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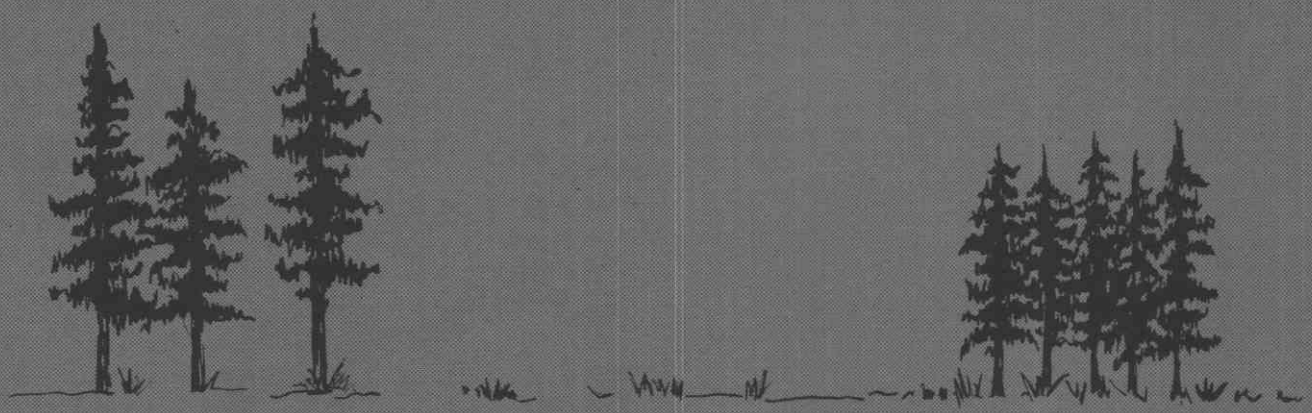
LEVELS-OF-GROWING-STOCK COOPERATIVE STUDY ON DOUGLAS-FIR

REPORT NO. 2

THE HOSKINS STUDY,
1963-1970



PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PORTLAND, OREGON

Levels-of-growing-stock study treatment schedule, showing percent of gross basal area increment of control plot to be retained in growing stock

Thinning	Treatment							
	1	2	3	4	5	6	7	8
	- - - - - - - - - - - - *Percent* - - - - - - - - - - - -							
First	10	10	30	30	50	50	70	70
Second	10	20	30	40	50	40	70	60
Third	10	30	30	50	50	30	70	50
Fourth	10	40	30	60	50	20	70	40
Fifth	10	50	30	70	50	10	70	30

Abstract for Report No. 1

Public and private agencies are cooperating in a study of eight thinning regimes in young Douglas-fir stands. Regimes differ in the amount of basal area allowed to accrue in growing stock at each successive thinning. All regimes start with a common level-of-growing-stock which is established by a conditioning thinning.

Thinning interval is controlled by height growth of crop trees, and a single type of thinning is prescribed.

Nine study areas, each involving three completely random replications of each thinning regime and an unthinned control, have been established in western Oregon and Washington, U.S.A., and Vancouver Island, Canada. Site quality of these areas varies from I through IV.

Climatic and soil characteristics for each area and data for the stand after the conditioning thinning are described briefly.

Keywords: Thinnings, stand growth, Douglas-fir, forest improvement cutting.

LEVELS-OF-GROWING-STOCK COOPERATIVE STUDY ON DOUGLAS-FIR

Report No. 2--The Hoskins Study, 1963-1970

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Forest Service
U.S. Department of Agriculture

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Study area	*Cooperator*
Skykomish	Forestry Research Center Weyerhaeuser Company Centralia, Washington
Hoskins	School of Forestry Oregon State University Corvallis, Oregon
Rocky Brook	U.S. Forest Service Region 6 and Pacific Northwest Forest and Range Experiment Station Portland, Oregon
Clemons	Forestry Research Center Weyerhaeuser Company Centralia, Washington
Francis	Washington State Department of Natural Resources Olympia, Washington
Iron Creek	U.S. Forest Service Region 6 and Pacific Northwest Forest and Range Experiment Station Portland, Oregon
Stampede Creek	U.S. Forest Service Region 6 and Pacific Northwest Forest and Range Experiment Station Portland, Oregon
Campbell River	Canadian Forestry Service Department of the Environment Victoria, British Columbia
Shawnigan Lake	Canadian Forestry Service Department of the Environment Victoria, British Columbia

Consultative services have been provided by the University of Washington and the U.S. Bureau of Land Management.

ABSTRACT

A calibration thinning and the first treatment thinning in a 20-year-old Douglas-fir stand at Hoskins, Oregon, are described. Data tabulated for the first 7 years of management show that growth changes in the thinned stands were greater than anticipated.

INTRODUCTION

This is the second report in a series on a cooperative levels-of-growing-stock study in Douglas-fir in the Pacific Northwest. The Hoskins study was initiated in 1963 as part of the regionwide program designed to examine the effect of different levels of growing stock on wood production, tree size, and growth-growing stock ratios. Report No. 1 presents the study plan including analysis of data and description of installations.

The Hoskins study area is located approximately 22 miles west of Corvallis near Hoskins, Oregon, on land owned by T. J. Starker and Bruce Starker. The area is immediately east of the summit of the Coast Ranges (fig. 1) on a southern aspect with slopes from 15 to 55 percent. At the time the study was established, the stand was 14 years of age at breast height (total age, 20 years) and contained on the average over 1,700 trees per acre. The study area is site class II. The stand is of natural origin following wildfires.

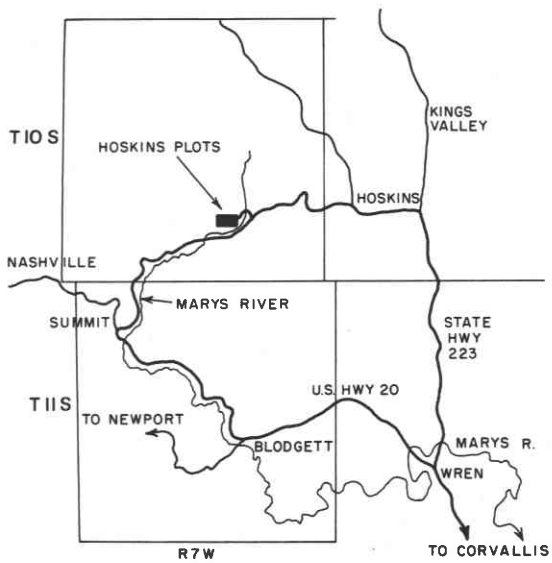

Figure 1.–Location of the Hoskins study.

METHODS

During the summer of 1963, 27 plots, 1/5-acre in size, were established (see appendix, also fig. 2 for map of plot location). Initial density was controlled by a calibration thinning[1] to a prescribed level of basal area. The basal area per acre at the beginning of the calibration period for the 24 treatment plots ranged between 48.2 square feet and 51.1 square feet compared with 122.0 to 158.3 square feet for the three control plots (table 7). The number of trees per acre on the treatment plots ranged from 290 to 395 compared with 1,610 to 1,885 on the control plots.

