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PONDEROSA PINE LUMBER RECOVERY

IN NORTH-CENTRAL WASHINGTON

by

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Prior to World War II, the U. S. Forest Service (Region 6) adopted the policy of appraising ponderosa pine timber with a standardized set of lumber grade recovery data obtained from representative pine mills which are known to use average care in manufacturing and marketing. Such data were derived by combining the results of several mill studies made about 20 to 25 years ago.

Since that time, utilization practices have changed, improved equipment has been developed and used, and the available timber probably differs in size and quality. Both buyers and sellers of pine timber have expressed need for up-to-date recovery expectancies in order to more accurately appraise pine timber.

To implement this reexamination, the Pacific Northwest Forest and Range Experiment Station conducted pine lumber recovery studies; the first^{1/} comprising 588 logs from south-central Oregon, the second, 409 logs from north-central Washington. This publication reports the results of the second study.^{2/}

^{1/} Matson, E. E. Ponderosa pine lumber recovery in Lakeview, Oregon area. U. S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 124, 13 pp. 1955. (Processed.)

^{2/} A cooperative project with C. A. Harris & Sons, Inc., Western Pine Association, Bureau of Land Management, Bureau of Indian Affairs, and U. S. Forest Service participating.

Publishing results of the second study was postponed, pending a study of log grading systems in use for ponderosa pine. Any marked change from the Pacific Northwest six-grade system^{3/} used in this study would limit usefulness of the reported recovery data. It now appears that proposed changes in the log grading system will be moderate and that results contained herein will be of interest and value.

During July 1957, a pine lumber recovery study was conducted at C. A. Harris and Son, Inc., mill, Ardenvoir, Wash., (approximately 30 miles north of Wenatchee). This mill is equipped with a single-cut band headrig, horizontal resaw, edger, trimmer, internal-fan dry kilns, and planing equipment.

STUDY PROCEDURE

Log Data

The logs used for this study originated in the upper Entiat River drainage area of the Wenatchee National Forest.

Logs selected for study were removed from the pond and bucked to sawing lengths with adequate trim allowance. Each short log was then appropriately numbered, scaled, graded, and diagrammed while out of the water. The log grading was done by the U. S. Forest Service representative in charge of scaling and grading for the western regions. He also collaborated on the log scaling with the Western Pine Association check scaler. All logs were scaled by Scribner Decimal C log rule in accordance with Forest Service methods as outlined in the National Forest Scaling Handbook. The maximum scaling length was 16 feet. After the numbering and diagramming,^{4/} the logs were returned to the pond.

The aim in selecting the log sample was to include logs in each of the six grades, well distributed over the diameter range. Log

^{3/} Developed by Dr. J. E. Lodewick in 1938. Described in the appendix of this report.

^{4/} A diagram form used for each study log is shown in the appendix. The reverse of this form shows the characteristics considered.

grade 4 was in short supply and grade 6 was not represented, as noted in the following tabulation:

	<u>Number of logs</u>
Log grade:	
1	45
2	41
3	161
4	29
5	<u>133</u>
Total	409

Logs in grade 4 are generally the small-, tight-, live-knotted type occurring in young-growth timber, and ordinarily are obtained from rights-of-way. Grade 6 logs are the rough, coarse, or densely knotted type. They are not generally of widespread occurrence in timber stands of certain areas, and none are included in this study.

Sawing

All test logs were consecutively cut by the regular commercial practice of the company. The sawyer was skilled and mill practices were not wasteful. No box lumber was produced. All Shop and Select items were cut random width (for S2S market) and only in 4/4- and 5/4-inch thicknesses. The carriage setout for these two thicknesses was 1-3/16 and 1-10/16 inch, respectively. The finished lumber sizes were in accordance with the American Lumber Standards.

The merry-go-round feed to the resaw was shut down to simplify the flow of lumber to the green chain. Additional lines were cut on the headsaw so one pass through the resaw sufficed. This practice had no effect on overrun, since both the headsaw and resaw had a 3/16-inch kerf. Each board carried the color designation and number of the log from which it originated.

Lumber Tally

The rough green lumber grading was done by a Western Pine Association lumber inspector, and the grade designation was marked on each piece. Combined lumber grades were not employed. In addition, a company grader measured random width Shop and Select

items and marked the board-foot volume on the piece. Common items were tallied by thickness, width, length, and grade. A separate tally sheet was used to record the lumber yield of each log.

Kiln-Drying

All the test lumber was kiln-dried in accordance with the company's commercial schedule. The kilns were relatively new and of the cross-circulation, steam-heated, side-loading type. The control instruments were calibrated prior to the test run. The Common lumber was dried to an average moisture content of 12 percent and the Shop and Selects to an average of 8 percent.

Surfacing

Since a seasoning degrade study was conducted jointly with the recovery study, the rough dry material was segregated according to planing items and green chain grade designation. It was then surfaced and regraded by a WPA inspector. Only pencil trimming was indicated. The volume loss and change in grade were recorded by cause. This information was the subject of a separate report.^{5/} The total dry surfaced volume of each lumber grade formed the basis for adjusting the green chain grade recovery curves for each log grade.

OFFICE PROCEDURE

For each log, the green chain tally of each lumber item and grade was totaled separately. For every log, green lumber recovery within each lumber grade was expressed as a percent of net log scale. The percentages were then plotted over log diameter and first or second degree curves fitted to the data.

The resulting series of green lumber recovery curves for each log grade were then converted to a dry shipping tally basis. Since individual log identity was not followed through the drying and surfacing stages, this conversion was based on the ratio of total green volume for a lumber grade to the total dry volume of that same grade,

^{5/} Knauss, A. C., and Clarke, E. H. Seasoning and surfacing degrade in kiln-drying ponderosa pine in eastern Washington. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 205, 12 pp. 1961. (Processed.)

regardless of log diameter or grade. A final readjustment was then made so that the total dry recovery (all lumber grades) for each log diameter was fixed by the original total green recovery for each diameter less the loss incurred in drying and machining.

