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FALL CREEK SECOND-GROWTH DOUGLAS-FIR THINNING STUDY

By

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Introduction

As the supply of old-growth timber in the Douglas-fir region decreases, there will be a continuous increase in the use of second growth. Eventually the entire wood-using industry will be wholly dependent on the younger timber stands. The exact amount of second growth being cut at present is not known, but it is estimated that close to one-third of the lumber production in the Douglas-fir region comes from timber less than 160 years old, or what are commonly known as second-growth stands. The acreage of these young timber stands is sizeable. Recent survey figures show second-growth forests, plus recently cut-over lands, amount to approximately two-thirds of the commercial forest land in the Douglas-fir region.

Before 1940 only a limited amount of second-growth timber was cut. However, the lessened supply of old growth and the brisk demand for wood products during the war and postwar years have established good markets for the young timber. With these markets has come the opportunity to put the younger timber stands under good management. Research studies indicate that periodic thinnings can be made in the young stands without decreasing the volume of the final crop. In young timber stands there is a high mortality of trees due to crowding, and periodic thinnings can be so designed that they forestall this mortality. The research results, which look promising, need to be tested on commercial-sized operations to see if they are economically feasible. A number of such tests are being made by both private companies and government agencies.

In 1948 one such cutting experiment was started by this Station in cooperation with the Willamette National Forest and the Fall Creek Lumber Company. The logging and milling of the timber on this study area was recently completed, and this report deals primarily with costs and preliminary results. Growth plots have been established in the thinned portion and in the adjoining uncut stand so a future measure of growth and quality can be obtained. According to the plan, this study will extend over a period of many years, with periodic cuts being made at about 5- to 10-year intervals.

Description of the Study Area

The area on which the study is being conducted is located on the Big Fall Creek drainage of the West Boundary Ranger District, Willamette National Forest. Approximately 108 acres are included in the study area; 69 acres were thinned and the other 39 acres were left uncut as a check area.

The stand consisted almost entirely of 90-year-old Douglas-fir timber, only a scattering of cedar, hemlock, maple, and chinquapin being present. Apparently most of this stand has been quite well-stocked for some time. Limbs are small; and most lower limbs have shaded off, leaving better-than-average clear boles for a stand of this age. Decay is light, consisting of occasional butt rot, white pocket rot, and a small amount of root decay. Site class is III+, about average for the region. The area is located at about the 2,000-foot elevation, and has gentle to moderate topography all of which is favorable to tractor logging.

The area logged contained an average of 47 M board feet Scribner log scale per acre in trees 12 inches and larger. Trees of this size averaged 115 per acre of which 76 were dominant or codominant trees. Counting trees 7 inches and larger in diameter gave an average of 172 per acre having a volume of 11,583 cubic feet, or about 130 cords. Table 1 shows the number of trees per acre in the original stand, those cut or destroyed in logging, and those remaining.

Study Objectives

Chief objective of the study is to determine the economic and silvicultural advantages or disadvantages of partial cutting in second-growth Douglas-fir stands. Since repeated thinnings are contemplated, one of the long-range objectives is to determine the trend in volume and quality increment of the residual stand. Costs of logging and returns from the material removed in subsequent thinnings and in the final regeneration cut will also be secured.

Table 1.--Statistics for logged area, Fall Creek thinning study - 1948-1949, by diameter class. (Values on per acre basis.)