[1] For basis of calibration thinning, see Richard L. Williamson and George R. Staebler, 1971. Levels-of-growing-stock cooperative study on Douglas-fir. Report No. 1–Description of study and existing study areas. USDA Forest Serv. Res. Pap. PNW-111, 12 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

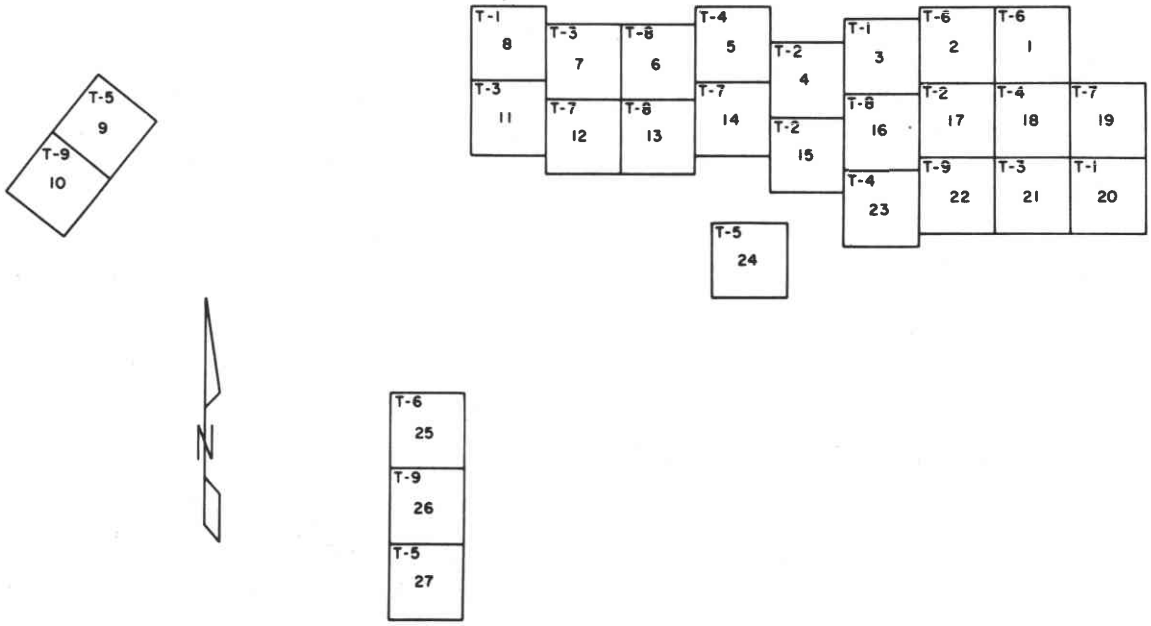

Figure 2.—Layout of Hoskins levels-of-growing-stock study. The plots are one-fifth acre in size.

Crop trees on all plots (including control plots) are numbered 1 through 16 (fig. 3), except plot 26 which has 15 crop trees.

Figure 3.—Picture of plot 22 (control) in 1963. Crop trees have a white circumferential band painted at the point of measurement. Noncrop trees have a different colored band for each treatment and identifying numbers of corresponding color. This facilitates work in the plots and identifies treatments for observers.

At the time of plot establishment, the measurements were made at the conclusion of the 1963 growing season. Height was measured on 340 trees, and these same trees were remeasured at the end of the 1966, 1969, and 1970 growing seasons. D.b.h. of each tree was measured to the nearest 0.1 inch at the end of each growing season, although the study plan called for measurements to be made only at the time of treatment. Annual measurement provides a comparison of diameter and basal area growth among the treatments (see inside front cover for treatments imposed). It also indicates when the response to the treatment occurred.

The periodic diameter, basal area, and increment percent of cubic-foot volume in tables 4 and 5 are calculated using the value at the beginning of the period as the base. For example, the basal area per acre at the outset of the 1964 growing season for treatment 1 was 49.3 square

feet (table 2), and the basal area increment for treatment 1 for the calibration period was 36.2 square feet (table 4), thus, 36.2/49.3 X 100 = 73.4 percent.

RESULTS AND DISCUSSION

Calibration Period

The calibration period[2/] was three growing seasons (1964-66), based on an average height growth of 9.8 feet for the crop trees (see fig. 4 for a pictorial comparison of plot 8 in 1963 and 1966). Mortality (windthrow) on the thinned plots was minimal and occurred primarily between the first and second growing seasons (table 6). Mortality on the control plots was due to natural suppression and occurred throughout the calibration period.

All Trees

Table 2 presents the basic data for all trees (crop and noncrop) for each treatment by growing season for the 7 years the study has been in existence. The stand table at the beginning of the calibration period is presented in table 9, and the stand table at the end of the calibration period is found in table 10. The basal area increment (table 4) for the first growing season on the control plots was 1-1/2 times that of the thinned plots. Yet, the average number of trees per acre on the control plots (table 2) is approximately five times that of the thinned plots. By the third growing season, the basal area increment for the control and thinned plots was nearly equal (table 4), and there was not a significant difference among the eight treatments and the control (at 95-percent probability level). The total basal area at the beginning of the calibration period in 1964 and the

Figure 4.—Picture of plot 8 after thinning in 1963 (upper) and in 1966 (lower).

[2] Thinnings subsequent to the calibration thinning are made whenever the average height growth of the crop trees on all treatments has increased approximately 10 feet (to the nearest growing season).

basal area increments for each growing season, 1964 through 1966, for all treatments and the control are shown in figure 5. Note the uniformity of growth among the treatments during the calibration period.

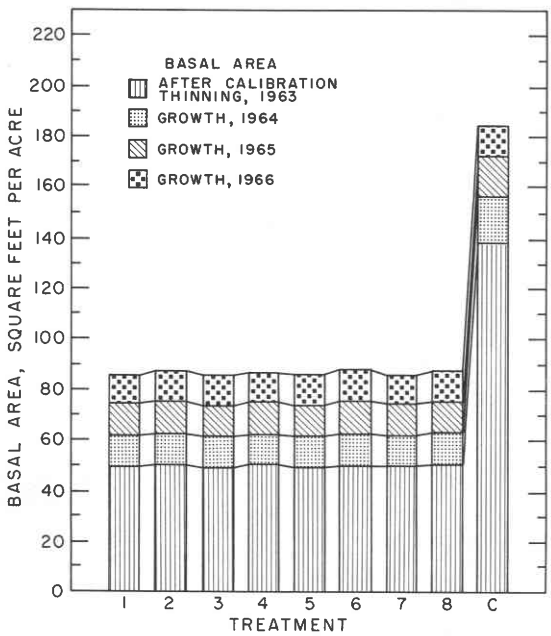

Figure 5.—Basal area by treatment for all trees during calibration period.

Crop Trees

During the calibration period, the average height of the crop trees increased from 36.1 to 45.9 feet (table 1). Table 3 presents other stand data for the crop trees. Table 8 presents basic data by treatment and plot for the crop trees, 1963 through 1970.

Diameter and basal area increment of the crop trees during the first growing season for the eight treatments show that they responded immediately to release. During the calibration period, the basal area increment of the crop trees on the thinned plots was nearly double that of the crop trees on the control plots (table 5 and fig. 7).

First Treatment Period

Following the 3-year calibration period, the first thinning treatments[3] were made between the 1966 and 1967 growing seasons. Data for the trees removed during the first thinning treatment are presented in table 11. The average diameters of trees varied from 6.1 to 6.7 inches. The basal area and cubic-foot volume per tree removed in thinning showed little variation by treatment. There was no mortality on the thinned plots during the first treatment period, but on the control plots mortality increased each year (table 6).

