Slash Disposal and Seedbed Preparation by Tractor

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CREATING GROUND conditions favorable to regeneration immediately after the final harvest cutting is basic to forest management wherever advance growth is deficient. Ponderosa (*Pinus ponderosa* Laws) and Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.) seeds require bare mineral soil for satisfactory germination. Pine seedlings, whether from natural seedfall or planting, survive and grow vigorously only when free from competition with other vegetation.[2,3] This article describes methods used and reports the cost of site preparation in recent years at the Blacks Mountain Experimental Forest in northeastern California and the Stanislaus Experimental Forest in the central Sierra Nevada. Performed as one step in the harvesting and regeneration of experimental areas, the operation cost $37 per acre in 1955, or less than 25 cents per thousand board feet harvested.

Site preparation requires the elimination of both slash and competing vegetation. The removal of slash aids in fire protection. Consequently, part of the cost can logically be regarded as a fire protection expense.

Most of the recent experience has been at the Blacks Mountain Experimental Forest, Lassen County, in the ponderosa-Jeffrey pine type. The timber stand is predominantly ponderosa and Jeffrey pine, with white fir (*Abies concolor* [Gord. & Glend.] Lind.) entering on upper slopes and with a small amount of incense-cedar (*Libocedrus decurrens* Torr.) Topography at Blacks Mountain is generally not very rugged. Slopes from the flats to ridge tops average about 10 to 17 percent; occasional areas on the slopes run to about 60 percent. The geologic formation is volcanic in origin. The soil tends to be somewhat stony, though not to a prohibitive degree on most regeneration areas so far encountered.

Homogeneous stand units are harvested according to needs and conditions of the stand as prescribed by the unit area control method of management.[4] Overmature units without adequate advance growth are clearcut for regeneration. Only these units receive site preparation.

Regeneration areas have ranged in size from 0.2 acre to about 2 acres. Volume removed from such clearcut areas is about 20,000 board feet to the acre; this volume figure is given as a rough indication of the amount of logging slash encountered in the work.

Slash Disposal and Site Preparation Methods

Regeneration areas are selected and mapped when timber is marked for cutting. A cost estimate of slash disposal and seedbed preparation is then calculated for the intended acreage, using previous records of production and expenditures. This cost estimate usually is increased by an allowance for complete clearing of occasional small areas of advance reproduction which might be badly damaged during logging.

Equipment Used

Clearing has been done primarily with crawler tractors of 80 and 130 horsepower, equipped with cable-operated angledozer blades. In 1952, however, most work was done with a commercially manufactured "rock rake," or "brush rake," mounted on an 80-horsepower tractor. This blade had distinct advantages in piling slash, since it allowed most soil and duff to pass between the teeth. It appeared to be less effective than a solid-edge dozer blade in eliminating low vegetation on somewhat rocky areas. However, it was driven by an inept tractor operator, so the rake probably did not receive a fair test.

In 1949, at the Stanislaus Experimental Forest, Tuolumne County, some work was done with a 43-horsepower tractor equipped with a brush rake having widely spaced teeth. This equipment could pile all but the heaviest slash, but was unstable and did not effectively remove low vegetation.

Some users believe that an 80-horsepower tractor is more economical to use than one of 130 horsepower. The reasons are that (1) length of angledozer blades used on the two machines differ but little, and (2) maximum tractive effort is seldom required to move the material encountered. But probably even more important to cost than tractor size is skillful tractor operation.

Work Procedures

To keep costs low, it is essential that the quantity of material and the distance it is moved be held to the minimum necessary to do the job. Experience shows that some tractor operators have a tendency to "clean up" too thoroughly. They feel that their work is

[1]The Experiment Station is maintained at Berkeley, California, in cooperation with the University of California.

[2]Tackle, D. and D. F. Roy. Site preparation as related to ground cover density in natural regeneration of ponderosa pine. Calif. Forest and Range Expt. Sta. Tech. Paper 4. 13 pp. 1953.

[3]Roy, D. F. Effects of ground cover and class of planting stock on survival of transplants in the eastside pine type of California. Calif. Forest and Range Expt. Sta. Res. Note 87. 6 pp. 1953.

[4]Hallin, William E. Unit area control—its development and application. Calif. Forest and Range Expt. Sta. Misc. Paper 16. 10 pp. 1954.