Diameter class	Douglas-fir			Other conifers			Total conifers		
	Original stand	Cut 1/	Residual	Original stand	Cut 1/	Residual	Original stand	Cut 1/	Residual
Inches				Number of trees					
1.5+	153.3	56.4	96.9	104.7	38.9	65.8	258.0	95.3	162.7
6.6+	151.9	56.2	95.7	20.6	2.8	17.8	172.5	59.0	113.5
11.6+	107.8	28.1	79.7	7.5	2.2	5.3	115.3	30.3	85.0
				Basal area (square feet)					
1.5+	219.3	55.0	164.3	23.8	5.3	18.5	243.1	60.3	182.8
6.6	219.1	54.9	164.2	16.8	3.0	13.8	235.9	57.9	178.0
11.6	197.0	40.1	156.9	11.7	2.7	9.0	208.7	42.8	165.9
				Average d.b.h. (inches)					
1.5+	16.2	13.3	17.6	6.4	4.2	7.2	12.2	9.6	13.4
6.6+	16.3	13.3	17.7	12.2	13.7	11.9	15.8	13.3	16.8
11.6+	18.3	16.2	19.0	16.9	14.8	17.7	18.2	16.1	18.9
				Average height (feet)					
1.5+	132	119	138	58	37	65	102	86	108
6.6+	132	119	138	98	106	97	128	118	132
11.6+	140	132	142	124	113	128	139	131	141
				Dominant and Codominant trees					
	145	144	145	138	124	139			
				Volume, cubic feet					
1.5+	10,817	2,575	8,242	887	170	717	11,704	2,745	8,959
6.6+	10,813	2,574	8,239	770	137	633	11,583	2,711	8,872
11.6+	9,920	1,968	7,952	607	128	479	10,527	2,096	8,431
				Volume, board feet (Scribner)					
11.6+	44,355	8,564	35,791	2,997	580	2,417	47,352	9,144	38,208

1/ Includes trees destroyed in logging, most of which were small understory Western hemlocks.

The main objectives of the initial thinning are:

Quantity increment - To study the growth and response to release of trees in the residual stand by vigor, crown class, and release; and to compare the growth and mortality in the residual stand with that of the uncut check area.

Quality increment - To study the quality growth response of trees in the residual stand, and compare with the quality growth obtained in the check area.

Logging methods - To collect information and experience on the most efficient logging methods that will also minimize damage to the residual stand.

Cost and returns - To determine costs and returns for logs and lumber produced from partially cut stands of this type.

Timber to be removed in this experiment was appraised in the usual manner and advertised for sale. The Fall Creek Lumber Company was the successful bidder. This company operates a sawmill, planing mill, and box factory at Fall Creek, Oregon. In addition, they operate a small, semi-portable Swede gang mill, which is located 12 miles east of their main mill. Small logs produced in their relogging operations are cut in this gang mill, and the green lumber is trucked to the main plant. All logs produced in this experimental cutting were manufactured into lumber at the gang mill.

Tree Marking Procedure

Examination of the area showed that not more than about 25 percent of the timber volume should be removed in the first cut. It was reasoned that cutting a greater volume would leave the residual stand susceptible to windthrow, sunscald, and other mortality losses, and in addition, would create an excessive slash hazard. On the other hand, it was estimated that a cut of this volume would permit an economical logging operation. Therefore, these two points were given consideration during the timber marking in determining the volume to be cut.

The marking guide aimed at leaving the better-quality, vigorous trees in the stand. Trees marked for cutting consisted of those that were expected to die before the next cut, defective or suppressed trees, and rough limby trees whose cutting would release trees of better quality. To minimize the shock to the residual stand, reserve trees were released on only one side.

Timber marking was done twice. The first time about two-thirds of the anticipated cut was marked. After the initial marking had been logged, the balance was designated in the "cleanup" marking. In the second marking any trees that had been severely injured in the initial logging were designated for cutting.

Future growth on the residual trees is estimated at 825 board feet, Scribner rule, per acre per year. On this basis return cuts can be made at 8-year intervals at which time approximately 6½ thousand board feet of timber can be removed per acre without decreasing the growing stock. Costs per thousand for removing this timber should be less than on the original cut as the timber will be of larger sizes and logging roads and skid trails will be in place. Also the timber quality of future cuts will continue to improve.

Logging Methods

Falling was done almost entirely by hand. A power saw was tried, but was soon discontinued because in this test the method was not as successful in avoiding damage to the residual trees. Logs were bucked mainly into 32-foot lengths; many of the smaller trees cut into one log, some as long as 54 feet. Utilization was to a 6-inch top diameter.

