

The Southern Pine Log Grades

Their Application In a Stumpage Appraisal

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This report presents the results of a log and tree grade study made by a large private timber owner in cooperation with the Forest Service's Santee Research Center. The primary objective was to establish a basis for appraising the quality of some 40 million board feet of pine saw-timber which was to be offered for sale. A secondary objective was to provide additional information on lumber grade yields¹ by a log grading system developed through the cooperative research of several U. S. Forest Service branches.

The log grades employed were the U. S. Forest Service Interim Log Grades for Southern Pine. This system of log grades is explained fully in a research committee report issued by the Southern Forest Experiment Station,² which may be obtained upon request. The tree grading system used was based on the log grades. Preliminary research has shown that trees may be stratified into quality or value classes on the basis of the grade of a 16-foot butt log only. This is based upon the observation that, on the average, trees with similar butt logs tend to have upper logs of the same quality. It was decided to give the butt-log tree grading system a practical test as a method of quality appraisal on this large timber sale. Although results were highly satisfactory, this single test is not enough to recommend a general application of these tree grades. They should be given additional tests and more research should be done to determine whether or not improvements can be made. In this study the trees were separated into three grades: those with No. 1 butt logs, those with No. 2 butt logs, and those with either No. 3 or No. 4 butt logs.

A sample of 300 trees, in groups of 30 each, was selected from ten separate areas throughout the tract. They were selected so that approximately 100 trees were in each grade. The diameter, height, and grade of each tree was recorded and a metal tag with an identifying number tacked to the base. As felling and bucking progressed, each log was graded, measured, and numbered so that the lumber grade yields of the separate logs could be re-assembled into grade yield by individual trees. The logs were taken to the mill and sawn into yard lumber and dimension stock. Because of a few lumber pile-ups at the mill, mis-numbering of logs, or log identification uncertainties, the records of some logs could not be positively accepted. The final results are based on 239 trees and 1009 logs.

Description of Timber, Logging, and Milling

The study was conducted on the Bonnie Doone Plantation located in Colleton County, 10 miles southeast of Walterboro, S. C. Bonnie Doone Plantation is owned by J. Peter Grace, Jr., president of W. R. Grace and Company. The timber lands are being placed under management with the objective of a sustained yield of forest products. A timber cruise

The writers wish to acknowledge the assistance of personnel of Region 8, U. S. Forest Service, the South Carolina Forestry Commission, Bonnie Doone Plantation, and the consulting firms of Bishop Brothers and Robert F. Knott and Company in various phases of the grade yield study and appraisal.

The cooperating sawmill was the Ashpoo River Lumber Company, and the Southern Pine Inspection Bureau provided the services of certified lumber graders.

indicated that 95 per cent of the saw-timber volume was loblolly pine, the balance being shortleaf. Stand age averaged 50 to 60 years. It was estimated that 75 per cent of the forest area was occupied by a forest-grown pine-hardwood mixture and 25 per cent by an old-field, pure pine type.

Logging of the study trees was done under the supervision of Fred Boodle, who employed power saws for felling and bucking, mules for skidding, and a Loggers Dream for loading. All logs were bucked into 12-, 14-, and 16-foot lengths, except for a few 8- and 10-foot top logs.

The logs were trucked to the Ashpoo River Lumber Company, Ashpoo, S. C., and sawn into lumber with the cooperation of J. A. Poole, superintendent. The mill had a six-foot Wheland band head-saw, a Wheland carriage with air dogs, a 48-inch Wheland edger, and a 60-inch Yates-American vertical band resaw. Sawing practice was, for the most part, to remove clear boards at the head-saw. The remainder of the cant went to the resaw, usually in four-inch thicknesses. At this point a reduction was made to two-inch dimension which was, when desirable, further reduced to one-inch boards. The lumber was

graded on the green chain by W. A. Carter and Cecil Dean, of the Southern Pine Inspection Bureau.

Lumber Grade Yields and Quality Indices by Log Grades

The grade yields obtained here are the result of a particular combination of timber, mill, sawyer ability, and quality of lumber grading. Whether or not they can be accurately applied elsewhere depends upon the similarity of conditions. Just as factors beyond control of a log rule make a quantity prediction subject to error, so there are factors at work which make it difficult to predict a quality out-turn that will apply under all circumstances.

The effect of timber differences on grade yield of logs that are similar in external appearance was noted in a recent publication (see Footnote 1). A knowledge of the timber history revealed that although logs from different areas appeared identical on the outside, they were quite different beneath the surface. In one area the trees had pruned early with a resultant small knotty core; in the other area they had pruned late and only recently had started a rind of knot-free growth. Of course, the former produced a higher percentage of quality lumber for a given grade and size of log.

The type of mill and its operating efficiency can influence lumber grade out-turn. An extreme case would be to compare lumber grade yield from similar logs sawn at a worn-out portable mill and at a precision-engineered stationary band mill; other things being equal, the latter would turn out a larger proportion of high-grade material. The difference would be due largely to mis-cuts.