All Trees

In 1967, the first growing season after treatment, the diameter increment among the eight treatments was nearly identical (table 4). In general, the lighter the thinning, the larger the basal area increment. For the 1969 growing season, the basal area increment for each of the eight treatments was greater than that for the control. Yet, the most heavily thinned treatments (1 and 2) had approximately one-third the basal area of the control plots at the end of the 1968 growing season. The basal area increment for each of the eight treatments was nearly double that of the control for the 1970 growing season. The total basal area at the beginning of 1967 and for each

[3]There were in effect only four treatments during the first treatment period—treatments 1 and 2 were treated alike, as were 3 and 4, 5 and 6, and 7 and 8. See inside front cover for treatments imposed.

growing season, 1967 through 1970, for all treatments and the control, is shown in figure 6. Stand tables for 1966 (after thinning) and 1970 are given in tables 12 and 13, respectively.

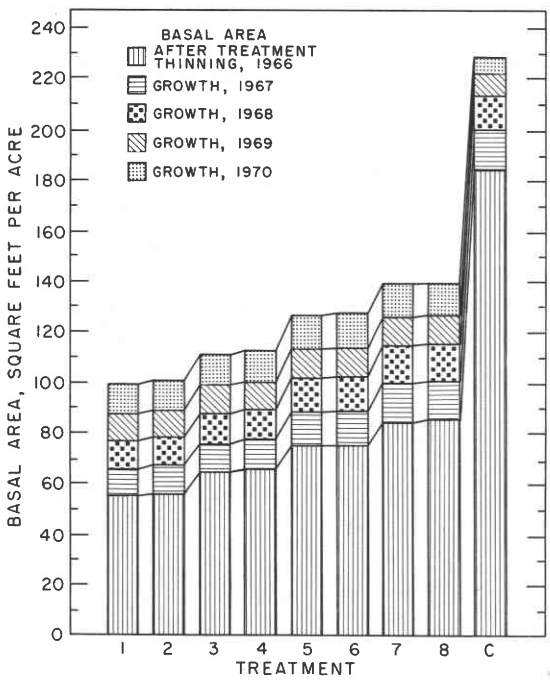

Figure 6.—Basal area by treatment for all trees during first treatment period.

Crop Trees

There was a continued marked increase in the basal area increment of the crop trees on the thinned plots for the first growing season (1967) compared with the crop trees on the control plots (table 5 and fig. 7). During the third and fourth growing seasons after thinning, the crop trees generally responded according to the degree of thinning--that is, the heavier the thinning, the greater the response. For example, the mean basal area per acre of the crop trees for the first growing season for treatments 1 and 2, 3 and 4, 5 and 6, and 7 and 8 ranged from 30.1 to 30.3 square feet with treatments 1 and 2 having the highest value (table 3). The range in mean basal area per acre for these same pairs of treatments in the third year was from 38.2 to 40.5, and the range in the fourth year was from 42.2 to 45.8. Treatments 1 and 2 had the highest values and treatments 7 and 8 the lowest, in each case. Thus, mean basal area per acre varied 0.2 square foot among the pairs of treatments in the first year, increasing to 3.6 square feet by the fourth growing season.

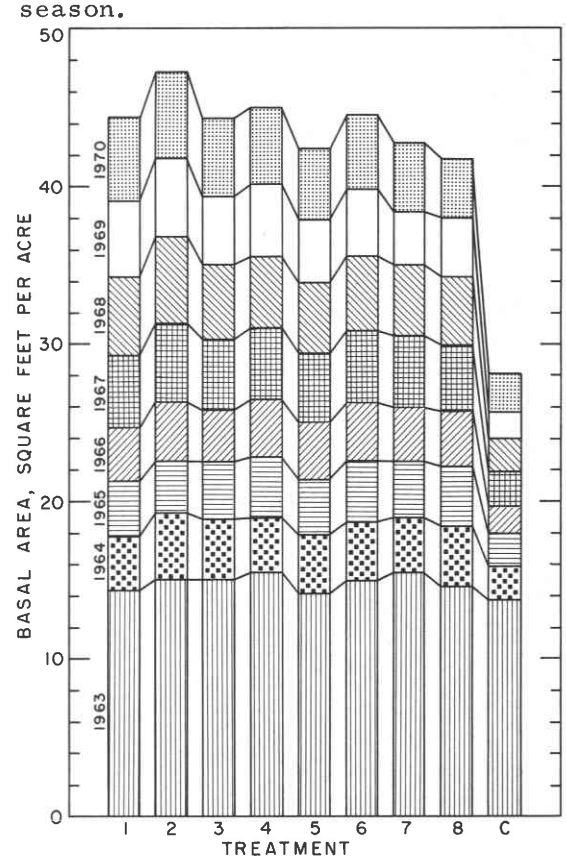

Figure 7.—Basal area by treatment for crop trees.

An analysis of variance comparing basal area increment of crop trees for treatments 1 and 2 with treatments 5 and 6, for the four growing seasons (1967-70), showed there was not a

significant difference (at the 95-percent probability level). However, an analysis of variance comparing basal area increment of crop trees for treatments 1 and 2 (heaviest thinning) with treatments 7 and 8 (lightest thinning) showed there was a significant difference (at the 95-percent probability level) for the three growing seasons (1967-69) and also for the four growing seasons (1967-70).

The percentage of the total growing stock that was represented by the crop trees is given in table 14. Note that the percentage for each treatment (treatments 1-8) was nearly constant from year to year. This indicates that both crop and noncrop trees for a given treatment were growing at the same rate regardless of intensity of thinning. However, the percentage of the total growing stock represented by the crop trees for the control plots had increased from 9.8 percent at the end of the 1963 growing season to 12.3 percent at the end of the 1970 growing season.

SUMMARY

The Hoskins study was established in 1963 as part of a regionwide cooperative program designed to examine the effect of different levels of growing stock on wood production, tree size, and growth-growing stock ratios. This installation was established in 20-year-old Douglas-fir, site class II. The experiment consists of eight treatments plus control replicated three times, making a total of twenty seven 1/5-acre plots in a completely randomized design. A common base for the eight treatments was created by a calibration thinning, with future thinnings to be made whenever the average height of the crop trees on all treatments increases 10 feet.

Preliminary results based on annual measurements for the first 7 years show that substantial changes have occurred in the thinned stand. There was an immediate response in basal area growth after the 1963 calibration thinning. The basal area increment of the thinned plots was nearly equal to the control plots by the third growing season.

The first thinning treatment was applied after the 1966 growing season. By the third growing season, all of the eight treatments had a greater basal area increment than the control plots. In the fourth growing season, the basal area increment for each of the eight treatments was nearly double that of the control.

The basal area increment of the crop trees for the first treatment period (1967-70) was significantly greater at the 95-percent probability level on the most heavily thinned treatments (1 and 2), compared with the most lightly thinned treatments (7 and 8).

The initial results of this study indicate that young Douglas-fir stands provide many opportunities for manipulating the growing stock to achieve the objectives of management.

APPENDIX

Calibration Thinning

Sixty-five man-days were required for locating the area, surveying plot boundaries, marking crop and other leave trees, and making initial measurements and office computations. In addition, 10 man-days were spent in making the final measurements following the calibration thinning.

During the summer of 1963, an Oregon State Forestry Department 30-man emergency fire crew stationed near Corvallis pruned the trees to just above head height to facilitate work on the plots. After the trees were marked for the calibration thinning, the unmarked trees were felled by the State Forestry crew.

The First Treatment Thinning

The following procedure was used to determine level-of-growing-stock for each treatment for the first thinning. Average gross basal area increment per acre in square feet of the three control plots equals net basal area increment plus mortality.

Average basal area increment per acre	= 46.55
Average basal area mortality per acre	= 1.98
Average gross basal area increment per acre	= 48.53

48.53 ÷ 5 = 9.71 gross increment per 1/5 acre

Average basal area per plot (one-fifth acre) of the 24 treated plots at end of 1963 growing season was 9.97 square feet.