A D4 tractor was used for yarding. Arches were not permitted, and logs were ground skidded to the various landings. Skidding distances were short--for the most part not over 800 feet. Loading was done by means of a swinging boom self-loading truck. Hauling distance to the mill was a little less than 5 miles.

Because a rocked road traversed the area, very little road construction was necessary: only a short spur about 300 feet long and a short stretch at each landing so loading could be done off the main highway.

Logging started in May 1948 and was closed in October on account of weather conditions. Work started again in April and was completed in May 1949.

A total of 7,927 logs was cut. They had a total volume of 788 M board feet, or an average of about 100 feet per log. Deductions for cull were light and averaged a little more than 3 percent.

Detailed logging costs were kept by the company and are summarized in the "Production Costs and Returns" portion of this report.

Lumber Grades and Milling Costs

A 2-day study was made at the Company's round-log gang mill to get data on lumber grade recovery for this type of timber. Every log sawed during this period was scaled and graded, and a certified lumber grader graded and tallied every piece of lumber. These data were kept by individual logs.

The mill is equipped with a 24-inch Swede gang headrig, a 6- by 48-inch four-saw edger, and a short green chain. It is powered by a 150 horsepower Diesel motor. Cost of the mill is estimated at $50,000. A crew of 8 men produces an average of 23 M board feet of lumber per 8-hour day. Only 2 x 4's and 2 x 6's were being produced. They were trucked to the company's main plant at Fall Creek for further manufacture.

Long logs hauled from the woods were dumped in the pond where they were bucked into shorter lengths, chiefly 16 feet. Each long log was given a number and when bucked each segment a letter. In this manner it was possible to compile the mill data by either short or long logs. During the 2-day run 355 long logs, which were bucked into 833 shorter lengths, were put through the mill. The short logs scaled 42,540 board feet by the Scribner Decimal C log rule. The lumber produced from these logs tallied 48,910 board feet, a difference of 15 percent.

Overrun of lumber tally over log scale was not as high as was expected for this type of mill and for small timber. If 1-inch lumber had also been cut, overrun would have been greater—some of the slabs going to the burner contained board material. Another reason for the low overrun was that the short logs gave little advantage on taper. Comparing woods scale on the long logs with lumber tally gave 28 percent overrun. This latter figure is the one that should be used for computing overrun as logging costs and purchased logs were measured on the basis of long lengths as loaded on the trucks.

Sawing time was obtained at the headrig for each individual log. Figure 1 shows graphically the sawing time for various lengths and diameters. One of the advantages of a gang headrig is that logs can be fed in a continuous stream, and length of log has little effect on lumber output. For example, 1.2 minutes were required to saw a 16-foot log 11 inches in diameter, and 0.75 minutes to cut a 10-foot log of the same diameter. In other words, the sawing time per linear foot was about the same for these two logs. Sawing time per thousand board feet of lumber is the important point to a mill operator. Therefore, the data for the 16-foot logs have been converted to a M-board-foot basis and are shown by log diameter in table 2.

Table 2.--Net sawing time of 16-foot logs per M board feet of lumber tally.

Log diameter	Sawing time per M feet lumber tally
Inches	Minutes
6	53.1
7	39.5
8	30.7
9	24.5
10	20.1
11	16.9
12	14.6
13	12.9
14	12.7
15	12.0
16	11.5
17	10.5
18	10.4
19	10.4
20	10.4
21	10.4