RESULTS AND DISCUSSION

The distribution of logs by diameter class and log grade is shown in table 1. These 409 logs had a gross log scale of 143,010 board feet, a net scale of 131,430 board feet (Scribner Decimal C). This indicates an average defect deduction of 8.1 percent of gross

Table 1.--Distribution of ponderosa pine logs,
by diameter class and log grade

Diameter class (inches)	Log grade					Total
	No. 1	No. 2	No. 3	No. 4	No. 5	
	----- <u>Number</u> -----					
8-10	--	1	--	7	16	24
11-13	--	--	3	7	30	40
14-16	1	3	11	9	36	60
17-19	5	6	25	4	18	58
20-22	9	4	29	2	13	57
23-25	8	8	37	--	9	62
26-28	9	6	22	--	7	44
29-31	5	4	17	--	3	29
32-34	2	4	9	--	1	16
35-37	3	2	5	--	--	10
38-40	2	3	2	--	--	7
41-43	1	--	1	--	--	2
Total	45	41	161	29	133	409

log scale for all study logs. The following tabulation shows the average diameter and average percentage defect deduction for each log grade:

	<u>Average diameter</u> (Inches)	<u>Deduction for defect</u> (Percent of gross scale)
Log grade:		
1	26.2	15.8
2	25.3	9.0
3	23.9	6.4
4	13.8	5.5
5	<u>16.2</u>	<u>5.3</u>
Average (all logs)	21.1	8.1

The percentage defect by diameter for all log grades combined is shown in figure 1.

Distribution of surfaced dry lumber grades from each log grade is shown in tables 2 through 6 as a percent of shipping tally. This lumber grade recovery (dry shipping tally) is also expressed graphically in figure 2, but is expressed as a percent of net log scale.

DEFECT

(Percent of gross log scale)

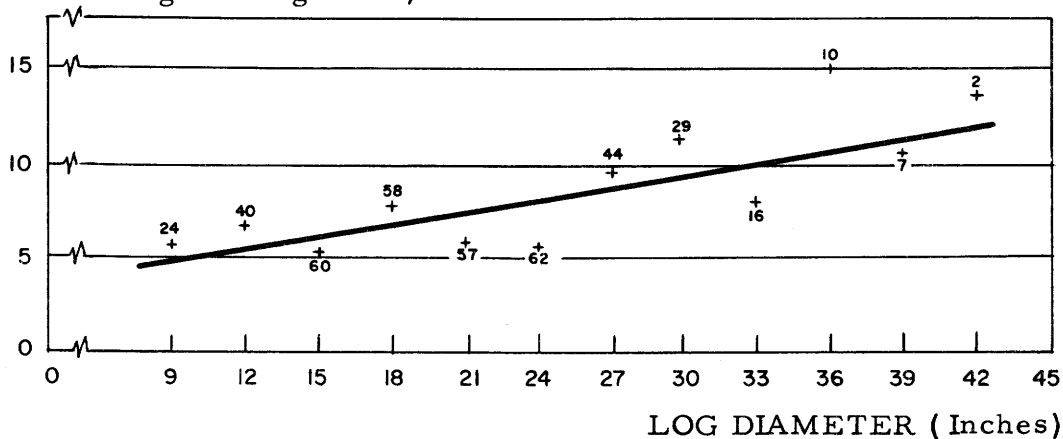


Figure 1. -- Defect of ponderosa pine logs.

Table 2.--Estimated lumber recovery, by lumber grade, from No. 1 ponderosa pine logs^{1/}

(Percent of total dry shipping tally)