Basal area level in square feet per treatment at conclusion of first thinning:

Treatments 1 and 2 = 9.97 + 10 percent of 9.71 = 10.94 or 54.70 per acre.
Treatments 3 and 4 = 9.97 + 30 percent of 9.71 = 12.88 or 64.40 per acre.
Treatments 5 and 6 = 9.97 + 50 percent of 9.71 = 14.82 or 74.10 per acre.
Treatments 7 and 8 = 9.97 + 70 percent of 9.71 = 16.77 or 83.85 per acre.

No trees were removed from two of the plots in treatment 7.

Table 1.--*Mean height of crop trees by treatment*[1/]

Treatment number	Number of trees measured	Mean height			
		1963	1966	1969	1970
		----------*Feet*----------			
1	33	35.9	45.3	56.0	59.7
2	30	35.1	46.0	56.7	60.7
3	30	36.1	45.8	56.3	59.6
4	32	36.8	47.3	57.8	61.1
5	31	35.7	45.9	56.8	59.6
6	30	36.7	46.0	56.7	60.2
7	31	35.9	45.3	56.0	59.5
8	33	36.3	45.8	56.3	60.0
Control	35	36.5	45.9	55.3	59.2
All trees	285	36.1	45.9	56.4	59.9
Standard deviation		.53	.58	.48	.61
Coefficient of variation		1.5	1.3	1.2	1.0

[1/] Data are as of the end of the growing season.

Table 2.--*Stand data by treatment for all trees*[1/]
(Per acre)

Treatment number	Number of trees[2/]									Average diameter breast height[3/]								
	Calibration period				First treatment period					Calibration period				First treatment period				
	1963	1964	1965	1966	1966[4/]	1967	1968	1969	1970	1963	1964	1965	1966	1966[4/]	1967	1968	1969	1970
										Inches								
1	353	352	352	352	215	215	215	215	215	5.1	5.7	6.2	6.7	6.9	7.5	8.1	8.7	9.2
2	343	342	342	342	207	207	207	207	207	5.2	5.8	6.3	6.8	7.0	7.7	8.3	8.9	9.4
3	343	343	343	342	252	252	252	252	252	5.1	5.7	6.3	6.8	6.8	7.4	8.0	8.5	9.0
4	333	332	330	330	243	243	243	243	243	5.3	5.9	6.5	6.9	7.0	7.7	8.2	8.7	9.2
5	365	363	363	363	312	312	312	312	312	5.0	5.6	6.1	6.6	6.6	7.2	7.7	8.2	8.6
6	338	338	338	338	283	283	283	283	283	5.2	5.8	6.4	6.9	7.0	7.6	8.1	8.6	9.1
7	328	328	328	328	323	323	323	323	323	5.3	5.9	6.5	6.9	6.9	7.5	8.1	8.5	8.9
8	337	335	335	335	327	327	327	327	327	5.2	5.9	6.4	6.9	6.9	7.5	8.0	8.4	8.8
Control	1,727	1,710	1,687	1,640	1,640	1,595	1,525	1,410	1,272	3.8	4.1	4.3	4.5	4.5	4.8	5.1	5.4	5.7

	Basal area									Total volume[5/]				
	Calibration period				First treatment period					Calibration period		First treatment period		
	1963	1964	1965	1966	1966[4/]	1967	1968	1969	1970	1963	1966	1966[4/]	1969	1970
	Square feet									*Cubic feet*				
1	49.3	61.4	74.1	85.5	55.1	65.7	77.0	87.8	99.5	839	1,770	1,153	2,168	2,588
2	50.0	62.1	75.0	87.1	55.9	67.1	78.3	89.0	100.5	827	1,824	1,180	2,220	2,630
3	49.0	61.6	73.9	85.1	64.4	75.8	88.1	99.1	111.4	845	1,785	1,357	2,464	2,893
4	50.4	62.0	75.0	86.7	65.6	77.9	89.4	100.3	112.7	855	1,835	1,398	2,524	2,970
5	49.2	61.5	73.8	86.0	74.9	88.0	101.7	113.6	126.5	814	1,766	1,546	2,818	3,287
6	49.9	62.6	75.6	88.0	75.1	88.6	102.1	113.7	127.1	854	1,820	1,560	2,816	3,284
7	50.1	62.1	74.3	85.9	84.9	100.0	114.8	126.1	139.4	854	1,777	1,756	3,113	3,627
8	50.4	62.9	75.8	87.8	85.8	100.1	115.2	126.7	139.3	871	1,848	1,807	3,155	3,650
Control	138.1	156.8	172.5	184.7	184.7	200.5	213.7	222.6	228.6	2,318	3,779	3,779	5,353	5,816

1/ Data are as of the end of the growing season.

2/ Rounded to nearest whole tree.

3/ Diameter of tree of mean basal area.

4/ 1966 data minus thinned trees.

5/ Cubic-foot volume derived from table 12 of Richard E. McArdle, Walter H. Meyer, and Donald Bruce. 1961. The yield of Douglas-fir in the Pacific Northwest. U.S. Dep. Agric. Tech. Bull. 201 (rev.), 74 p.

Table 3.--*Stand data by treatment for crop trees*[1/]

(Per acre)

Treatment number	Number of trees	Average diameter breast height[2/]								
		Calibration period				First treatment period				
		1963	1964	1965	1966	1966[3/]	1967	1968	1969	1970
		Inches								
1	80	5.7	6.4	7.0	7.5	7.5	8.2	8.9	9.5	10.1
2	80	5.9	6.7	7.2	7.8	7.8	8.5	9.2	9.8	10.4
3	80	5.9	6.6	7.2	7.7	7.7	8.3	9.0	9.5	10.1
4	80	6.0	6.6	7.2	7.8	7.8	8.4	9.0	9.6	10.2
5	80	5.7	6.4	7.0	7.6	7.6	8.2	8.8	9.3	9.9
6	80	5.9	6.5	7.2	7.8	7.8	8.4	9.0	9.6	10.1
7	80	6.0	6.6	7.2	7.7	7.7	8.4	9.0	9.4	9.9
8	80	5.8	6.5	7.1	7.7	7.7	8.3	8.9	9.3	9.8
Control	80	5.6	6.0	6.4	6.7	6.7	7.1	7.4	7.7	8.0

Treatment number	Basal area									Volume[4/]				
	Calibration period				First treatment period					Calibration period		First treatment period		
	1963	1964	1965	1966	1966[3/]	1967	1968	1969	1970	1963	1966	1966[3/]	1969	1970
	Square feet									*Cubic feet*				
1	14.4	17.8	21.3	24.7	24.7	29.3	34.3	39.1	44.4	254	529	529	987	1,180
2	15.0	19.3	22.6	26.3	26.3	31.3	36.8	41.8	47.3	257	572	572	1,069	1,269
3	15.1	18.6	22.5	25.8	25.8	30.3	35.1	39.4	44.3	266	556	556	997	1,169
4	15.5	19.0	22.9	26.5	26.5	31.1	35.6	40.2	45.0	275	584	584	1,037	1,209
5	14.2	17.9	21.4	25.0	25.0	29.4	33.9	37.9	42.4	250	541	541	974	1,131
6	15.0	18.7	22.6	26.2	26.2	30.9	35.6	39.8	44.5	269	566	566	1,009	1,178
7	15.6	19.0	22.6	26.0	26.0	30.6	35.1	38.4	42.8	263	555	555	972	1,136
8	14.6	18.4	22.2	25.7	25.7	29.9	34.3	38.0	41.7	260	556	556	971	1,120
Control	13.8	15.9	17.9	19.7	19.7	21.9	24.0	25.7	28.1	246	428	428	660	757

1/ Data are as of end of growing season.