All sawyers cutting for grade do not size up and turn a log in the same way within a prescribed time lapse. As their ability to "get the most out of a log" differs, so does the lumber grade yield. The range in ability is not too great, and proper training can usually raise the standards in any particular case.

Quality out-turn in a grade-yield study can be influenced by the ability of the grader. When lumber is in short supply, there often exists a tendency by uncertified graders to up-grade wherever possible and desirable. A study made under such conditions would tend to result in a higher quality out-turn for similar logs than that from a study made

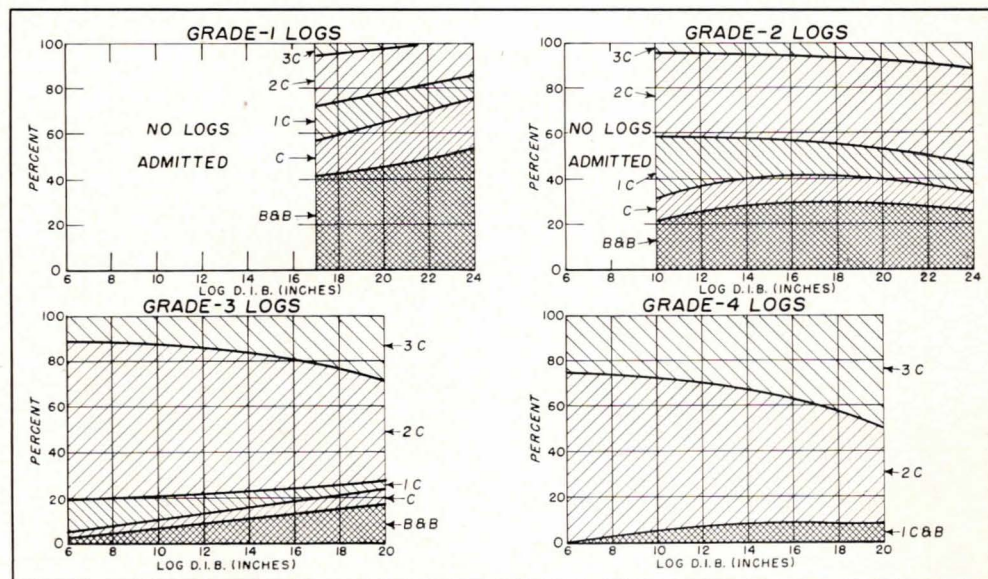


FIGURE 1.—Average percentage yard lumber grade recovery by log diameters and grades—loblolly pine type in the central Atlantic Coastal Plain near Walterboro, S. C.

¹McClay, T. A. Lumber grade yields in the loblolly-shortleaf pine type by the Southern pine log grades. Southeastern Forest Expt. Sta. Paper No. 37. April, 1954.

²U. S. Forest Service. Interim log grades for Southern pine. Southern Forest Expt. Sta. 1953.

Table 1.--Average percentage yard lumber grade recovery and quality indices by log diameters and grades--loblolly pine type in the central Atlantic Coastal Plain near Walterboro, S. C.

Log grade 1							Log grade 2						
Log	Lumber grade			Log			Lumber grade			Log			
d.i.b.	B &	:	:	:	:	quality	B &	:	:	:	:	quality	
(inches)	Btr:	C	1C	2C	3C	index 1/Basis	Btr:	C	1C	2C	3C	index 1/Basis	
	Percent of rough green			Index		No. of logs	Percent of rough green			Index		No. of logs	
10	--	--	--	--	--	--	22	10	27	37	4	147	
11	--	--	--	--	--	--	24	11	24	37	4	150	
12	--	--	--	--	--	--	26	12	21	37	4	152	
13	--	--	--	--	--	--	28	13	18	37	4	154	
14	--	--	--	--	--	--	29	13	17	37	4	157	
15	--	--	--	--	--	--	29	14	16	37	4	160	
16	--	--	--	--	--	--	29	13	15	38	5	162	
17	42	15	16	22	5	200	30	13	14	38	5	164	
18	43	16	15	22	4	203	30	12	14	38	6	166	
19	45	17	14	21	3	207	30	12	13	39	6	169	
20	46	19	13	20	2	211	29	11	13	40	7	172	
21	48	20	12	19	1	215	29	10	13	40	8	174	
22	49	21	12	18	--	219	28	9	13	41	9	177	
23	51	22	10	17	--	223	27	9	13	42	9	180	
24	53	23	9	15	--	227	26	8	13	43	10	182	