Log diameter (inches)	No. of logs	Select					Shop					Common				
		B & Btr.	C	D	Mldg.	Total	No. 3 clear	No. 1	No. 2	No. 3	Total	No. 2	No. 3	No. 4	No. 5	Total
16	1	1.6	9.4	27.2	5.2	43.4	0.3	0.8	1.0	0.9	3.0	29.5	17.1	4.3	2.7	53.6
17	1	1.7	10.2	26.2	7.0	45.1	.4	1.1	1.3	1.2	4.0	26.5	15.3	5.4	3.7	50.9
18	0	1.9	11.1	25.1	8.7	46.8	.5	1.3	1.6	1.4	4.8	23.7	13.7	6.5	4.5	48.4
19	4	2.0	11.9	24.2	10.1	48.2	.6	1.5	1.9	1.7	5.7	21.1	12.2	7.5	5.3	46.1
20	3	2.1	12.5	23.5	11.4	49.5	.7	1.7	2.1	1.9	6.4	18.8	10.9	8.4	6.0	44.1
21	0	2.3	13.1	22.7	12.6	50.7	.7	1.9	2.4	2.2	7.2	16.6	9.6	9.2	6.7	42.1
22	6	2.4	13.8	22.0	13.7	51.9	.8	2.1	2.6	2.3	7.8	14.5	8.4	10.1	7.3	40.3
23	4	2.5	14.4	21.4	14.6	52.9	.8	2.2	2.7	2.5	8.2	12.8	7.4	10.8	7.9	38.9
24	3	2.6	14.9	21.0	15.5	54.0	.9	2.3	2.9	2.6	8.7	11.2	6.4	11.4	8.3	37.3
25	1	2.6	15.4	20.5	16.2	54.7	.9	2.5	3.0	2.7	9.1	9.6	5.6	12.2	8.8	36.2
26	3	2.7	15.8	20.4	16.8	55.7	.9	2.5	3.1	2.9	9.4	8.3	4.8	12.7	9.1	34.9
27	4	2.7	16.2	20.0	17.5	56.4	.9	2.6	3.2	3.0	9.7	7.1	4.1	13.2	9.5	33.9
28	2	2.8	16.5	19.8	17.9	57.0	1.0	2.7	3.3	3.0	10.0	6.1	3.5	13.7	9.7	33.0
29	1	2.9	16.9	19.7	18.2	57.7	1.0	2.7	3.3	3.1	10.1	5.1	3.0	14.2	9.9	32.2
30	2	2.9	17.2	19.6	18.4	58.1	1.0	2.8	3.4	3.2	10.4	4.4	2.5	14.5	10.1	31.5
31	2	3.0	17.4	19.7	18.6	58.7	1.0	2.8	3.4	3.2	10.4	3.7	2.1	14.9	10.2	30.9
32	1	3.0	17.7	19.8	18.6	59.1	1.0	2.8	3.4	3.1	10.3	3.2	1.9	15.2	10.3	30.6
33	0	3.0	17.8	20.0	18.5	59.3	1.0	2.8	3.5	3.1	10.4	2.9	1.7	15.4	10.3	30.3
34	1	3.0	18.0	20.2	18.4	59.6	1.0	2.8	3.4	3.1	10.3	2.7	1.5	15.7	10.2	30.1
35	1	3.0	18.2	20.5	18.2	59.9	1.0	2.8	3.4	3.1	10.3	2.5	1.4	15.8	10.1	29.8
36	1	3.1	18.2	21.0	17.8	60.1	1.0	2.7	3.3	3.0	10.0	2.6	1.4	15.9	10.0	29.9
37	1	3.1	18.2	21.4	17.4	60.1	.9	2.7	3.3	2.9	9.8	2.7	1.5	16.1	9.8	30.1
38	1	3.1	18.3	21.9	16.9	60.2	.9	2.6	3.2	2.8	9.5	2.9	1.7	16.1	9.6	30.3
39	0	3.1	18.3	22.5	16.3	60.2	.9	2.5	3.0	2.7	9.1	3.4	1.9	16.1	9.3	30.7
40	1	3.1	18.3	23.1	15.5	60.0	.8	2.4	2.9	2.7	8.8	3.9	2.2	16.1	9.0	31.2
41	0	3.1	18.2	23.9	14.8	60.0	.8	2.3	2.7	2.5	8.3	4.6	2.5	15.9	8.7	31.7
42	1	3.1	18.1	24.8	13.8	59.8	.7	2.1	2.6	2.4	7.8	5.4	3.0	15.8	8.2	32.4

^{1/} Average log defect = 15.8 percent.

Table 3.--Estimated lumber recovery, by lumber grade, from No. 2 ponderosa pine logs^{1/}

(Percent of total dry shipping tally)

Log diameter (inches)	No. of logs	Select					Shop					Common				
		B & Btr.	C	D	Mldg.	Total	No. 3 clear	No. 1	No. 2	No. 3	Total	No. 2	No. 3	No. 4	No. 5	Total
10	1	2.1	3.1	23.6	0	28.8	0.4	1.2	1.1	2.6	5.3	26.9	23.2	6.8	9.0	65.9
11	0	2.1	3.8	22.8	1.3	30.0	.5	1.5	1.5	2.7	6.2	25.5	22.2	7.5	8.6	63.8
12	0	2.1	4.6	22.1	2.7	31.5	.5	1.7	1.9	2.8	6.9	24.1	21.2	8.1	8.2	61.6
13	0	2.0	5.4	21.4	4.1	32.9	.6	1.9	2.3	2.9	7.7	22.8	20.2	8.7	7.7	59.4
14	1	1.9	6.1	20.7	5.4	34.1	.7	2.2	2.7	3.0	8.6	21.5	19.2	9.2	7.4	57.3
15	1	1.9	6.8	20.1	6.6	35.4	.7	2.4	3.1	3.1	9.3	20.3	18.3	9.7	7.0	55.3
16	1	1.9	7.5	19.4	7.9	36.7	.8	2.6	3.4	3.2	10.0	19.1	17.4	10.1	6.7	53.3
17	1	1.9	8.1	18.9	9.0	37.9	.9	2.9	3.8	3.2	10.8	18.0	16.5	10.4	6.4	51.3
18	3	1.9	8.7	18.4	10.1	39.1	1.0	3.1	4.2	3.2	11.5	16.8	15.7	10.8	6.1	49.4
19	2	1.8	9.2	18.0	11.1	40.1	1.1	3.4	4.5	3.3	12.3	15.7	14.9	11.2	5.8	47.6
20	1	1.9	9.8	17.7	12.0	41.4	1.2	3.7	4.8	3.3	13.0	14.5	14.1	11.4	5.6	45.6
21	3	1.9	10.3	17.3	13.0	42.5	1.3	3.9	5.1	3.3	13.6	13.5	13.3	11.7	5.4	43.9
22	0	1.9	10.8	17.0	13.7	43.4	1.4	4.2	5.4	3.3	14.3	12.6	12.7	11.9	5.1	42.3
23	2	1.9	11.2	16.8	14.5	44.4	1.4	4.6	5.7	3.3	15.0	11.6	11.9	12.1	5.0	40.6
24	4	2.0	11.7	16.5	15.2	45.4	1.5	4.8	6.1	3.2	15.6	10.6	11.3	12.2	4.9	39.0
25	2	2.0	12.0	16.5	15.8	46.3	1.6	5.2	6.4	3.1	16.3	9.8	10.6	12.3	4.7	37.4
26	2	2.0	12.4	16.4	16.4	47.2	1.7	5.5	6.6	3.1	16.9	8.9	10.0	12.4	4.6	35.9
27	3	2.1	12.7	16.3	16.9	48.0	1.8	5.8	6.9	3.0	17.5	8.1	9.5	12.4	4.5	34.5
28	1	2.2	13.0	16.4	17.3	48.9	1.9	6.1	7.2	2.8	18.0	7.4	9.0	12.3	4.4	33.1
29	1	2.3	13.3	16.4	17.7	49.7	2.0	6.6	7.4	2.7	18.7	6.6	8.5	12.1	4.4	31.6
30	2	2.3	13.5	16.6	18.0	50.4	2.1	6.9	7.6	2.6	19.2	6.0	8.0	12.0	4.4	30.4
31	1	2.4	13.7	16.8	18.2	51.1	2.3	7.3	7.9	2.4	19.9	5.3	7.5	11.8	4.4	29.0
32	1	2.5	13.8	17.1	18.3	51.7	2.4	7.7	8.1	2.2	20.4	4.8	7.2	11.5	4.4	27.9
33	2	2.6	13.9	17.6	18.3	52.4	2.5	8.1	8.3	2.0	20.9	4.2	6.8	11.3	4.4	26.7
34	1	2.7	14.0	17.9	18.3	52.9	2.6	8.5	8.5	1.9	21.5	3.7	6.5	10.9	4.5	25.6
35	1	2.8	14.0	18.4	18.2	53.4	2.8	8.9	8.7	1.6	22.0	3.3	6.2	10.5	4.6	24.6
36	1	3.0	14.0	19.0	18.0	54.0	2.9	9.4	8.9	1.3	22.5	2.9	5.9	10.0	4.7	23.5
37	0	3.2	13.9	19.6	17.8	54.5	3.1	9.8	9.0	1.0	22.9	2.5	5.7	9.5	4.9	22.6
38	2	3.3	13.9	20.3	17.3	54.8	3.2	10.3	9.3	.7	23.5	2.3	5.5	8.8	5.1	21.7
39	1	3.4	13.7	21.2	16.9	55.2	3.4	10.8	9.4	.4	24.0	1.9	5.4	8.2	5.3	20.8

