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Brush Management-

The Brushland Disk

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INTRODUCTION

Brush management through brush clearing or removal, usually in conjunction with a brush burning program, may involve several types of operations, each of which is best done by particular types of tools. Heavy, brushland disks may be used to knock down or incorporate low stands of material; dozing with the straight blade and brush rake in limited situations may be used to crush, clear, and pile brush; the chain or ball and chain equipment may be used to tear out and crush brush stands. For information on your particular needs, see also:

Brush Management—The Ball and Chain, leaflet 2920.
Brush Management—Modified and Smooth Chains, leaflet 2922.
Brush Management—Straight Dozer Blade and Brush Rake Clearing, leaflet 2923.

The brushland disk is an adaptation of the standard agricultural cultivation implement. Where terrain is not steep and brush volume not high, the brushland disk can be used alone. The tilling action of the disk will crush brush, incorporate it with the soil, and provide a rough seedbed.

Sizes. Brushland disks for use with crawler tractors are available from several manufacturers; size ranges are from 6,000 to 12,000 pounds, 8 to 12 feet wide. Blade diameters vary from 28 to 38 inches. The most commonly used disks are the 9½-foot and 12-foot-2-inch Towner models with 36-inch blades.

Weight determines pulling requirements. A crawler tractor with 125 to 145 net engine horsepower is needed to pull an 8,000- to 9,000-pound disk; 150 to 180 horsepower for a 9,000 to 10,000 pound disk; and 185 to 270 horsepower for a 10,000 to 11,000 pound disk. (Some tractors are rated in drawbar horsepower. This can be calculated as being 75 to 81 percent of rated net engine horsepower.)

Brushland disks have two gangs of blades set in tandem; the gangs can be offset to create a chopping-cutting action as the disk is pulled through the brush. The angle between the gangs can be adjusted automatically while in operation on disks equipped with hydraulic or cable controls. With manual disks it is necessary to stop the tractor, remove certain bolts, move the tractor forward or backward, and then replace the bolts. Hydraulic or cable controls are preferred because the cutting angle can be easily adjusted during operations to meet changing soil and brush conditions.

Some disks are mounted with wheels and rubber tires for highway towing. The wheels rise out of the way, either manually or hydraulically, while the disk is in use. Such equipment should be equipped with multiple-ply, puncture-proof tires.

Large brushland disks are generally quite effective in uprooting, chopping, and mulching brush, even when concentrations are heavy. These disks are especially effective in uprooting root crowns, which can sprout if brush is only cut or broken at the surface. Sprout control has been particularly good using brushland disks in chamise-ceanothus chaparral, where effective disking is more closely related to total implement weight than to blade diameter. Some project managers and equipment operators believe heavy disks, regardless of blade size, are required to dig out roots to control sprouting in brush like chamise.

Disking does not remove top soil, but it stirs and loosens it to a depth of 8 to 16 inches, depending on disk weight and blade size. As a result, rates of water infiltration and percolation in the soil may increase temporarily. Potential erosion must be considered, although little erosion has been observed on freshly disked land.

Brushland disking. Brushland disks have proved effective in light to moderate brush not exceeding 30 tons per acre. The effectiveness depends on disk weight and number of passes through and over the

brush, taking into account brush volume and composition (table 1). Two or more passes usually are required.

Brush should be disked on the contour — not parallel to the slope — or serious erosion can result. Efficient contour disking is limited to slopes of 30 to 35 percent.

When the disk is in its open, working position, it should be turned only to the left because of the severe angle of the gangs. If the disk is turned to the right, the tongue, drawbar and other parts will be stressed and may bend or break. Right turns are not a problem when the disk is closed.

A few scattered stones will not limit disking effectiveness. However, numerous stones will reduce the disk's ability to dig into the soil, decreasing the amount of brush cut and mixed with the soil and the number of root crowns brought to the surface.

The disk can be applied to either moist or dry soils. However, using the disk in wet weather on saturated soil is not recommended — the soil can be moist but not wet. If the tractor bogs down, it is generally too wet to disk.

There is one significant advantage to disking dry soils: dislodged roots and root crowns brought to the surface have less chance of survival. Also, the moisture content of brush is lower in dry weather than during late winter and spring, and the material is more readily broken and mulched.

In general, the disk is considered a tool that is very selective and maneuverable. When scattered large boulders or trees are present, the disk can be worked around these obstacles. Patches of brush and roost trees can be left for wildlife habitat. The perimeter of disked areas can be made irregular or scalloped to enhance "edge," the transition zone between vegetation types, which is so important to wildlife.

Production rates. In southern California disking time in light brush (less than 15 tons per acre) has averaged 0.7 to 1.5 acres per hour using a 9½-foot disk with 36-inch blades. In heavier brush (15 to 30 tons per acre), production has averaged 0.7 to 0.9 acres per hour. In brush exceeding 30 tons per acre, production averaged 0.3 to 0.5 acres per hour. In each case the lowest averages occurred on slopes of 25 to 35 percent, the highest averages on slopes of less than 25 percent.

TABLE 1. BRUSH CLASSIFICATION BY TYPE AND VOLUME

Vegetation type[1]	Vegetation loading[2]		
	Light	Moderate	Heavy
	tons/acre (estimated)		
Light to medium chamise (2.5'-5' high)	—	7-15	16-25
Low brush mixtures including combinations of big sagebrush, California sagebrush, California buckwheat, white sage, black sage, coyote brush, chamise, and sumac (2'-5' high)	—	7-15	16-25
Mixed brush (4'-6' high) and scrub oak	10	11-25	—
Heavy pure chamise, manzanita or buckbrush (4'-8' high)	—	20-30	31-40
Heavy mixed brush (6'-8' high)	—	20-30	31-45
Heaviest mixed brush with toyon, oaks, big manzanita and madrone on north slopes at higher elevations and latitudes (8'-12' high)	—	30-45	46-60

1. Adapted by Clive Countryman and Lisle Green, U. S. Forest Service, and T. E. Adams, Cooperative Extension, from *Fireline Handbook*, U. S. Forest Service.