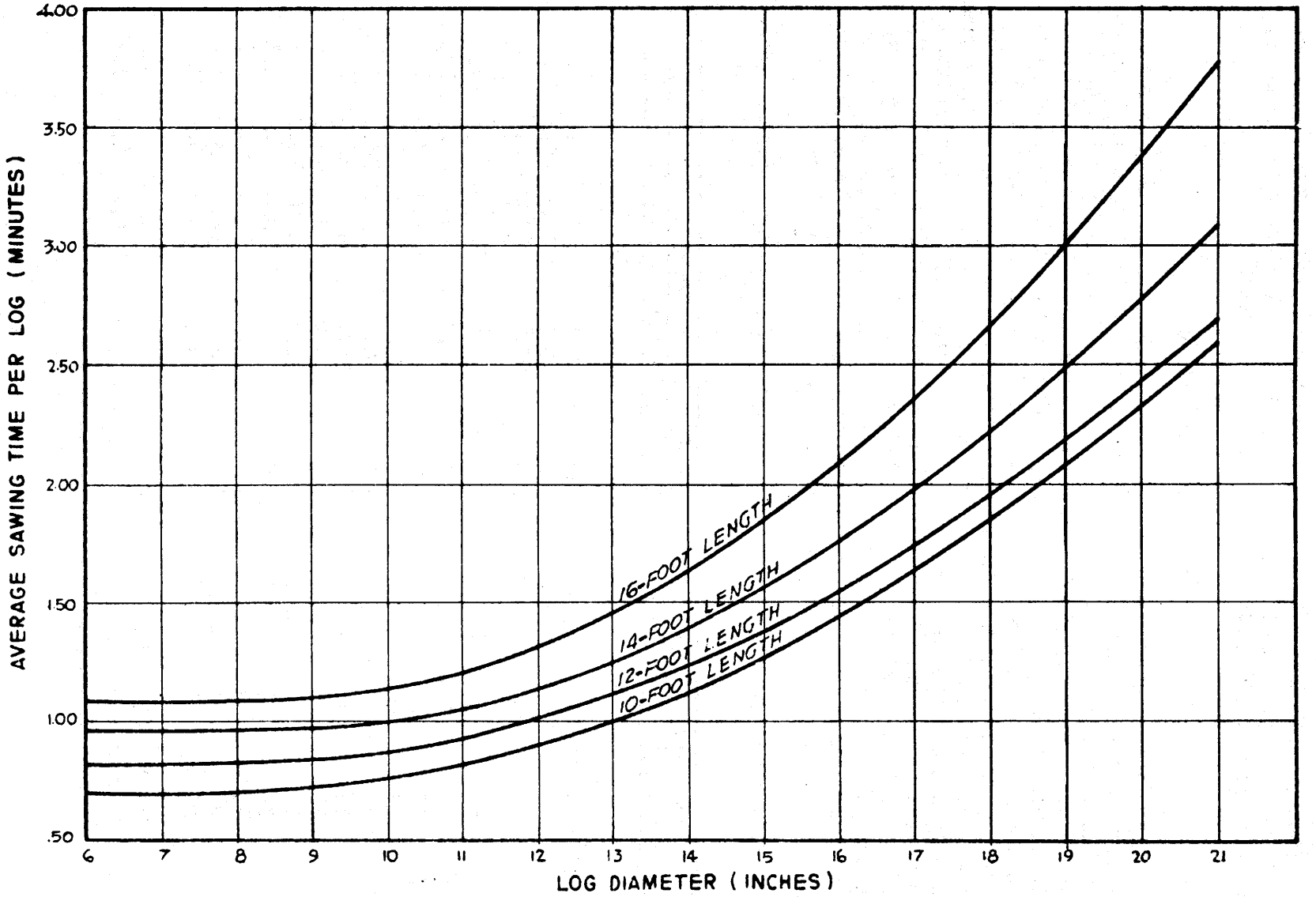

Figure No 1 Sawing Time

Little difference in sawing time per thousand board feet of lumber was found in logs 13 to 20 inches. For the logs 12 inches and smaller, however, there was a marked increase in sawing time.