^{1/} Average log defect = 9.0 percent.

Table 4.--Estimated lumber recovery, by lumber grade, from No. 3 ponderosa pine logs^{1/}

(Percent of total dry shipping tally)

Log diameter (inches)	No. of logs	Select					Shop					Common				
		B & Btr.	C	D	Mldg.	Total	No. 3 clear	No. 1	No. 2	No. 3	Total	No. 2	No. 3	No. 4	No. 5	Total
13	3	0.1	1.2	10.0	3.0	14.3	1.9	2.4	0.8	0.3	5.4	48.8	26.7	1.4	3.4	80.3
14	4	.3	1.3	9.6	3.4	14.6	2.1	3.3	2.4	1.0	8.8	44.9	26.2	2.4	3.1	76.6
15	3	.3	1.4	9.3	3.8	14.8	2.4	4.1	4.0	1.7	12.2	41.2	25.7	3.4	2.7	73.0
16	4	.2	1.6	8.9	4.2	14.9	2.8	5.0	5.5	2.3	15.6	37.7	25.2	4.2	2.4	69.5
17	8	.2	1.7	8.5	4.8	15.2	3.1	5.8	7.0	3.0	18.9	34.2	24.5	5.1	2.1	65.9
18	10	.2	1.8	8.3	5.2	15.5	3.5	6.5	8.3	3.5	21.8	31.0	24.0	5.9	1.8	62.7
19	7	.2	2.0	7.9	5.6	15.7	3.7	7.3	9.6	4.1	24.7	27.8	23.3	6.8	1.7	59.6
20	9	.1	2.2	7.8	6.2	16.3	4.0	8.0	10.7	4.6	27.3	24.8	22.6	7.5	1.5	56.4
21	10	.1	2.3	7.5	6.6	16.5	4.3	8.8	11.9	5.0	30.0	22.0	22.0	8.1	1.4	53.5
22	10	.1	2.5	7.3	7.1	17.0	4.6	9.4	12.9	5.5	32.4	19.3	21.2	8.7	1.4	50.6
23	12	.2	2.6	7.2	7.5	17.5	4.8	10.1	13.8	5.8	34.5	16.8	20.5	9.3	1.4	48.0
24	13	.2	2.7	6.9	8.0	17.8	5.1	10.7	14.6	6.2	36.6	14.5	19.7	9.8	1.6	45.6
25	12	.2	2.9	6.9	8.4	18.4	5.3	11.4	15.3	6.5	38.5	12.4	18.9	10.1	1.7	43.1
26	9	.3	3.1	6.7	8.9	19.0	5.5	12.0	15.9	6.7	40.1	10.5	18.0	10.5	1.9	40.9
27	7	.3	3.3	6.7	9.4	19.7	5.8	12.4	16.3	6.9	41.4	8.8	17.1	10.8	2.2	38.9
28	6	.4	3.4	6.6	9.8	20.2	6.0	13.0	16.7	7.1	42.8	7.3	16.2	11.0	2.5	37.0
29	5	.4	3.6	6.6	10.1	20.7	6.2	13.5	17.0	7.1	43.8	6.0	15.4	11.2	2.9	35.5
30	6	.5	3.7	6.7	10.4	21.3	6.3	13.9	17.1	7.3	44.6	5.1	14.4	11.3	3.3	34.1
31	6	.6	3.9	6.8	11.0	22.3	6.6	14.3	17.0	7.3	45.2	4.0	13.4	11.3	3.8	32.5
32	3	.7	4.1	6.8	11.5	23.1	6.7	14.6	17.0	7.2	45.5	3.4	12.4	11.2	4.4	31.4
33	3	.8	4.3	6.9	11.8	23.8	6.9	15.0	16.7	7.1	45.7	3.0	11.4	11.1	5.0	30.5
34	3	.9	4.4	7.1	12.3	24.7	6.9	15.3	16.4	6.9	45.5	2.8	10.4	10.9	5.7	29.8
35	2	1.0	4.6	7.2	12.7	25.5	7.1	15.5	15.9	6.7	45.2	2.9	9.3	10.6	6.5	29.3
36	0	1.1	4.8	7.4	13.0	26.3	7.2	15.7	15.3	6.5	44.7	3.2	8.3	10.2	7.3	29.0
37	3	1.3	5.1	7.5	13.3	27.2	7.3	15.9	14.6	6.2	44.0	3.7	7.2	9.8	8.1	28.8
38	1	1.4	5.3	7.8	13.6	28.1	7.3	16.0	13.9	5.8	43.0	4.5	6.0	9.3	9.1	28.9
39	0	1.6	5.4	8.1	14.0	29.1	7.4	16.1	12.9	5.4	41.8	5.4	5.0	8.7	10.0	29.1
40	1	1.7	5.6	8.4	14.3	30.0	7.5	16.0	11.8	5.0	40.3	6.5	3.9	8.2	11.1	29.7
41	0	1.8	5.7	8.8	14.7	31.0	7.5	16.1	10.6	4.6	38.8	7.9	2.8	7.4	12.1	30.2
42	1	2.0	5.9	9.1	15.0	32.0	7.5	16.0	9.4	4.0	36.9	9.6	1.6	6.7	13.2	31.1