2/ Diameter of tree of mean basal area.

3/ 1966 data minus thinned trees.

4/ Cubic-foot volume derived from table 12 of Richard E. McArdle, Walter H. Meyer, and Donald Bruce. 1961. The yield of Douglas-fir in the Pacific Northwest. U.S. Dep. Agric. Tech. Bull. 201 (rev.), 74 p.

Table 4.-- ***Increment data for all trees***

(Per acre)

Treatment number	Diameter breast height increment											Basal area increment											Volume increment[1/]				
	Calibration period					First treatment period						Calibration period					First treatment period						Calibration period, 1964-66		First treatment period		
	1964	1965	1966	Total		1967	1968	1969	1970	Total		1964	1965	1966	Total		1967	1968	1969	1970	Total				1970	Total	
	--------*Inches*-------				*Percent*	----------*Inches*----------					*Percent*	-----*Square feet*-----				*Percent*	---------*Square feet*---------					*Percent*	*Cubic feet*	*Percent*	*Cubic feet*		*Percent*
1	0.6	0.5	0.5	1.6	31.4	0.6	0.6	0.6	0.5	2.3	33.3	12.1	12.7	11.4	36.2	73.4	10.6	11.3	10.8	11.7	44.4	80.6	931	110.9	420	1,435	124.5
2	.6	.5	.5	1.6	30.8	.7	.6	.6	.5	2.4	34.3	12.1	12.9	12.1	37.1	74.2	11.2	11.2	10.7	11.5	44.6	79.8	997	120.6	410	1,450	122.9
3	.6	.6	.5	1.7	33.3	.6	.6	.5	.5	2.2	32.4	12.6	12.3	11.2	36.1	73.7	11.4	12.3	11.0	12.3	47.0	73.0	940	111.2	429	1,536	113.2
4	.6	.6	.4	1.6	30.2	.7	.5	.5	.5	2.2	31.4	11.6	13.0	11.7	36.3	72.0	12.2	11.5	11.0	12.4	47.1	71.8	980	114.6	446	1,572	112.4
5	.6	.5	.5	1.6	32.0	.6	.5	.5	.4	2.0	30.3	12.3	12.3	12.2	36.8	74.8	13.1	13.7	11.9	12.9	51.6	68.9	952	116.8	469	1,741	112.6
6	.6	.6	.5	1.7	32.7	.6	.6	.4	.5	2.1	30.0	12.7	13.0	12.4	38.1	76.4	13.5	13.5	11.6	13.4	52.0	69.2	966	113.1	468	1,724	110.5
7	.6	.6	.4	1.6	30.2	.6	.6	.4	.4	2.0	29.0	11.7	12.5	11.2	35.4	70.7	15.1	14.7	11.2	13.3	54.5	64.2	923	108.1	514	1,871	106.5
8	.7	.5	.5	1.7	32.7	.6	.5	.4	.4	1.9	27.5	12.5	12.9	12.0	37.4	74.2	14.3	15.1	11.5	12.6	53.5	62.4	977	112.2	495	1,843	102.0
Control	.3	.2	.2	.7	18.4	.3	.3	.3	.3	1.2	26.7	18.8	15.7	12.2	46.6	33.7	15.8	13.2	8.9	6.0	43.9	23.8	1,461	63.0	463	2,037	53.9

1/ Volume computed only for the years height was measured.

Table 5.-- ***Increment data for crop trees***

(Per acre)

Treatment number	Diameter breast height increment											Basal area increment											Volume increment[1/]				
	Calibration period					First treatment period						Calibration period					First treatment period						Calibration period, 1964-66		First treatment period		
	1964	1965	1966	Total		1967	1968	1969	1970	Total		1964	1965	1966	Total		1967	1968	1969	1970	Total				1970	Total	
	--------*Inches*-------				*Percent*	----------*Inches*----------					*Percent*	-----*Square feet*-----				*Percent*	--------*Square feet*---------					*Percent*	*Cubic feet*	*Percent*	*Cubic feet*		*Percent*
1	0.7	0.6	0.5	1.8	31.6	0.7	0.7	0.6	0.6	2.6	34.7	3.4	3.5	3.4	10.3	71.5	4.6	5.0	4.8	5.3	19.7	79.8	275	108.3	193	651	123.1
2	.8	.5	.6	1.9	32.2	.7	.7	.6	.6	2.6	33.3	3.6	4.0	3.7	11.3	75.3	5.0	5.5	5.0	5.5	21.0	79.8	315	122.6	200	697	121.8
3	.7	.6	.5	1.8	30.5	.6	.7	.5	.6	2.4	31.2	3.8	3.6	3.3	10.7	70.9	4.5	4.8	4.3	4.9	18.5	71.7	290	111.1	172	613	110.2
4	.6	.6	.6	1.8	30.0	.6	.6	.6	.6	2.4	30.8	3.5	3.9	3.6	11.0	71.0	4.6	4.5	4.6	4.8	18.5	69.8	309	112.4	172	625	107.0
5	.7	.6	.6	1.9	33.3	.6	.6	.5	.6	2.3	30.3	3.7	3.5	3.6	10.8	76.1	4.4	4.5	4.0	4.5	17.4	69.6	291	116.4	157	590	109.1
6	.6	.7	.5	1.8	30.5	.7	.6	.6	.5	2.3	29.5	3.7	3.9	3.6	11.2	74.7	4.7	4.7	4.2	4.7	18.3	69.8	297	110.4	169	612	108.1
7	.6	.6	.5	1.7	28.3	.7	.6	.4	.5	2.2	28.6	3.4	3.6	3.4	10.4	66.7	4.6	4.5	3.3	4.4	16.8	64.6	292	111.0	164	581	104.7
8	.7	.6	.6	1.9	32.8	.6	.6	.4	.5	2.1	27.3	3.8	3.8	3.5	11.1	76.0	4.2	4.4	3.7	3.7	16.0	62.3	296	113.8	149	564	101.4
Control	.4	.4	.3	1.1	19.6	.4	.3	.3	.3	1.3	19.4	2.1	2.0	1.8	5.9	42.8	2.2	2.1	1.7	2.4	8.4	42.6	182	74.0	97	329	76.9

1/ Volume computed only for the years height was measured.

Table 6.--*Mortality by treatment of all trees*

(Per acre)

Treatment number	Number of trees					Basal area				
	Calibration period, 1964-66	First treatment period				Calibration period, 1964-66	First treatment period			
		1967	1968	1969	1970		1967	1968	1969	1970
						Square feet				
1	1	0	0	0	0	0.1	0	0	0	0
2	1	0	0	0	0	.2	0	0	0	0
3	1	0	0	0	0	.2	0	0	0	0
4	3	0	0	0	0	.3	0	0	0	0
5	1	0	0	0	0	.3	0	0	0	0
6	0	0	0	0	0	.0	0	0	0	0
7	0	0	0	0	0	.0	0	0	0	0
8	1	0	0	0	0	.2	0	0	0	0
Control	87	45	70	115	138	2.0	1.1	2.1	3.7	5.9
	Average diameter[1/]					Volume[2/]				
	Calibration period, 1964-66	First treatment period				Calibration period, 1964-66	First treatment period			
		1967	1968	1969	1970		1967	1968	1969	1970
	Inches					*Cubic feet*				
1	3.5	0	0	0	0	1.7	0	0	0	0
2	4.2	0	0	0	0	2.2	0	0	0	0
3	4.1	0	0	0	0	2.9	0	0	0	0
4	4.1	0	0	0	0	4.8	0	0	0	0
5	5.4	0	0	0	0	4.5	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	5.0	0	0	0	0	3.7	0	0	0	0
Control	2.1	2.2	2.3	2.4	2.8	27.0	17.7	33.9	66.7	118.9

1/ Diameter of tree of mean basal area.