Lumber Grade Recovery

Logs in this study were of two grades. Those under 12 inches in diameter were automatically No. 3 sawmill logs on account of their size. Those logs 12 inches and over in diameter were all No. 2 sawmill quality except for 2 or 3 very rough logs. Therefore, there is no necessity to show lumber recovery by separate log grades, and data for all logs have been combined in one tabulation by diameter. In table 3 and figure 2 those logs under 12 inches in diameter are No. 3 sawmill logs; those 12 inches and over are No. 2. There is but little difference in lumber grade recovery between the two classes. Actually the smaller logs produced a better grade of lumber than those 12 inches and over in diameter. This difference is due primarily to the fact that the bigger logs came from the more open grown trees, which had produced big limbs. On the other hand, the smaller logs came primarily from densely grown trees that had not had enough sunlight to produce big limbs.

Table 3.--Summary of volume and lumber grade recovery for all logs.

Diameter, inches	No. of logs	Scribner log scale	Lumber tally	Lumber grade recovery			
				Select struct.	No. 1	No. 2	No. 3
		Bd. ft.	Bd.ft.	Percent			
6	98	1,190	1,362	10.6	79.4	5.5	4.5
7	130	2,860	3,030	16.6	74.3	5.4	3.7
8	134	3,360	4,123	21.8	69.6	5.2	3.4
9	106	3,840	4,429	26.2	65.5	5.6	2.7
10	95	5,030	5,370	29.8	61.8	5.9	2.5
11	77	4,680	5,633	32.7	58.5	6.7	2.1
12	61	4,410	5,162	34.7	55.8	7.6	1.9
13	46	4,180	4,704	35.9	53.6	9.1	1.4
14	25	2,600	3,185	36.4	51.8	10.4	1.4
15	20	2,630	2,877	36.1	50.5	12.0	1.4
16	12	1,820	2,192	34.9	49.9	13.8	1.4
17	8	1,250	1,423	32.7	50.0	16.2	1.1
18	7	1,200	1,480	30.3	50.0	18.6	1.1
19	7	1,470	1,749	26.8	51.0	21.1	1.1
20	4	1,120	1,138	22.5	52.5	23.6	1.4
21	3	900	1,053	17.4	54.8	26.2	1.6
Total	833	42,540	48,910	--	--	--	--
Average	--	--	--	30.0	59.2	8.9	1.9