^{1/} Average log defect = 6.4 percent.

Table 5.--Estimated lumber recovery, by lumber grade, from No. 4 ponderosa pine logs^{1/}

(Percent of total dry shipping tally)

Log diameter (inches)	No. of logs	Select					Shop					Common				
		B & Btr.	C	D	Mldg.	Total	No. 3 clear	No. 1	No. 2	No. 3	Total	No. 2	No. 3	No. 4	No. 5	Total
9	3	0.1	0.7	1.9	2.1	4.8	0.1	0.3	0.2	0.8	1.4	74.1	9.8	7.9	2.0	93.8
10	4	.2	1.5	3.9	2.4	8.0	.2	.6	.5	1.4	2.7	69.5	10.2	7.5	2.1	89.3
11	1	.3	2.2	6.0	2.8	11.3	.3	.9	.8	2.0	4.0	64.9	10.6	7.1	2.1	84.7
12	4	.5	3.0	8.1	3.0	14.6	.3	1.2	1.0	2.9	5.4	60.1	11.0	6.7	2.2	80.0
13	2	.5	3.8	10.2	3.4	17.9	.4	1.6	1.3	3.6	6.9	55.2	11.3	6.3	2.4	75.2
14	3	.6	4.7	12.4	3.7	21.4	.5	1.8	1.6	4.3	8.2	50.3	11.7	5.9	2.5	70.4
15	3	.7	5.5	14.8	4.0	25.0	.6	2.2	1.8	5.0	9.6	45.1	12.2	5.5	2.6	65.4
16	3	.9	6.4	17.0	4.4	28.7	.7	2.5	2.1	5.8	11.1	39.9	12.6	5.0	2.7	60.2
17	1	1.0	7.2	19.4	4.8	32.4	.8	2.8	2.5	6.5	12.6	34.5	13.0	4.6	2.9	55.0
18	2	1.1	8.2	21.9	5.1	36.3	.9	3.2	2.8	7.3	14.2	29.0	13.4	4.1	3.0	49.5
19	1	1.3	9.1	24.3	5.5	40.2	1.0	3.6	3.0	8.2	15.8	23.4	13.8	3.7	3.1	44.0
20	1	1.3	10.1	26.9	5.9	44.2	1.1	4.0	3.3	9.0	17.4	17.7	14.3	3.2	3.2	38.4
21	1	1.4	11.1	29.5	6.3	48.3	1.2	4.3	3.7	9.9	19.1	11.8	14.7	2.7	3.4	32.6

^{1/} Average log defect = 5.5 percent.