2/ Cubic-foot volume derived from table 12 of Richard E. McArdle, Walter H. Meyer, and Donald Bruce. 1961. The yield of Douglas-fir in the Pacific Northwest. U.S. Dep. Agric. Tech. Bull. 201 (rev.), 74 p.

Table 7.--*Basic data by treatment and plot for all tree*

(P

Treatment and plot numbers	Number of trees								Diameter[2/]							
	1963	1964	1965	1966	1967	1968	1969	1970	1963	1964	1965	1966	1967	1968	1969	197
									Inches							
1:																
3	345	345	345	345	210	210	210	210	5.1	5.7	6.4	6.8	7.6	8.3	8.9	9.
8	380	375	375	375	225	225	225	225	5.0	5.5	6.0	6.4	7.3	7.9	8.4	8.
20	335	335	335	335	210	210	210	210	5.1	5.8	6.3	6.8	7.6	8.2	8.7	9.
2:																
4	360	360	360	360	220	220	220	220	5.1	5.6	6.2	6.7	7.5	8.1	8.6	9.
15	325	325	325	325	185	185	185	185	5.3	5.9	6.5	7.1	8.2	8.9	9.5	10.
17	345	340	340	340	215	215	215	215	5.2	5.8	6.3	6.8	7.5	8.1	8.6	9.
3:																
7	390	390	390	390	295	295	295	295	4.8	5.3	5.8	6.3	6.9	7.4	7.9	8.
11	340	340	340	340	240	240	240	240	5.1	5.8	6.4	6.9	7.7	8.3	8.8	9.
21	300	300	300	295	220	220	220	220	5.5	6.2	6.7	7.3	7.8	8.4	8.9	9.
4:																
5	390	390	390	390	285	285	285	285	4.9	5.4	6.0	6.4	7.2	7.7	8.2	8.
18	320	320	320	320	245	245	245	245	5.3	5.9	6.5	7.0	7.7	8.2	8.7	9.
23	290	285	280	280	200	200	200	200	5.7	6.3	6.9	7.5	8.3	8.9	9.4	10.
5:																
9	355	355	355	355	315	315	315	315	5.0	5.6	6.1	6.6	7.2	7.8	8.1	8.
24	345	345	345	345	280	280	280	280	5.2	5.9	6.4	6.9	7.6	8.2	8.6	9.
27	395	390	390	390	340	340	340	340	4.8	5.3	5.8	6.3	6.9	7.4	7.9	8.
6:																
1	325	325	325	325	275	275	275	275	5.3	5.9	6.5	7.0	7.7	8.2	8.7	9.
2	360	360	360	360	300	300	300	300	5.1	5.7	6.3	6.7	7.4	7.9	8.4	8.
25	330	330	330	330	275	275	275	275	5.2	5.9	6.4	7.0	7.7	8.2	8.7	9.
7:																
12	330	330	330	330	330	330	330	330	5.2	5.8	6.4	6.8	7.4	7.9	8.3	8.
14	325	325	325	325	310	310	310	310	5.4	6.0	6.6	7.1	7.7	8.3	8.7	9.
19	330	330	330	330	330	330	330	330	5.3	5.9	6.4	6.9	7.5	8.0	8.4	8.
8:																
6	375	370	370	370	360	360	360	360	5.0	5.6	6.2	6.6	7.2	7.7	8.1	8.
13	330	330	330	330	320	320	320	320	5.3	6.0	6.5	7.0	7.5	8.1	8.5	8
16	305	305	305	305	300	300	300	300	5.4	6.1	6.7	7.2	7.8	8.4	8.8	9
Control:																
10	1,885	1,885	1,875	1,830	1,770	1,670	1,555	1,425	3.6	3.8	4.0	4.2	4.5	4.7	5.0	5.
22	1,610	1,565	1,510	1,430	1,395	1,345	1,230	1,110	4.2	4.6	4.8	5.1	5.4	5.6	6.0	6.
26	1,685	1,680	1,675	1,660	1,620	1,560	1,445	1,280	3.6	3.9	4.2	4.3	4.6	4.9	5.2	5.

1/ Data are as of the end of the growing season.

2/ Diameter of tree of mean basal area.

963-70 (calibration and first treatment periods) 1/

cre)

Basal area								Volume			
1963	1964	1965	1966	1967	1968	1969	1970	1963	1966	1969	1970
Square feet								*Cubic feet*			
49.5	61.6	76.0	88.4	67.0	78.8	90.2	102.1	799.8	1,744.6	2,158.6	2,562.5
50.2	61.3	73.0	84.2	64.8	75.9	86.4	98.1	879.0	1,762.4	2,180.6	2,620.8
48.3	61.4	73.3	84.0	65.3	76.4	86.7	98.3	837.0	1,803.8	2,165.2	2,580.6
50.3	61.5	75.7	87.3	67.4	79.0	89.3	102.2	835.4	1,812.2	2,212.2	2,647.8
50.1	63.5	75.2	88.3	67.9	79.6	91.4	102.6	854.0	1,938.6	2,321.6	2,741.0
49.6	61.3	74.3	85.7	65.8	76.2	86.3	96.7	791.9	1,720.4	2,125.0	2,499.8
48.7	60.3	72.3	83.4	76.6	89.1	100.4	113.1	855.6	1,738.4	2,492.0	2,906.4
49.3	62.1	75.1	87.2	77.2	89.4	101.5	114.5	845.1	1,819.4	2,531.4	3,021.2
49.1	62.5	74.2	84.7	73.8	85.6	95.3	106.4	833.8	1,798.5	2,369.0	2,752.3
50.6	62.2	76.8	88.3	79.7	92.3	103.7	116.2	825.0	1,761.5	2,476.8	2,902.4
49.6	61.5	74.6	85.9	78.4	89.9	101.1	113.5	808.2	1,805.4	2,563.6	3,020.4
51.0	62.2	73.5	85.8	75.3	85.8	96.0	108.3	930.8	1,937.1	2,533.0	2,988.2
48.2	59.7	71.7	83.5	87.7	102.4	113.6	126.5	851.5	1,828.2	2,943.3	3,446.3
50.7	64.9	77.6	89.9	88.6	101.7	112.5	124.1	794.4	1,798.0	2,730.4	3,163.4
48.7	59.9	72.0	84.5	87.7	101.1	114.6	128.9	794.6	1,672.0	2,780.8	3,251.2
50.2	62.2	75.4	87.2	88.0	101.8	113.5	125.3	865.5	1,816.0	2,838.4	3,239.0
50.5	63.3	76.9	89.1	89.6	103.2	114.8	127.9	847.0	1,782.6	2,783.4	3,221.0
48.8	62.1	74.4	87.6	88.3	101.4	112.9	128.1	850.5	1,861.3	2,825.3	3,392.1
49.2	60.7	73.0	83.7	98.6	113.5	123.7	136.7	857.0	1,755.7	3,099.3	3,589.2
51.0	63.8	76.2	88.5	100.3	115.8	127.4	141.6	893.4	1,884.1	3,173.8	3,691.0
50.2	61.7	74.5	85.5	101.2	115.2	127.3	139.8	810.0	1,639.8	3,072.3	3,600.3
51.1	63.1	77.1	88.7	100.7	116.2	128.9	141.4	850.2	1,818.6	3,113.6	3,606.7
51.0	64.0	76.2	88.1	99.0	114.9	125.0	137.2	880.4	1,811.4	3,075.5	3,521.2
49.0	61.8	74.2	86.5	100.8	114.6	126.4	139.2	882.8	1,913.6	3,275.1	3,821.3
134.1	152.0	167.7	178.3	193.9	204.5	212.8	218.7	2,139.2	3,578.0	5,006.4	5,355.0
158.3	176.5	191.1	201.7	218.5	233.0	240.9	245.9	2,643.9	4,184.2	5,965.0	6,470.2
122.0	142.0	158.8	174.0	188.9	203.4	214.1	221.3	2,171.4	3,574.9	5,087.9	5,623.4