2. Prepared by Clive Countryman and Lisle Green, U.S. Forest Service.

These rates include the two or more passes generally necessary to uproot brush, incorporate smaller stems, reduce brush so that it will not carry fire, and allow planting with a rangeland drill without additional preparation.

In heavy brush the disk cannot fully incorporate brush into the soil, but will do a good job of breaking down and crushing vegetation. Later, when sufficiently dry, this crushed brush can be burned.

In chamise, one or two passes of the disk usually will incorporate 85 to 95 percent of the plant material. In the heaviest brush in which the disk generally is used, it takes an average of four passes to do an adequate job. On the first pass, disking will be at a rate of about 1 acre per hour. Subsequent passes may increase to 3 acres per hour. The increase in speed sometimes stimulates excessive disking to leave disked brush fields unnecessarily "clean."

In San Luis Obispo County, on the cooperative Ranchita Range Study, a brush range improvement demonstration was conducted using small, 8- and 9-foot brush disks, pulled by crawler tractors in the 75 to 120 drawbar horsepower range commonly available to ranchers.

With added weight, the 8-foot unit weighed 5,100 pounds. The front gang carried 28-inch cutout disks and the rear gang, 32-inch cutout disks. The 9-foot disk with added weight weighed 5,300 pounds and used 32-inch cutout disks in both gangs.

Two trials were involved, both on heavy mixed brush 10 or more feet high growing in sandy loam 12 to 24 inches deep. Slopes averaged 20 to 30 percent.

In the first trial, initiated in May 1965, a TD-20 tractor equipped with a straight dozer blade pulled the smaller disk. With the blade set about 1 foot above ground, this combination knocked down and uprooted most of the brush and turned under much of the vegetation in one pass, at a rate averaging 0.8 acres per hour.

During the following November, the same tractor pulled the 9-foot disk to complete seedbed preparation in one pass. Nearly all remaining debris and all sprouts that appeared in summer were turned under. (Spot burning eliminated unincorporated debris.) In this operation, rate of production averaged 1.0 acres per hour.

The second trial was initiated in June 1966 using a D6 with a straight dozer blade, pulling the 9-foot unit through slightly heavier brush. This equipment averaged 0.7 acres per hour for one pass. In October, after one inch of rain, the crushed brush was burned. Removal of debris by fire permitted use of a 14-foot grainland disk for a second disking in January 1967. This eliminated sprouts and seedlings brought up by early rains. Average rate of production for the one pass necessary was 2.0 acres per hour.

Costs per acre. To figure costs for your operation, cost of tractor operation can be calculated from data in "Farm Machinery Costs," Leaflet 2263, Division of Agricultural Sciences, University of California. To this add your local costs for transportation, support equipment, and wages for the tractor driver and swamper.

On-site costs reported by the U.S. Forest Service vary from $26 to $70 per acre in light brush and from $60 to $175 per acre in heavier stands. These costs reflect experience in southern California through 1973.

General Recommendations

Mechanical failures. On several projects, the tongues and drawbars failed. The most frequent failures were breaking of the main weld near the back of the tongue, and bending of the tongue or swivel. Some failures were probably caused by equipment abuse, such as turning the wrong direction or too much horsepower, but weakness in design of the tongue assembly also was found. These points should be reinforced before the equipment is used and inspected frequently during operation.

Hydraulic ram failures — where the ram knocks out the end of the cylinder — have been attributed to metal fatigue caused by snapping the ram open and closed. Failures can be prevented by attaching a heavy safety chain to limit the opening distance of the gangs. When the disk opens, the chain, not the ram, will take the load. To keep slack chain out of the disk when the gangs are closed, attach the chain to an upright bracket and garage door spring.

Hydraulic hoses have been caught in brush or trees and broken. Usually the damage can be avoided by encasing the lines in old cotton-jacket firehose suspended loosely above the disk tongue. A 3- to 4-foot length of steel rod with a loop in the

top end is welded vertically to the disk tongue to hold the encased lines slack but up and out of the way.

Safety precautions. A canopy over and around the tractor operator is essential for work on steep, irregular terrain. Because the disk has a double-action swivel hitch, it can tip forward as well as sideways. (On one project, a 10,000 pound disk rose up onto "balled" brush, tipped forward, and damaged the tractor canopy at the level of the operator's head.)

A disk will tip sideways generally when it rides up on accumulations of balled brush. Disks 10 to 12 feet wide are more stable than narrower models. Swampers should be aware of the danger and stay clear, especially on the downhill side.

Care also should be taken when performing maintenance on these large pieces of equipment. Disks should be on ground as level as possible, and should be securely "chocked" in place while repairs are made.

Seeder attachment. A commercial seeding attachment for brushland disks has been used by the Forest Service, which reported its use and possibilities for modification were both unsatisfactory.

Some advantages and disadvantages of the brushland disk include:

Advantages

Good maneuverability — around trees, boulders, drainages.

Effective for creating irregular edge (scalloping or feathering) to enhance wildlife habitat and aesthetics.

Allows varying degrees of cleanup.

Does a complete job — burning needed only in heavy brush.

Incorporates debris; enhances nutrient recycling.

Digs out many roots and root crowns; reduces or eliminates need for herbicides to control brush sprouts.

Disadvantages

Use limited by slopes, soil, rocky conditions.

Disturbs and loosens soil, increases potential for erosion.

Costs and fuel consumption generally higher than with other mechanical treatments.

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