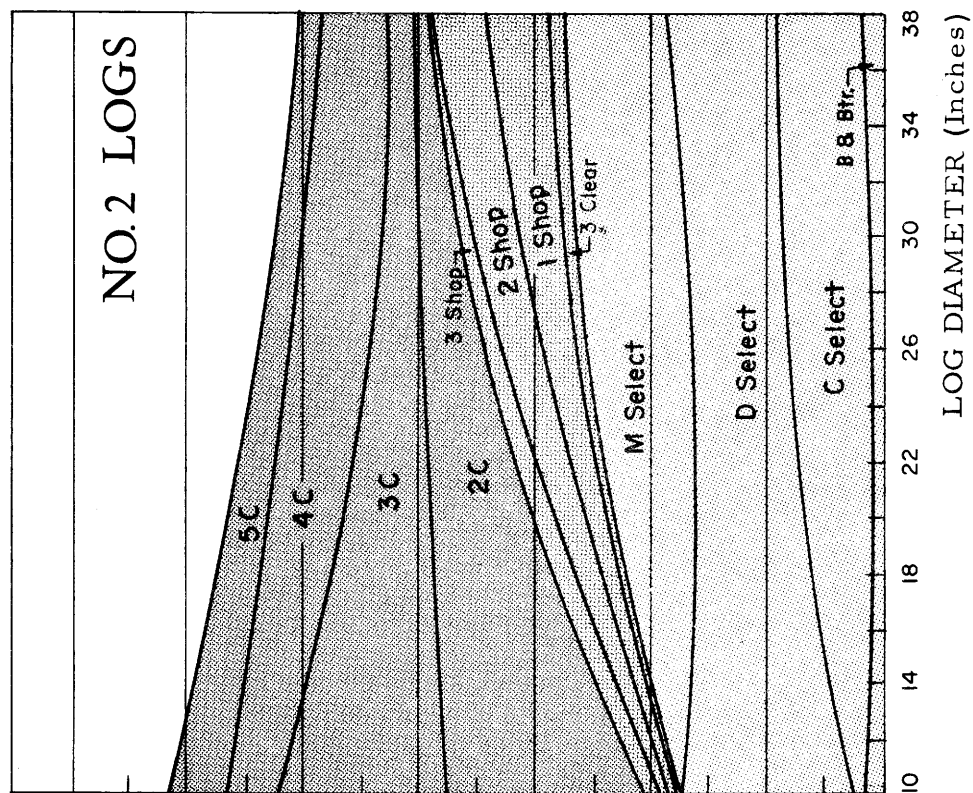
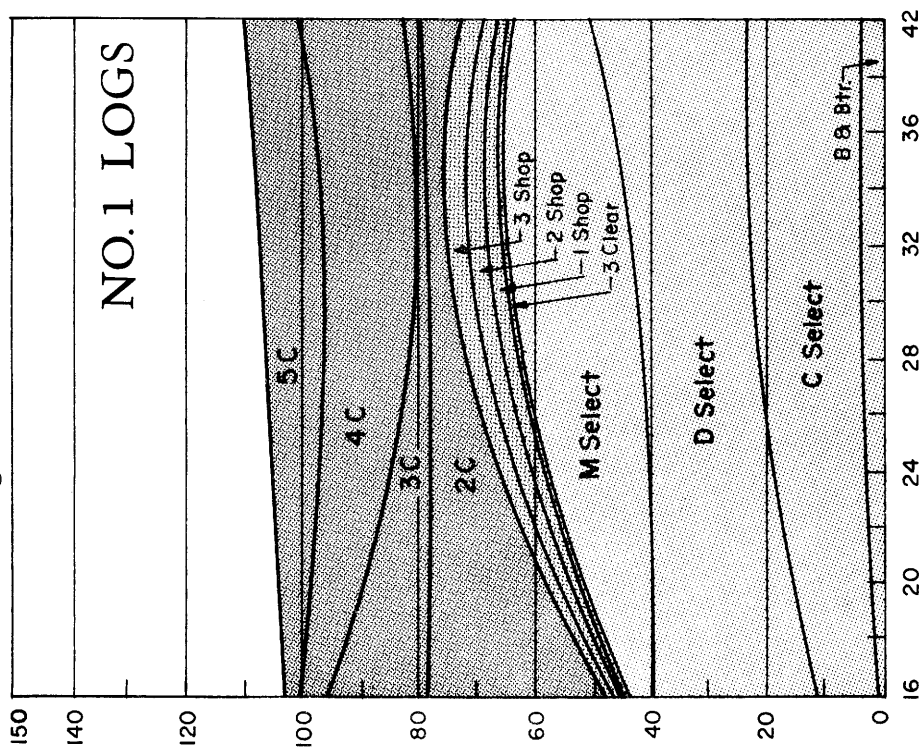
Table 6.--Estimated lumber recovery, by lumber grade, from No. 5 ponderosa pine logs^{1/}

(Percent of total dry shipping tally)

Log diameter (inches)	No. of logs	Select					Shop					Common				
		B & Btr.	C	D	Mldg.	Total	No. 3 clear	No. 1	No. 2	No. 3	Total	No. 2	No. 3	No. 4	No. 5	Total
7	1	0	0	0	0	0	0	0	0	0	0	48.3	31.2	13.5	7.0	100.0
8	2	0	0.1	0.2	0.1	0.4	0.2	0.6	0.5	0.3	1.6	45.7	32.0	13.8	6.5	98.0
9	5	0	.1	.4	.4	.9	.4	1.2	1.0	.5	3.1	43.1	32.8	14.1	6.0	96.0
10	8	0	.1	.7	.5	1.3	.7	1.8	1.6	.7	4.8	40.6	33.4	14.4	5.5	93.9
11	13	0	.1	.9	.7	1.7	1.0	2.4	2.1	1.0	6.5	38.1	34.0	14.6	5.1	91.8
12	12	0	.2	1.1	.8	2.1	1.2	3.0	2.7	1.4	8.3	35.6	34.4	14.9	4.7	89.6
13	6	0	.2	1.3	1.1	2.6	1.6	3.6	3.3	1.6	10.1	33.3	34.7	15.0	4.3	87.3
14	11	0	.3	1.6	1.3	3.2	1.8	4.3	3.9	2.0	12.0	30.9	34.9	15.1	3.9	84.8
15	17	0	.4	1.9	1.4	3.7	2.1	5.1	4.5	2.2	13.9	28.7	35.1	15.1	3.5	82.4
16	7	0	.4	2.2	1.7	4.3	2.4	5.7	5.1	2.6	15.8	26.5	35.0	15.1	3.3	79.9
17	8	0	.5	2.3	1.9	4.7	2.7	6.5	5.8	2.9	17.9	24.5	34.9	15.0	3.0	77.4
18	2	0	.5	2.6	2.1	5.2	3.0	7.3	6.5	3.3	20.1	22.5	34.6	14.9	2.7	74.7
19	8	0	.6	2.9	2.3	5.8	3.4	8.0	7.2	3.6	22.2	20.6	34.2	14.7	2.5	72.0
20	3	0.1	.6	3.2	2.6	6.5	3.7	8.8	8.0	4.0	24.5	18.8	33.5	14.4	2.3	69.0
21	6	.1	.7	3.5	2.8	7.1	4.0	9.7	8.6	4.4	26.7	17.1	32.8	14.2	2.1	66.2
22	4	.1	.8	3.8	3.1	7.8	4.4	10.6	9.4	4.8	29.2	15.5	31.8	13.7	2.0	63.0
23	4	.1	.8	4.2	3.3	8.4	4.8	11.4	10.2	5.2	31.6	14.1	30.7	13.2	2.0	60.0
24	1	.1	.9	4.5	3.6	9.1	5.2	12.4	11.1	5.5	34.2	12.8	29.4	12.6	1.9	56.7
25	4	.1	.9	4.9	3.8	9.7	5.6	13.4	11.9	6.0	36.9	11.6	27.9	12.0	1.9	53.4
26	2	.1	1.1	5.2	4.2	10.6	5.9	14.3	12.9	6.4	39.5	10.5	26.2	11.3	1.9	49.9
27	3	.1	1.1	5.6	4.5	11.3	6.3	15.4	13.8	6.9	42.4	9.7	24.1	10.4	2.1	46.3
28	2	.1	1.2	6.0	4.7	12.0	6.9	16.4	14.7	7.4	45.4	9.0	22.0	9.4	2.2	42.6
29	1	.1	1.2	6.4	5.1	12.8	7.3	17.6	15.7	7.9	48.5	8.4	19.5	8.3	2.5	38.7
30	2	.1	1.4	6.8	5.4	13.7	7.7	18.7	16.7	8.5	51.6	8.1	16.7	7.2	2.7	34.7
31	0	.1	1.5	7.2	5.8	14.6	8.3	19.9	17.8	8.9	54.9	7.9	13.7	5.8	3.1	30.5
32	1	.1	1.5	7.7	6.1	15.4	8.8	21.0	18.9	9.5	58.2	8.0	10.4	4.4	3.6	26.4