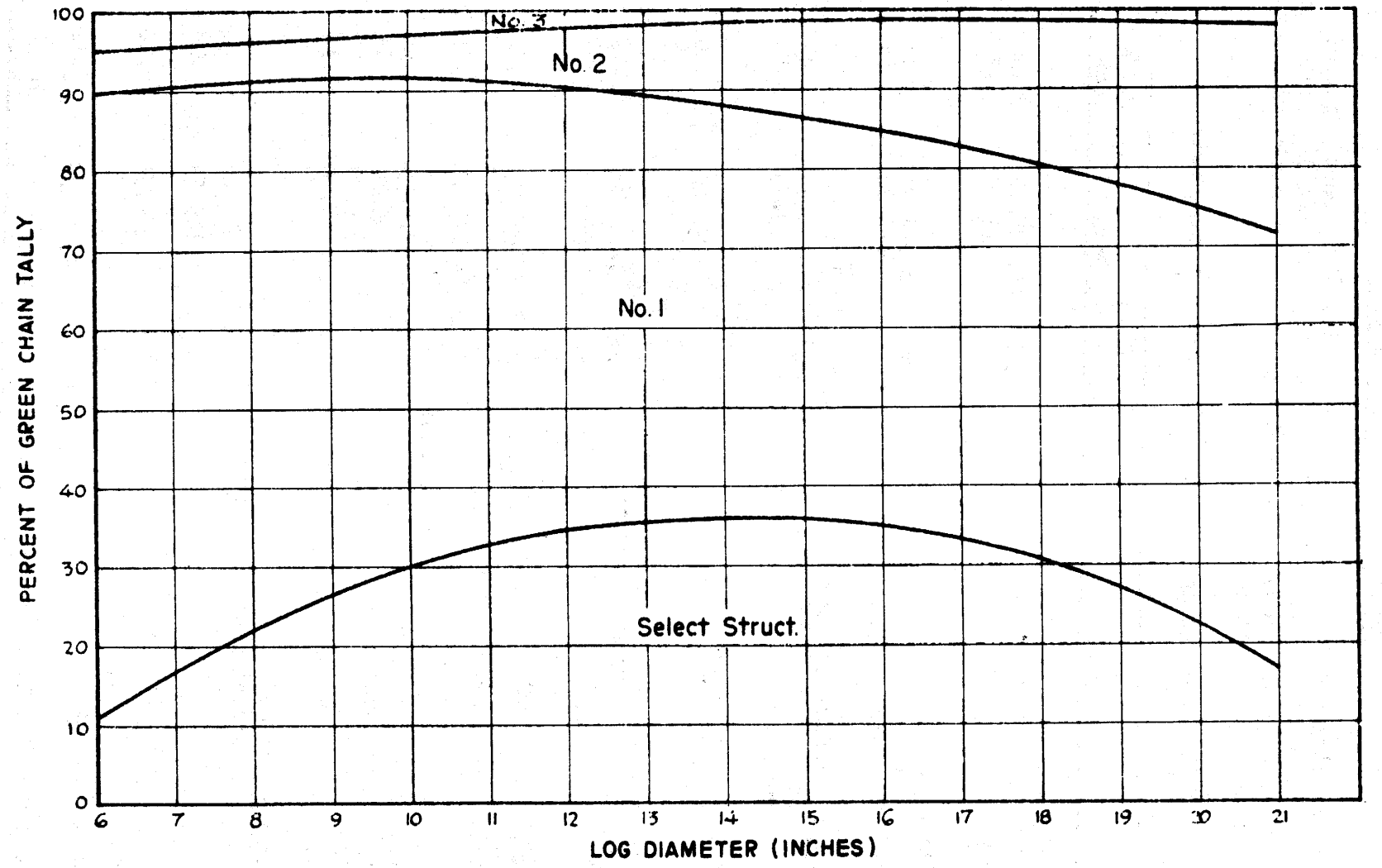

Figure No. 2 Cumulative Grade Recoveries in Second-growth Douglas-fir Logs

Production Costs and Returns

Detailed logging costs were obtained for the 850 M board feet of logs cut. These costs amounted to $26.48 per M board feet log scale, not including stumpage or allowance for profit and risk. A breakdown of logging costs is shown in table 4.

Table 4.--Logging costs in Fall Creek thinning sale.

Item	Man hours	Amount	Per M cost
1. Falling and bucking			
(a) Labor	2594	$5,525.19	$6.50
(b) Supplies		211.95	.25
2. Yarding			
(a) Labor	2461	5,361.67	6.31
(b) Supplies		840.28	.99
3. Truck road construction			
(a) Labor	434	947.34	1.11
(b) Supplies		793.73	.93
4. Transportation (of employees)			
(a) Supplies		252.00	.30
5. Loading and truck haul (5 miles)			
(a) Labor	1509	3,139.61	3.69
(b) Supplies		881.38	1.04
6. General expense			
(a) Proportion of administration		934.99	1.10
(b) Proportion of office and clerical expense		125.00	.15
(c) Legal and professional expense			
(d) Insurance on equipment		218.95	.26
(e) Fire insurance		95.10	.11
(f) Timekeeper		75.00	.09
(g) Dues, membership		127.50	.15
7. Payroll taxes			
(a) Industrial insurance and first aid		763.64	.90
(b) Social Security		149.73	.18
(c) Unemployment, State and Federal		269.52	.32
8. Depreciation			
(a) Equipment		1,791.30	2.10
Total, for 849,990 board feet logged		$22,503.88	$26.48

Average milling costs for the last 6 months of 1948 were used for the lumber manufacturing cost in this study, as follows:

Cost item	Dollars per M
Milling costs (gang mill)	$16.73
Depreciation	1.50
Transporting to main mill (12 miles)	3.50
Planing 1/	2.24
Handling and shipping	1.69
Total	$25.66

1/ Average cost for total production. Only part of the lumber was surfaced; none was seasoned.

