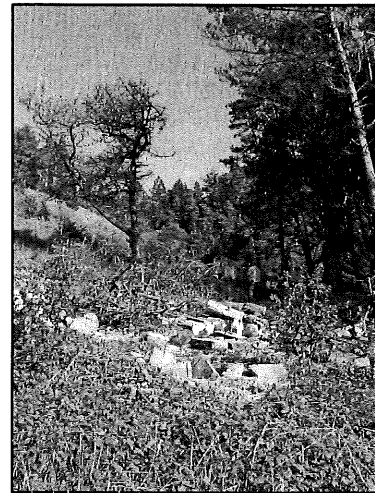
Removal of trees and brush, as well as the slash created from selective thinning and other fuel treatment methods often requires the transport and removal of waste materials from the treatment area. To do so, skidding trails are created that focus the movement of these materials along specified routes in order to minimize the potential for ground disturbance created by dragging and hauling materials to the landing site. Yarding typically includes the removal of larger tree sections, and can be performed using cables, tractors, and other methods to carry or drag these materials to the landing site for further treatment and removal.

### **Mechanical Cutting and Crushing**

A tractor or similar equipment can be used to crush fuel materials using a blade that is kept slightly off the ground. A variety of attachments include rollers (e.g., brush hog), a horizontal cutting blade (which operates similar to a large mower), or a set of chains to flail the material being treated. Grinding machines with an articulated arm to grind off woody material, and in some cases shatter or crush shrub roots, can also be used to reduce the overall size of materials.

### **Chipping or Mulching**

This mechanical technique sometimes is used subsequent to other removal techniques and reduces the size of materials by passing them through a series of high-speed blades. The smaller-sized materials produced may then be removed from the site or redistributed as mulch. Natural compaction of this layer presents a fuel structure that is less likely to ignite. Larger grinders, such as tub grinders, can chip logs up to 24 inches in diameter.



Removal of dead trees

### 3. Chemical Treatment Techniques

Chemicals that prevent seed germination (i.e., pre-emergence chemicals) and kill sprouted plants (post-emergence chemicals) can be used to establish firebreaks and in roadside treatments, or to assist in the restoration of less flammable native vegetation by inhibiting the growth of non-native species. Two primary treatment techniques are used:

- **Cut Stump Application:** To maximize the efficacy of treatment the tree must be cut leaving a stump not more than four (4) inches in height above soil surface and the cut surface of the stump must be treated with an herbicide within minutes of the cut. Garlon 4 Ultra is applied to the exposed cambium (zone of living transport tissue) layer of the tree. The herbicide is translocated to the roots and disrupts the transportation of nutrients and water, causing the plant to die.
- **Basal Bark Application:** This treatment consists of spraying at very low pressure a solution of Garlon 4 Ultra mixed with esterified vegetable oil to the lower 12 to 15 inches of the resprout. This application method permits the operator to selectively treat resprouts without injury to adjacent vegetation, and is particularly effective on resprouts less than 6 inches in diameter.

### 4. Grazing Treatments

Although the concept of grazing is the same regardless of which type of animal is used, how each animal type conducts its grazing varies significantly. As a result, not all animals will be ideally suited for grazing treatments in all areas.

#### Cattle

Using cattle for grazing treatments is appropriate in large grassy areas (typically with a minimum of 100 acres) with a less than 35 percent slope. Cattle do not usually eat shrubby material, and so cannot be used to create fuel reduction zones. They will, however, easily maintain a grassland area. Cattle grazing for commercial production can be cost-effective, and even revenue-generating depending on the use agreement. Existing cattle grazing operations in the East Bay Hills parks are confined to large areas of grasslands and open oak savannas, which are limited to Wildcat Canyon Regional Park, Robert Sibley Volcanic Regional Preserve, and Anthony Chabot Regional Park within the study area. Cattle operations are based on long-standing revenue-generating licenses in accordance with EBRPD's Wildland Management Policies and Guidelines.<sup>1</sup> EBRPD policies require a site-specific grazing management plan and a grazing monitoring program to identify resource and fuel management goals, and to ensure that livestock are removed when management