^{1/} Average log defect = 5.3 percent.

DRY SHIPPING TALLY
Percent of Net Log Scale



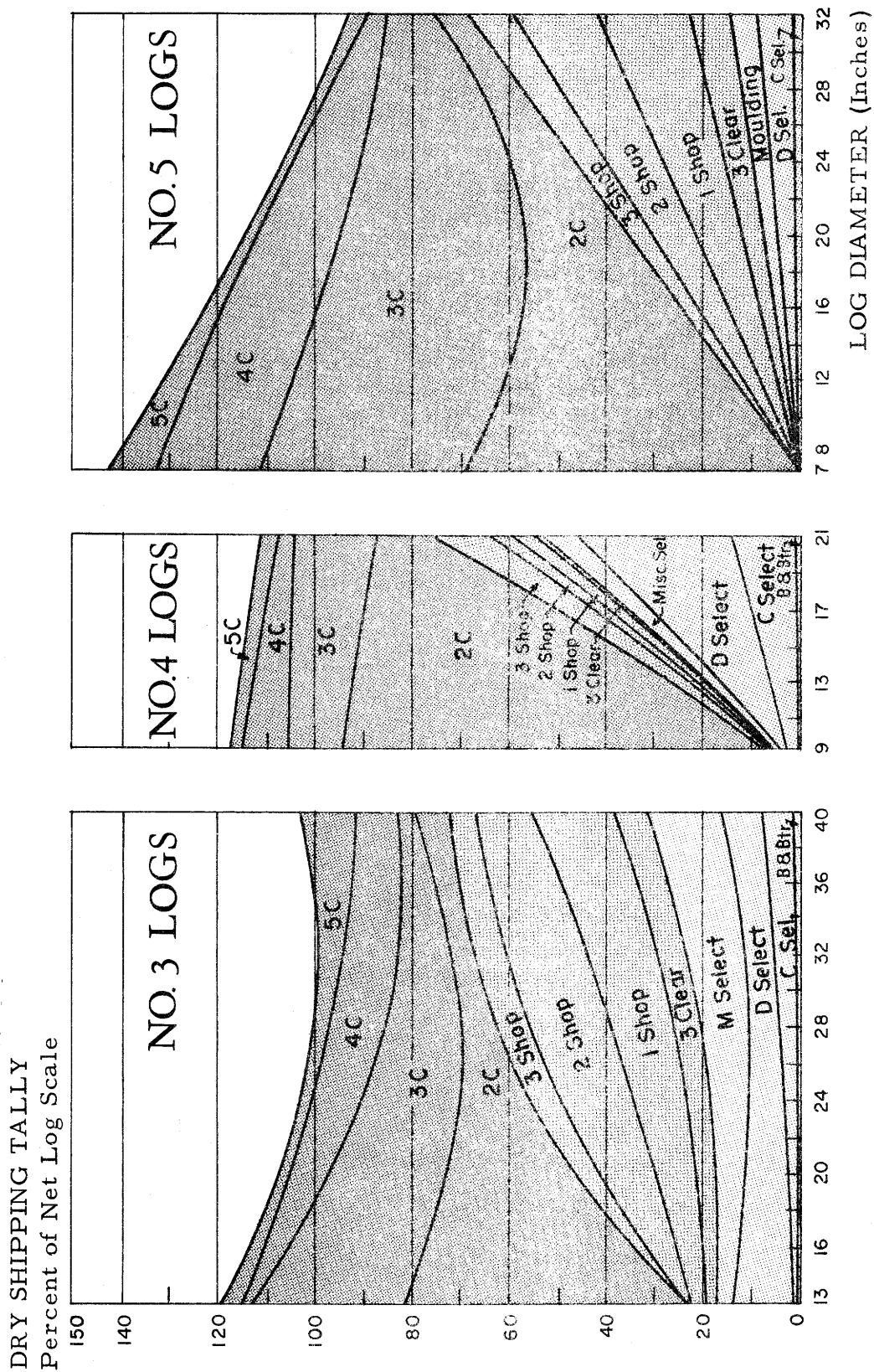


Figure 2.--Cumulative estimated lumber recovery in ponderosa pine.

