Harvesting Costs and Production Rates for Seed-Tree Removal in Young-Growth, Mixed-Conifer Stands

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ABSTRACT—Ponderosa pine seed trees left from a previous cutting on the Challenge Experimental Forest, California, were removed in October 1963. Logging costs and production rates were compared with those for a seed-tree cutting on an area nearby. Production rates for seed-tree removal greatly exceeded those for the operation as a whole. Skidding production increased by 38 percent or 1,247 bd. ft. per hour. Components of this net increase were: using pre-existing skid roads (+9 percent), a larger average log volume (+59 percent), and cost of safeguarding regeneration (−30 percent). The cost of returning to the woods to harvest seed trees may vary considerably. In this study "return" costs decreased skidding production by 4 percent.

LOGGING COST and production rate information for young-growth stands is badly needed. And this need is increasing, especially in the western states, as more and more of these stands are managed, appraised, and sold. This paper reports logging costs and production rates of seed-tree removal in young, mixed-conifer stands on the Challenge Experimental Forest,[1] Yuba County, Calif., and compares them to seed-tree cuttings.

Original seed-tree cuttings on the Challenge forest were logged in 1958, 1959, and 1960. Two to ten vigorous trees per acre were retained for seed production. Slash was piled by a bulldozer on about 70 percent of the area and later burned (Fig. 1). Seed trees were removed in October 1963, when regeneration exceeded the minimum standard (1,300 well distributed two-year-old seedlings per acre). Altogether, about 360 seed trees and 135 smaller trees (12-19 inches d.b.h.) were removed from ten small cutting units that totaled 53 acres. The small trees contributed 14 percent to the total number of logs and only 2.6 percent to the total seed-tree removal volume. The cutting units were within a quarter-mile of each other, except one which was about 1.5 miles from the others.

The seed trees were at least 20 inches in diameter and primarily ponderosa pine (*Pinus ponderosa* Laws.). Each tree contained from four to seven 16-foot logs. The minimum merchantable log was 10 feet long and 10 inches in diameter inside bark at the small end. Defect in logs trucked to the mill was less than 1 percent of the gross volume.

Regeneration in the Challenge area typically is thickest where mineral soil occurs. Old skid trails, landings, and favorable microsites within the cutting units often become heavily regenerated. Special procedures were used to minimize damage to these seedlings. They included flagging reusable portions of former skid trails, designating new ones, and marking the felling direction of each seed tree. In addition,

Table 1.—Logging Cost and Production Rates for Seed-Tree Removal, Challenge Experimental Forest, California, 1965

Basic data:			
Average number of trees per acre			9
Average volume[1] per tree	bd. ft.		1,345
Average volume per acre logged	bd. ft.		12,660
Average log[2] volume	bd. ft.		540
Felling production:			
Volume per man-hour	bd. ft.		3,532
Man-hours per M bd. ft.	hours		.28
Skidding production:			
Volume per tractor-hour	bd. ft.		4,519
Tractor hours per M bd. ft.	hours		.22
Volume per man-hour	bd. ft.		2,260
Man-hours per M bd. ft.	hours		.44
Production costs per M bd. ft.[3]:			
Felling	dollars		3.86
Skidding			
Labor cost	dollars	1.70	
Tractor cost	dollars	1.89	
Total skidding cost	dollars		3.59
Total cost, felling and skidding	dollars		7.45

[1] All volumes are net log scale, board feet (Scribner rule).
[2] Primarily long logs (32 feet): others of variable lengths.
[3] 1965 costs.

[1] U.S. Forest Service research at the Challenge Experimental Forest is conducted in cooperation with the Soper-Wheeler Company, Strawberry Valley, Calif.

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several locations were designated as "winch pull" areas within which logs would be snaked out by winch line. These precautions, including on-the-ground supervision in the "pull" areas, resulted in a cost to management of 8.5 man days.

The felling team consisted of two men; one man would fell, the other buck. The faller usually made the first buck on the larger trees to equalize the work load. Each member's saw was keyed to his job. Thus the bucker had a smaller, faster saw with a shorter bar. The team worked at a negotiated rate of $3 per M bd. ft., net log scale (Scribner rule). Payroll expenses for unemployment compensation, social security, workmen compensation, health insurance, etc., increased this cost by 29 percent to $3.86 per M bd. ft.

A skidding team consisted of a choker setter, a tractor operator, and a tractor of 113-drawbar-horsepower equipped with a bulldozer blade. Logs were ground skidded an average of 550 feet on slopes of 5 to 25 percent (Fig. 2). The tractor use-rate was $8.55 per hour. The hourly wage rate for the tractor operator was $3.01, and for the choker setter, $2.80. Additional payroll expenses increased these rates by 32 percent to $3.97 and $3.70, respectively.

An additional cost inherent in seed-tree removal is the cost of "returning to woods." This cost, of course, varies directly with the distance moved and the general condition of the road being traveled; hence, it is a cost factor that probably will vary with each logging operation. Nevertheless it is a pertinent cost to this operation and to the seed-tree cutting method as a whole.

In this study, the moving distance was about 40 miles (round trip) over a well-maintained, graveled, main-haul road. The time to move was regarded as a production loss for skidding but not for felling, because fallers began their jobs anew each morning. In addition, the costs of the truck and lowbed trailer operator were charged to the skidding operation. Returning-to-woods decreased skidding production by 4 percent (176 bd. ft. per tractor hour) and increased the cost of skidding by 25 cents per M bd. ft.