---

<sup>1</sup> East Bay Regional Park District. 2001. Wildland Management Policies and Guidelines. Oakland CA 27 pp. plus appendices.

goals are met. The grazing management plan should specify management goals, stocking rate and use levels, grazing seasons, monitoring techniques and performance criteria.<sup>1</sup> Stocking rates are determined by a range analysis conducted by EBRPD, which calculates the number of cattle required for a given period to attain the desired use level, typically measured in pounds per acre of residual dry matter (RDM). EBRPD standards for RDM levels generally range between 600 and 1,000 pounds per acre depending on site-specific goals and conditions. The prescribed levels for RDM will be based on site-specific conditions such as the need for increased RDM to suppress weeds, provide habitat, build fuel loads for future prescribed burns, or inhibit erosion.

The availability of alternative pastures on public open space or private property in the vicinity of treatment areas where livestock can be moved following attainment of target use levels is critical to reducing potential adverse impacts. Fencing must be used to prohibit grazing animals from venturing into areas outside the treatment area. However, fencing is typically the major expense in utilizing livestock for fuel management. As a result, ranchers and others supplying grazing animals are typically asked to provide and repair fencing during treatment. Additionally, water sources are required for animals and need to be provided if an insufficient number are available at the treatment site. Exclusion fencing to prevent livestock from gaining access to riparian zones and wetlands may be necessary to prevent degradation of water quality and habitat.

### **Horses**

Grazing with horses is another effective way to reduce fire hazards because they prefer grass and other plant materials that constitute flashy, ignitable fuels during summer months. Horses can be grazed on slopes over 35 percent, making them an ideal complement to cattle grazing, but erosion can be a problem in small acreages where bare dirt is exposed as a result of high hoof traffic. Horses do not usually prefer shrubby material, and so cannot be used to completely clear areas as firebreaks. Horse grazing in areas open to the public may generate user conflicts as well.

### **Sheep**

Sheep will eat both forbs and grasses, will graze steep slopes, and are more likely to eat shrubs than horses or cattle. Their herding instinct allows grazing without the installation and maintenance of permanent fences, but requires that a shepherd and dogs be present. Sheep grazing also requires that drinking water sources be present, which typically are provided through hauled water tanks. A combination of sheep and goats can be a viable option when a mixture of grass and shrubs are present in the area to be treated. EBRPD

---

<sup>1</sup> Ibid.

policy requires that a site-specific grazing management plan be prepared and implemented for sheep grazing treatments.<sup>1</sup>

### Goats

Conversely to cattle and horses, goats prefer to “browse” on woody vegetation (e.g., tree leaves, twigs, vines, and shrubs) and will eat materials up to 6 feet above the ground. This grazing pattern creates a desirable vertical separation between the canopy and ground cover, but is best used in areas with low numbers of plants intended for retention, since goats will indiscriminately damage most plants (the bark of large-diameter trees is typically not affected, however). Goat grazing is also preferable in areas of steep terrain, where other grazing animals are less-suited for the topographic conditions and are therefore less effective in grazing to achieve the desired vegetation management results.



Goat grazing

Portable electric fences are commonly used to help control the herd and the outcome of their grazing. Measures may also be taken to prevent girdling of small trees that can result from the goats browsing on tree bark. A herd of 200-300 goats can graze up to 1 acre per day. Herd movement has the advantage of breaking off dead material in a stand as well as punching a humus layer into the soil (if the ground is somewhat moist) and thereby removing available fuel. EBRPD policy requires that a site-specific grazing management plan be prepared and implemented for goat grazing treatments.<sup>2</sup> This plan should include goals and implementation actions to ensure that timing of grazing treatment is optimal to prevent the spread of seeds from invasive and other targeted species and to maximize fuel reduction. The plan should also provide a range analysis to determine the optimum stocking rate and duration. Monitoring should be conducted by qualified personnel to determine when utilization and fuel load objectives are attained so that grazing animals are removed in a timely manner.

---

<sup>1</sup> Ibid.

<sup>2</sup> Ibid.