A total volume of 137,594 board feet of dry surfaced lumber was produced from the study logs (131,430 board feet net log scale). This represents an overrun of 4.7 percent (based on shipping tally) which apparently is comparable to average milling operations. Figure 3 shows overrun percent by diameter for the sound logs, unsound logs, and all logs combined. Percent overrun is also influenced

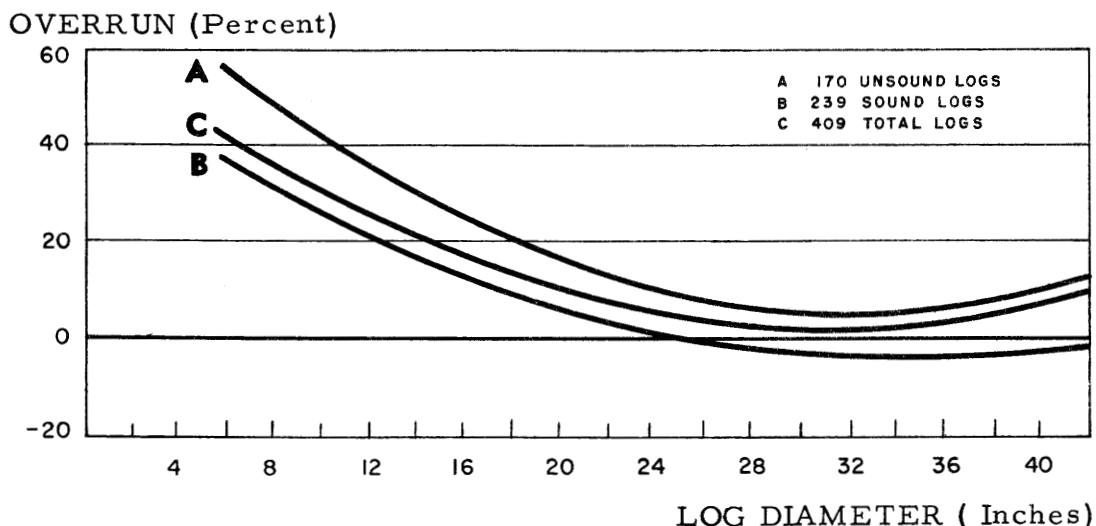


Figure 3.--Overrun from 409 ponderosa pine logs (all log grades combined). Basis: dry surfaced tally as percent of net log scale.

by log length, with logs of the longest scaling length (16 feet for pine) generally yielding the highest overrun. Figure 3 includes all log lengths studied and comprises 12-, 14-, 16-, and 18-foot logs in the following distribution:

Log grade:	Number of logs--			
	12-ft.	14-ft.	16-ft.	18-ft.
1	--	2	41	2
2	--	--	40	1
3	5	7	142	7
4	1	--	26	2
5	<u>6</u>	<u>13</u>	<u>98</u>	<u>16</u>
Total	12	22	347	28

A total volume loss of 5.03 percent of the rough green lumber occurred during kiln-drying and surfacing and is represented as cull and trim. The volume loss and degrade was highest for Select, intermediate for Shop, and lowest for Common items (table 7). This is understandable considering the limited defects allowable in the upper lumber grades. In addition, the upper grades are dried to a lower moisture content; thus the losses due to seasoning and planing defects are greater.

Table 7.--Green vs. dry lumber tally, by major lumber grade groupings, from 409 ponderosa pine logs

Grade group	Lumber tally		Ratio: green to dry
	Green	Dry	
	----- <u>Board feet</u> -----		<u>Percent</u>
Select	42,521	36,701	86.3
Shop	40,410	38,625	95.6
Common	61,941	62,268	100.5
Total	144,872	137,594	94.97

APPENDIX

Ponderosa Pine Log Grade Descriptions As Reworded on November 1, 1938

Grade 1 Shall be smooth and surface clear without indications of knots near the surface, providing, however, that one pin knot is permissible any place on the log.

Grade 2 Shall be smooth and surface clear on three faces but with knots permissible on the fourth face; or shall be smooth and surface clear on the lower three-fourths of the length, above which a few knots are permissible; or shall be smooth and surface clear to within two feet of the upper end, above which any number of knots are permissible. In any case one pin knot is permissible on the clear portion of the log.

Grade 3 Shall display knots which may vary from small black knots to large sound or unsound knots but which are spaced at least three feet apart (longitudinally) when the knots are staggered or six feet apart when they are in solid whorls. The surface clear areas must aggregate at least 50 percent of the total surface of the log, provided that each clear area must be at least four feet long by one-fourth the circumference in width.

Grade 4 Shall display numerous small and medium-sized red (live) knots, provided, however, that black (dead) knots which in the grader's judgment will cut out sound beneath the surface (usually on black barked logs) are permissible. The size of the knots shall be proportionate to the size of the log. For a 12-inch log 2-inch live or 1-inch dead knots and for a 24-inch log 4-inch live or 2-inch dead knots are permissible. An average longitudinal spacing of not less than 2 feet shall be required for logs with maximum knot sizes.

Grade 5 Shall display numerous live and/or dead knots, the maximum size of which shall be proportionate to the size of the log. For a 12-inch log, 4-inch live and 2-inch dead knots, and for a 24-inch log, 5-inch live and 3-inch dead knots, and for a 36-inch log, 6-inch live and 4-inch dead knots are permissible. An average longitudinal spacing of not less than two feet shall be required for logs with maximum knot sizes.

Logs with larger knots shall also be admitted to this grade if their surface clear areas aggregate at least one-third of the total surface of the log, provided that each clear area must be at least three feet long by one-fourth the circumference in width.

Grade 6 Shall be rough, coarse or densely knotted logs unsuited to any of the previous grades.

General Considerations Foregoing specifications as to spacing between knots refer to distance between knot or limb edges rather than between center and center.

Defects for which deductions are made in scaling shall not be considered in determining log grades.

Standing trees shall be graded on the basis of 16-foot logs and each log shall be graded solely on the basis of its own grade characteristics; i. e., the grade characteristics of adjoining logs shall not be allowed to influence the grader's judgment.