TABLE 1.—COST AND TIME REQUIRED FOR SLASH DISPOSAL AND REGENERATION SITE PREPARATION[1]

Experimental forest and year	Cost[2]			Time per acre of regeneration area	
	Per acre of regeneration area	Per acre, gross area logged	Per M ft. b.m., all timber cut	Man-days	Tractor[3] meter time
	Dollars	*Dollars*	*Dollars*	*Number*	*Hours*
Blacks Mountain (Lassen National Forest)					
1951	7.91	0.33	0.04	0.2	0.6
1952	45.71	2.70	0.34	1.4	2.8
1953	50.58	2.27	0.44	0.9	3.4
1954	49.50	2.56	0.19	1.1	3.5
1955	36.91	1.20	0.24	0.9	2.1
Average, 1952-55	45.99	2.05	0.30	1.1	3.0
Stanislaus (Stanislaus National Forest)					
1948	70.90	25.23	0.64	1.9	4.8
1949	45.46	10.67	0.27	1.7	2.4

[1]Basic data shown in Table 2.
[2]Charges for hauling tractors, transporting men, and slash burning not included.
[3]Usually about 6 meter hours registered per 8 hour work day.

substandard if they don't clean all the surface to mineral soil. But narrow stringers of litter or logging slash, large windthrown trees, and even narrow strips of low vegetation can be left in an area without seriously interfering with normal spacing requirements for planted seedlings (in this case 6 feet by 6 feet). Likewise, when preparing seedbeds for natural seedfall, exposure of mineral soil on 100 percent of an area is not essential.

Sometimes the tractor work is oriented with the general direction of numerous skidtrails running through a regeneration area; this eliminated work on trails which were already cleared. Slash is sometimes piled on stump concentrations to eliminate lost time in maneuvering to clear the ground between the stumps. Slash is piled so as to occupy a minimum area and far enough from standing trees to prevent scorching or killing when the piles are burned. They are not ignited until after a snowfall.

Tractor operators are trained to examine their work continuously to ensure that they completely eliminate all vegetation within cleared strips. The work supervisor or swamper chops off at ground level any pieces of brush or damaged seedlings and saplings which were bent over but not completely removed by the tractor blade.

For the conditions at Blacks Mountain, the best site-preparation procedure on some areas requires two steps: First "once over lightly" to pile slash, then more thoroughly to expose mineral soil. In some areas the material from these latter passes is pushed to the edges of the clearings to keep large quantities of duff and soil out of slash piles that are to be burned. Where large amounts of slash occur on steep slopes, piles are made in the form of windrows on contours in order to reduce erosion. Also, on steep slopes the tractor blade is used to construct waterbreaks to reduce erosion in skidtrails.

During the 1955 season, Oscar Stark, logging foreman on the project, devised an efficient procedure for clearing some areas to mineral soil after slash is piled. After angling the tractor blade, the operator drives the tractor in a continuous spiral. Material scraped from the surface slides off the rear end of the blade, forming a narrow strip. In this method all tractor effort is expended in clearing, and effort in backing is eliminated. Size of area, steepness of slope, stump concentration, and necessary location of slash piles sometimes prevent or limit use of this method.

Owing to the small size of our operation, site preparation is usually left until the end of the logging season. On larger operations site preparation probably should follow logging more closely because slash is generally easier to handle when green, and the fire hazard would be reduced sooner. Regeneration areas are examined during the spring after burning to detect any hold-over fire that may be present.

Supervision

Slash disposal and site preparation are supervised closely by a forester or another well-trained man who clearly understands the purposes. Safety and efficiency require the presence of someone on the ground near the tractor operator. The supervisor is guided by logging maps showing regeneration areas and skidtrails. He locates work areas ahead of the tractor and directs the travel between areas to keep the tractor working continuously.

The supervisor determines and shows the boundaries to the equipment operator. Silvicultural considerations often govern his selection of the specific boundaries. For example, he may remove fringes or fingers of the less desirable white fir or incense-cedar reproduction that adjoin or extend into a pine regeneration area.

Some skillful, conscientious tractor operators soon become expert at picking good boundaries and proper locations for slash piles and in removing competing vegetation. Such men need less supervision than normal. In fact, at times they can be given a map and a swamper and left without immediate supervision. Then, quality of the work is checked at intervals of two or three days.

Costs

The cost of site preparation at Blacks Mountain varied during five years of record from $7.91 to $50.58 per acre treated (Tables 1 and 2). The 1955 cost—$36.91—is probably most representative of what can be expected with a reasonable amount of experience. On a volume basis, the relative investment for site preparation is low, from $.04 to $.44 per thousand board-feet net scale (Scribner), with $.24 being the representative figure in 1955.