Selling prices of the lumber during the fall of 1948 amounted to $62.00 per M for No. 2 Common and better f.o.b., the mill, and $42.00 for the No. 3 Common.

Costs and Returns on a Log Scale Basis

Cost and returns for this operation are shown in the following tabulation:

Selling Price		
No. 2 Common and better 98.1 percent at $62.00	$60.82	
No. 3 Common 1.9 percent at $42.00	.79	
Average (lumber tally basis)	$61.61	
Average (log scale - long log - basis, 28 percent overrun)		$78.86
Operating Costs		
Logging cost per M feet of logs	$26.48	
Milling cost per M feet of logs ($25.66 x 1.28)	$32.84	
Total		$59.32
Margin for Stumpage, Profit and Risk		$19.54

Margin for stumpage and profit and risk is the amount left after all operating costs and depreciation are deducted from the selling price. This margin is often called conversion return. The profit and risk portion is the amount due the operator for expenditure of his capital and for his know-how.

Costs and Returns on a Lumber Tally Basis

Most mill men keep their cost and return calculations on the basis of board feet of lumber produced rather than on the footage of logs consumed. Using lumber tally as the basis, the cost and return statement for this operation would be as follows:

Average selling price (lumber tally)		$61.61
Operating cost (lumber tally)		
Logging $26.48 ÷ 1.28	$20.85	
Milling	$25.66	
Total		$46.51
Margin for stumpage and profit and risk (lumber tally)		$15.10

Summary

In the summer of 1948 a thinning experiment was started in a 90-year-old, well-stocked, site II Douglas-fir stand. The purpose of the study was to obtain information on the silvicultural and economic advantages and disadvantages of partial cuttings in immature stands of the Douglas-fir region.

Prior to logging, the 69-acre stand averaged 115 trees, 12 inches and larger, per acre having a net volume of 47 M board feet. Approximately 25 percent of this board-foot volume was marked for cutting. A total of 780 M board feet was advertised for sale in a regular timber sale procedure. The Fall Creek Lumber Company was the successful bidder. They completed the operation in the fall of 1949.

Logging was not difficult. Very little road construction was necessary, and topography was favorable for tractor yarding. Logs were hauled 5 miles to the company's semi-portable Swede gang mill. Lumber produced was trucked another 12 miles to the company's main sawmill and remanufacturing plant at Fall Creek.

In order to get reliable data on the economics of this type of operation, detailed costs were kept on the logging operation, and average milling costs were obtained for the sawmill. Also a detailed 2-day study was made at the mill to get lumber grade recovery for this type of timber.

Logging costs amounted to $26.48 per M board feet log scale. Sawmill costs were $25.66 per M on a lumber tally basis, or $32.48 on a log scale basis since overrun amounted to 28 percent. Lumber from these logs graded 30 percent Select structural, 59 percent No. 1, 9 percent No. 2, and 2 percent No. 3. Average selling price for the lumber was $61.61 lumber tally, or $78.86 log scale. Deducting logging and milling costs from the average sales price left $19.54 to cover stumpage and profit and risk. If all costs and selling prices are computed on a lumber tally basis, as is often the case at sawmills, the amount left for stumpage and profit and risk would be $15.10.

Conclusions

Results of this study demonstrate that we have reached a stage where it is economically feasible to cut and manage our second-growth Douglas-fir forests properly. Each year there is a tremendous loss of wood in these young stands from natural mortality. A forest starts out with hundreds of trees per acre. As these trees grow in size, there is a continuous crowding, and the weaker trees drop out so that at the time the timber is harvested there may be only a hundred trees or less left per acre. Now that periodic improvement cuts can be made at a profit, there is good prospect that timber managers can salvage the volume that would otherwise die, and concentrate growth on the better quality trees without sacrificing volume at the time the final harvest cut is made.