Logging costs and production rates for seed-tree removal were calculated without adjustment for return-to-the-woods (Table 1).

Discussion

Differences between a seed-tree cutting on a comparable area of the experimental forest and seed-tree removal were as follows:

	Differences between seed-tree cutting and seed-tree removal
Production rates and logging costs:	
Average volume per acre logged....bd. ft.	−9,562
Average log volume.....bd. ft.	+ 201
Felling volume per man-hour.....bd. ft.	+1,746
Skidding volume per tractor hour..bd. ft.	+1,247
Total skidding cost per M bd. ft....dollars[2]	− 1.36
Total cost (felling and skidding) per M bd. ft.....dollars	− 1.36

[2] Values for the seed-tree cutting are adjusted to 1965 rates for comparability.

Fig. 1.—A typical seed-tree area on the Challenge Experimental Forest, California. The "open" stand condition is free of slash and understory. August 1959.

Fig. 2.—Skidding former seed trees to a nearby landing. Nearly 90 percent of all "turns" contain four to five logs. Challenge Experimental Forest, California, December 1963.

In both total skidding cost and total cost (felling and skidding), the differences in logging costs were identical: $1.36. The reason for this similarity is that felling cost remained unchanged for both seed-tree removal and seed-tree cutting. If the fallers had been paid at an hourly rather than a negotiated rate, a difference in cost of felling between the two operations would be indicated.

Skidding production for seed-tree removal increased 38 percent (1,247 bd. ft. per hour) over that from the seed-tree cutting. This increased production rate was the result of three factors:

1. Using portions of the main skid roads established earlier.
2. A significantly larger average log volume.
3. The regeneration safeguards (dodging regeneration, felling the trees a designated direction, and pulling the winch line to the log).

The first and second factors will increase skidding production while the third will decrease it. Factors 1 and 2 were dominant because production increased.

How much does each factor contribute to the skidding production rate? Analysis of records on equipment use (when logging at Challenge) indicate a production increase of 8 to 10 percent or 294 bd. ft. per tractor hour when reusing most of the previously established main skid roads.

The effect of the larger log volume was calculated from the hourly tractor production rate, average log volume, and the difference in average log volume between the seed-tree cutting and seed-tree removal. The effect of the regeneration safeguards could then be computed as a residual. This residual may contain effects of other factors but these, if present, are small enough to be not significant. The extent that each factor contributed to the overall increase in skidding production was as follows:

	Effect on production	
Factor	*bd. ft. per hr.*	*percent*
Established skid roads	+ 294	+ 9
Larger average log volume	+1,940	+59
Regeneration safeguards	− 987	−30
Net increase	+1,247	+38

The larger average log volume had the greatest single effect on skidding production, increasing it by 59 percent—a value which probably would have been larger had this been a "pure" seed-tree removal operation with no smaller trees included. Applying regeneration safeguards was also a relatively large factor, decreasing production substantially. Quantifying these three factors both individually and as a whole helps both the forest manager and the logger with their planning.

The mean reduction in seedling stocking caused by seed-tree removal was 3.8 percent or about 212 seedlings per acre—a value slightly less than that incurred from natural mortality. Most important, regeneration did not fall below the minimum acceptable stocking level.

In this operation the logging was profitable, and the tree reproduction was saved. □

Seth Jackson

Forestry ir

ABSTRACT—Through the centuries, forestry in Ireland has suffered repeated setbacks due to invasions and world war involvement. Over the past four decades, however, a program has gradually evolved and, since the establishment of the Republic of Ireland in 1949, great strides have been made.

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DURING a recent journey around Ireland, seeking to learn something of the island's forest resources and their management, I was constantly aware of what seem ideal conditions for tree growth. Height gains of two feet a year for conifers and up to six feet for eucalyptus are not uncommon.

The topography of this fascinating island, which is slightly smaller than the state of Maine, consists of a central plain (about half of its land area) surrounded by mountains, which range up to 3,000 feet. Soils vary greatly, with the peat areas offering probably the greatest challenge for revegetation.

Ireland's climate is influenced by the Gulf Stream, but subject to the vagaries of North Atlantic weather. Temperatures are uniformly cool, averaging 40°F in January, 60°F in July. Precipitation is well distributed, with at least 200 wet days annually. The total varies from 100 inches in the western part of the island to 27 inches in the eastern half.

As in this country, Ireland's farm population is diminishing—down 20 percent during the last quarter century. The drop in small farms (under 30 acres) is 33 percent. Most of the forestry land is in the hill pasture zone, formerly used by cattle and sheep.

While all this may add up to a favorable forestry situation, the Irish until recent years have not been able to take advantage of it. Plundered and exploited by centuries of foreign conquests, by 1700 little was left of the island's originally abundant timberlands. The insurrection of 1798 made further inroads.

Many of the great English estates survived, though, and these still comprise the largest private forest holdings. A few enterprising landowners engaged foresters. Some planting was done; in fact, a tree nursery was established at Kilkenny as early as 1765. Estate planting, which became popular in the 18th century, brought about steady improvement for a century and a half. In 1880 there were 340,000 acres in woodland, but by 1920 the area had declined to 130,000 acres, mainly because of demands for World War I.

In 1921, after 700 years of struggle, a treaty with England made the 26 counties a Commonwealth of Britain—the Irish Free State. This status was abandoned by referendum of the people in 1949, and the Republic of Ireland came into being. And with it, a modern program of forestry.