The work in 1951 was planned just to "hit the high spots." This accounted for the low cost of $7.91 an acre. Later developments

TABLE 2.—BASIC DATA FOR COMPUTATION OF TABLE 1 (time-cost table)

Location and year	All labor		Equipment				Total cost	Regeneration area average	Gross acreage logged	Net scale logged
	Man-days	Cost[1]	Tractor horsepower	Metered time	Type of blade	Cost[2]				
	Number	*Dollars*	*Number*	*Hours*		*Dollars*	*Dollars*	*Acres*	*Acres*	*Bd.-ft.*
Blacks Mt.										
1951	3.75	67.50	80	12	angledozer	85.20	152.70	19.3	461.7	4,249,330
1952	22.37	402.66	80	45	brush rake	319.50	722.16	15.8	267.5	2,124,850
1953	21.00	378.00	130	76	angledozer	744.80	1,122.80	22.2	494.6	2,527,280
1954	12.25	220.50	80	16	angledozer	113.60				
			130	24	angledozer	235.20				
				40		348.80	569.30	11.5	222.0	3,000,100
1955	13.75	247.50	130	32	angledozer	313.60	561.10	15.2	466.3	2,292,030
Stanislaus										
1948	60.00	1,080.00	80	117	angledozer	830.70				
			130	38	angledozer	372.40				
						1,203.10	2,283.10	32.2	90.5	3,559,140
1949	43.5	783.00	43	15	brush rake	60.75				
			80	47	angledozer	333.70				
				62		394.45	1,177.45	25.9	110.4	4,413,460

[1]All labor computed at $2.25 per hour or $18.00 per 8-hour day.
[2]Tractor cost computed at U. S. Forest Service, Region 5, 1955 hourly rates: 43 H.P.—$4.05; 80 H.P.—$7.10; 130 H.P.—$9.80.

showed that insufficient low vegetation had been removed; seriously high losses of planted seedlings occurred on some of the areas. Consequently, the averages shown in Table 1 include only 1952-55 data.

Costs for slash disposal and seedbed preparation with a commercially manufactured brush rake in 1952 were favorable even though the operator was very inept. The cost that year—$45.71 an acre cleared—is close to the average. We believe that brush rakes should be more thoroughly tested in the hands of skilled operators.

Some comparative cost data are given for work during two years on the Stanislaus Experimental Forest, about 30 miles east of Sonora. Timber stands there are typical of the high site quality sugar pine-fir type of the western slopes of the Sierra Nevada. This work was reported previously[5] but costs have here been converted to current rates. The high cost at the Stanislaus Experimental Forest in 1948 was undoubtedly due to lack of experience. Cost of the Stanislaus work in 1949 — $45.46 — is about the same as the average at Blacks Mountain. At the Stanislaus Experimental Forest about 88,000 board-feet to the acre was cut on regeneration areas. The comparative figure for Blacks Mountain is 20,000 board-feet to the acre, as previously mentioned. Volume of slash, then, may not be a predominant factor in the cost of seedbed preparation.

[5]Gordon, Donald T. and Richard D. Cosens. Slash disposal and site preparation in converting old-growth sugar pine-fir forests to regulated stands. Calif. Forest and Range Expt. Sta. Res. Note 81. 7 pp. 1952.

Conclusion

Site preparation is an essential treatment of clear-cut regeneration areas in the application of unit area control to the ponderosa-Jeffrey pine type. However, the benefits will be lost unless seedlings are established before the areas are invaded by competing vegetation. As site preparation is the first investment in establishing a new crop, additional reductions in cost are desirable. Consequently, further investigations to develop new methods and equipment should be carried on.

John Harold Foster (1880-1956)

The death of John H. Foster, former state forester of New Hampshire, occurred on September 6, 1956 at Concord, N. H. He had been in poor health for a long time. Born in Waltham, Mass., he was graduated from Norwich University and received his M F. at Yale in 1907. In 1940, Dartmouth College conferred on him an honorary M.A.

Serving first in the U. S. Forest Service from 1907 to 1911, he then spent 4 years as professor of forestry at the University of New Hampshire. In 1915, he became the first state forester of Texas. He was appointed state forester of New Hampshire in 1920, which post he held until his retirement in 1951. During this period he was responsible for many of the advances in forest fire protection, acquisition, and management of state forests and their development for public recreation. The expanded forestry activities of the depression years, the 1938 hurricane, and the great fires of 1942 and 1947 were some of the many crises he met ably. Finally he was active in timber tax reform since 1907 culminating in the 1949 law in New Hampshire. Long a member of the Society, he served in many capacities, especially in the New England Section.

At the dinner tendered him on his retirement Gov. Sherman Adams referred to him as "Honest John." Certainly that was one of his outstanding qualities; but he was above all a friendly and kindly man, and as such his many friends and associates remember him with affection.