Table 8.--*Basic data by treatment and plot for crop trees,*

(Per

Treatment and plot numbers	Number of trees	Diameter[2/]							
		1963	1964	1965	1966	1967	1968	1969	1970
		Inches							
1:									
3	80	5.6	6.1	6.8	7.4	8.1	8.8	9.4	10.0
8	80	6.0	6.6	7.2	7.7	8.4	9.0	9.7	10.3
20	80	5.7	6.3	6.9	7.4	8.1	8.8	9.4	9.9
2:									
4	80	5.6	6.2	6.8	7.3	8.0	8.7	9.3	9.9
15	80	6.6	7.7	8.0	8.7	9.4	10.2	10.9	11.6
17	80	5.3	6.0	6.7	7.2	7.9	8.6	9.1	9.7
3:									
7	80	5.7	6.4	6.9	7.4	8.0	8.7	9.2	9.8
11	80	6.2	6.9	7.5	8.1	8.7	9.4	10.0	10.5
21	80	5.8	6.5	7.1	7.6	8.2	8.8	9.3	9.9
4:									
5	80	5.7	6.3	7.0	7.4	8.1	8.7	9.2	9.7
18	80	5.4	6.0	6.6	7.1	7.8	8.4	8.9	9.5
23	80	6.7	7.4	8.1	8.7	9.4	10.0	10.6	11.2
5:									
9	80	5.7	6.3	6.9	7.5	8.1	8.7	9.2	9.8
24	80	5.9	6.7	7.3	7.8	8.5	9.1	9.6	10.1
27	80	5.5	6.2	6.8	7.4	8.0	8.6	9.1	9.7
6:									
1	80	6.0	6.6	7.3	7.9	8.5	9.2	9.7	10.2
2	80	5.6	6.2	6.8	7.4	8.0	8.6	9.1	9.7
25	80	6.0	6.8	7.4	8.0	8.7	9.3	9.8	10.4
7:									
12	80	6.0	6.6	7.2	7.9	8.3	8.9	9.3	9.8
14	80	6.0	6.7	7.3	7.9	8.5	9.2	9.6	10.2
19	80	6.0	6.6	7.1	7.6	8.3	8.8	9.2	9.7
8:									
6	80	5.8	6.5	7.2	7.7	8.3	9.0	9.4	9.9
13	80	6.1	6.8	7.5	8.0	8.5	9.2	9.6	10.0
16	80	5.5	6.2	6.8	7.3	8.0	8.5	8.9	9.4
Control:									
10	80	5.5	6.0	6.3	6.6	7.0	7.2	7.5	7.8
22	80	5.9	6.3	6.6	6.9	7.2	7.5	7.8	8.2
26	80	5.4	5.9	6.3	6.7	7.0	7.4	7.8	8.1

1/ Data are as of the end of the growing season.

2/ Diameter of tree of mean basal area.

1963-70 (calibration and first treatment periods) 1/

acre)

Basal area								Volume				Height of crop trees			
1963	1964	1965	1966	1967	1968	1969	1970	1963	1966	1969	1970	1963	1966	1969	1970
Square feet								*Cubic feet*				*Feet*			
13.5	16.7	20.4	23.8	28.5	33.7	38.6	43.7	224.4	483.4	937.3	1,115.0	34.1	42.7	54.5	58.1
15.7	19.1	22.5	26.1	30.7	35.7	40.7	46.3	290.8	573.0	1,056.3	1,278.8	37.5	46.5	57.5	61.4
14.0	17.5	20.9	24.2	28.7	33.4	38.1	43.1	248.4	530.9	966.4	1,145.8	36.0	46.3	55.6	59.3
13.6	16.7	20.2	23.4	28.2	33.2	37.4	42.8	226.6	492.8	939.2	1,121.9	34.7	45.5	56.6	59.1
19.0	23.5	28.0	32.7	38.6	45.0	51.7	58.3	347.6	758.0	1,358.9	1,610.9	37.9	50.2	60.4	64.7
12.5	15.7	19.5	22.9	27.2	32.1	36.3	40.9	197.4	464.5	907.7	1,073.6	33.2	42.9	54.7	58.3
14.3	17.6	20.9	24.2	28.2	32.7	37.0	41.7	257.4	528.4	947.3	1,109.5	37.0	46.4	57.1	59.8
16.5	20.7	24.6	28.4	33.3	38.3	43.2	48.4	292.2	606.4	1,094.6	1,289.8	37.0	46.2	57.0	61.0
14.5	18.4	21.9	24.9	29.5	34.2	38.0	42.7	247.8	533.6	948.3	1,106.9	34.5	44.8	55.1	58.0
14.3	17.4	21.1	24.2	28.6	32.8	37.0	40.9	244.2	507.8	914.5	1,051.1	35.5	44.5	54.3	56.9
12.9	15.7	19.1	22.1	26.3	30.6	34.8	39.5	209.4	461.7	877.8	1,048.6	34.1	45.3	57.2	60.4
19.4	23.7	28.4	33.2	38.5	43.5	48.9	54.6	370.8	782.4	1,318.4	1,528.6	40.4	52.0	62.3	65.9
14.1	17.4	20.9	24.5	28.7	33.4	37.2	41.6	260.8	562.6	993.8	1,152.8	37.9	49.5	60.1	63.1
15.2	19.5	23.0	26.7	31.6	36.3	40.3	44.7	259.4	568.1	1,017.8	1,180.0	34.4	43.9	54.8	58.4
13.4	16.8	20.3	23.6	27.8	31.9	36.3	41.0	229.8	491.7	909.6	1,060.5	34.8	43.9	55.3	57.2
15.6	19.3	23.5	27.1	31.6	36.6	40.8	45.2	287.0	596.5	1,053.3	1,212.3	36.9	46.4	57.8	61.0
13.5	16.9	20.4	23.7	28.2	32.6	36.5	40.8	232.3	489.8	900.5	1,046.8	35.0	43.8	54.4	57.3
15.7	19.9	23.8	27.9	32.8	37.5	42.1	47.4	288.5	610.6	1,074.2	1,275.4	38.3	47.8	58.0	62.2
15.5	18.9	22.4	25.7	30.3	34.4	37.8	41.6	275.2	551.0	963.8	1,107.0	36.8	46.2	57.4	60.4
15.6	19.3	23.1	27.1	31.7	36.9	40.4	45.5	277.4	591.7	1,023.8	1,208.2	37.0	46.7	56.5	60.0
15.7	18.8	22.2	25.2	29.7	33.9	37.1	41.2	236.1	521.4	929.1	1,093.5	34.0	43.3	54.4	58.0
14.6	18.3	22.5	26.0	30.1	35.0	38.8	42.9	257.2	564.5	995.6	1,152.4	35.5	45.3	55.7	59.2
16.1	20.1	23.9	27.6	31.8	36.6	40.3	43.9	287.4	585.0	1,014.8	1,152.6	36.6	45.1	55.9	59.1
13.0	16.7	20.1	23.5	27.7	31.4	34.8	38.3	234.6	519.6	902.4	1,054.2	36.9	47.1	57.5	61.8
13.4	15.4	17.4	18.9	21.1	22.9	24.5	26.3	235.2	403.6	617.4	690.4	36.5	45.6	55.3	58.3
15.3	17.2	19.2	20.7	22.9	24.8	26.4	29.6	281.6	466.6	698.9	822.6	37.2	46.8	56.0	60.8
12.7	15.0	17.3	19.4	21.6	24.2	26.3	28.3	222.2	414.2	664.6	756.8	35.7	45.0	54.5	58.5

Table 9.--*Stand table after calibration thinning, 1963*[1/]

(Number of trees per acre)

D.b.h. class (inches)	Treatment number								
	1	2	3	4	5	6	7	8	Control
2	2	--	--	--	--	--	--	--	533
3	28	42	43	33	45	32	33	32	420
4	123	75	100	80	105	85	75	83	357
5	105	123	97	105	118	118	92	110	225
6	63	72	75	77	77	65	92	70	118
7	32	30	17	33	17	37	28	33	43
8	--	2	8	3	3	2	8	7	5
9	--	--	3	2	--	--	--	2	2
10	--	--	--	--	--	--	--	--	2
Total	353	344	343	336	365	339	328	337	1,725

1/ Rounded to nearest whole tree.

Table 10.--*Stand table for end of calibration period, 1966*[1/]

(Number of trees per acre)

D.b.h. class (inches)	Treatment number								
	1	2	3	4	5	6	7	8	Control
2	--	--	--	--	--	--	--	--	307
3	2	--	--	--	--	--	--	2	407
4	23	33	25	20	32	18	22	23	333
5	58	48	67	52	70	47	55	52	243
6	102	97	97	77	93	92	63	83	165
7	87	72	62	85	85	92	85	75	112
8	43	57	55	52	67	48	65	57	50
9	30	33	25	33	12	37	28	30	15
10	7	7	8	5	8	5	8	10	3
11	--	--	3	0	--	--	--	3	3
12	--	--	--	2	--	--	--	--	2
Total	352	347	342	328	367	339	326	335	1,640

1/ Rounded to nearest whole tree.

Table 11.--*Trees removed in first treatment thinning, 1966*

(Per acre)

Treatment number	Number of trees[1/]	Average d.b.h.	Basal area		Volume	
			Total	Per tree	Total	Per tree
		Inches	*-----Square feet------*		*------Cubic feet------*	
1	137	6.4	30.4	0.220	612.40	4.47
2	135	6.5	31.2	.230	643.70	4.77
3	90	6.5	20.7	.230	428.30	4.76
4	87	6.7	21.1	.245	436.25	5.07
5	51	6.2	11.1	.215	218.60	4.20
6	55	6.5	12.9	.235	260.00	4.73
7	5	6.1	1.0	.205	20.80	4.16
8	8	6.7	2.0	.250	40.45	5.06

[1/] Rounded to nearest whole tree.

Table 12.--*Stand table after first treatment thinning, 1966*[1/]

(Number of trees per acre)

D.b.h. class (inches)	Treatment number								
	1	2	3	4	5	6	7	8	Control
2	--	--	--	--	--	--	--	--	307
3	--	--	--	--	--	--	--	2	407
4	15	15	22	17	25	13	20	23	333
5	28	25	43	34	67	42	53	50	243
6	62	52	73	57	72	73	63	82	165
7	53	48	40	57	71	73	82	70	112
8	25	38	42	40	60	40	65	57	50
9	25	22	20	33	10	35	28	30	15
10	7	5	8	5	8	5	8	10	3
11	--	--	3	0	--	--	--	3	3
12	--	--	--	2	--	--	--	--	2
Total	215	205	251	245	313	281	319	327	1,640

[1/] Rounded to the nearest whole tree.

Table 13.--*Stand table at end of first treatment period, 1970*[1/]

(Number of trees per acre)

D.b.h. class (inches)	Treatment number								
	1	2	3	4	5	6	7	8	Control
2	--	--	--	--	--	--	--	--	53
3	--	--	--	--	--	--	--	--	223
4	--	2	2	2	2	2	2	2	267
5	3	5	5	8	15	7	10	20	220
6	15	15	28	15	35	22	35	28	172
7	23	12	38	35	50	27	40	48	125
8	47	37	47	40	60	65	50	58	103
9	48	47	45	45	63	65	77	63	58
10	37	37	37	40	55	42	62	55	30
11	15	27	25	40	18	35	28	27	12
12	23	20	18	12	7	18	13	18	3
13	3	7	3	5	7	2	7	7	3
14	--	--	3	2	--	--	--	--	--
15	--	--	--	--	--	--	--	--	2
Total	214	209	251	244	312	285	324	326	1,271

[1/] Rounded to the nearest whole tree.

Table 14.--*Percent of growing stock in crop trees*

Treatments	Calibration period					
	Basal area		Number of trees		Cubic-foot volume	
	1963	1966[1/]	1963	1966[1/]	1963	1966[1/]
Thinned	29.9	29.8	23.4	23.5	31.0	30.9
Control	9.8	10.4	4.5	4.8	10.4	11.1

First treatment period

	Basal area				Number of trees				Cubic-foot volume			
	1967	1968	1969	1970	1967	1968	1969	1970	1967	1968	1969	1970
1 and 2	45.9	45.8	45.8	45.8	37.9	37.9	37.9	37.9	47.2	46.9	46.8	46.9
3 and 4	39.9	39.8	39.9	39.8	32.3	32.3	32.3	32.3	41.4	40.9	40.8	40.6
5 and 6	34.1	34.1	34.2	34.3	26.9	26.9	26.9	26.9	35.6	35.5	35.2	35.1
7 and 8	30.3	30.2	30.2	30.3	24.6	24.6	24.6	24.6	31.2	31.1	31.0	31.0
Control	10.4	11.1	11.5	12.3	4.8	5.1	5.7	6.3	11.1	11.7	12.9	13.0

[1/] End of 1966 growing season prior to thinning.

Other LOGS (levels-of-growing-stock) reports :

WILLIAMSON, RICHARD L., and GEORGE R. STAEBLER
1965. A cooperative level-of-growing-stock study in Douglas-fir. USDA Forest Serv. Pac. Northwest Forest & Range Exp. Stn., 12 p., illus. Portland, Oreg.

Describes purpose and scope of a cooperative study which is investigating the relative merits of eight different thinning regimes. Main features of six study areas installed since 1961 in young stands are also summarized.

WILLIAMSON, RICHARD L., and GEORGE R. STAEBLER
1971. Levels-of-growing-stock cooperative study on Douglas-fir. Report No. 1--Description of study and existing study areas. USDA Forest Serv. Res. Pap. PNW-111, 12 p., illus. Pac. Northwest Forest & Range Exp. Stn., Portland, Oreg.

Thinning regimes in young Douglas-fir stands are described. Some characteristics of individual study areas established by cooperating public and private agencies are discussed.

The FOREST SERVICE of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.