Log grade 3							Log grade 4							
6	3	2	14	70	11	103	1	--	--	--	75	25	90	5
7	4	2	13	70	11	105	9	--	--	1	73	26	91	40
8	5	3	12	69	11	107	21	1	--	2	71	26	92	53
9	6	3	11	68	12	109	33	2	1	2	69	26	94	51
10	7	4	10	67	12	111	29	2	1	2	68	27	95	56
11	8	4	9	66	13	113	24	2	2	2	66	28	96	52
12	9	4	9	64	14	115	37	3	2	2	64	29	97	50
13	10	5	8	62	15	117	26	3	2	2	62	31	98	41
14	11	5	8	60	16	119	19	3	2	2	60	33	99	34
15	12	5	8	58	17	121	31	4	2	2	58	34	100	31
16	13	5	7	56	19	123	19	5	3	1	55	36	102	11
17	14	5	6	54	21	125	27	5	3	1	52	39	103	7
18	15	6	5	51	23	127	17	5	3	--	50	42	104	3
19	16	6	4	48	26	129	6	5	3	--	46	46	105	4
20	17	6	4	44	29	131	2	5	3	--	42	50	106	1

1/ In these indices the f.o.b. car price of No. 2 Common, standard length, 1 X 8, kiln dried, S4S boards has an index value of 100.

when the lumber was graded by a certified Southern Pine Inspection Bureau grader. Differences such as these have actually been observed on grade-yield studies. They are simply a product of certain conditions and as such should be taken into consideration when using grade-yield information obtained elsewhere.

For these reasons, a mill desiring to use any log or tree grading system should endeavor to make its own grade-yield study under its own particular conditions. Such a study is not difficult to conduct, and advice can be obtained.² It should not be implied that a grading system is inefficient simply because it does not result in identical grade yields under all conditions. Its main features should be ease of application and ability to stratify any group of logs or trees into distinct quality or value classes. This feature can be observed in Table 1, which shows curved lumber grade yields and quality indices by log grade and diameter, or in Figure 1, which presents lumber grade yields in graphic form. The quality index of each log in the study was computed by the method shown in the publication describing log grades (see Footnote 2). The indices within each log grade were then curved over log diameter by means of regression. Although the log quality indices were not needed in the stumpage appraisal, they are shown here primarily for those interested in computing and comparing values by log grade.

Log quality index represents the average value per thousand board feet of dry lumber in a log and is based on the price of No. 2 Common, standard length, 1 X 8, kiln-dried, S4S boards. Thus, if a log had a quality index of 147, and the No. 2 Common price was \$75

²Contact the Forest Utilization Service of the Southeastern Forest Experiment Station, P. O. Box 2570, Asheville, N. C., or the Southern Forest Experiment Station, 704 Lowich Bldg., New Orleans, La.

Table 2.--Average percentage yard lumber grade recovery and quality indices by tree diameters and grades--loblolly pine type in the central Atlantic Coastal Plain near Walterboro, S. C.

Tree d.b.h. (inches)	Trees with No. 1 butt log						Trees with No. 2 butt log						Trees with No. 3 or 4 butt log					
	Lumber grade			Tree			Lumber grade			Tree			Lumber grade			Tree		
	B & :			: quality :			B & :			: quality :			B & :			: quality :		
	Btr:	C :	1C :	2C :	3C :	index 1/Basis	Btr:	C :	1C :	2C :	3C :	index 1/Basis	Btr:	C :	1C :	2C :	3C :	index 1/Basis
	Percent of rough green					No. of trees	Percent of rough green					No. of trees	Percent of rough green					No. of trees
10	--	--	--	--	--	--	--	--	--	--	--	--	2	3	14	72	9	108
11	--	--	--	--	--	--	--	--	--	--	--	--	4	3	15	68	10	109
12	--	--	--	--	--	--	5	7	14	61	13	116	0	5	3	16	64	12
13	--	--	--	--	--	--	8	7	13	60	12	118	6	6	4	15	61	14
14	--	--	--	--	--	--	10	7	13	58	12	121	9	8	4	14	58	16
15	--	--	--	--	--	--	12	7	12	57	12	123	8	8	5	13	56	18
16	--	--	--	--	--	--	14	7	11	55	12	125	12	9	5	11	56	19
17	--	--	--	--	--	--	15	7	11	54	13	127	18	10	5	9	56	20
18	--	--	--	--	--	--	15	8	10	53	14	129	12	10	5	8	56	21
19	--	--	--	--	--	--	16	8	10	51	15	131	7	11	5	7	56	21
20	22	9	9	48	12	149	6	16	9	9	50	16	12	12	6	6	57	19
21	22	9	9	46	14	151	13	16	9	9	49	17	4	12	6	5	58	19
22	23	9	9	44	15	152	16	16	10	8	48	18	1	13	6	4	59	18
23	23	9	9	42	17	154	9	16	10	8	47	19	3	13	6	3	60	18
24	24	9	9	42	18	156	9	16	11	7	46	20	0	14	6	2	60	18
25	24	9	10	38	19	157	13	--	--	--	--	--	--	--	--	--	--	--
26	24	10	10	36	20	159	8	--	--	--	--	--	--	--	--	--	--	--
27	25	10	10	34	21	161	8	--	--	--	--	--	--	--	--	--	--	--
28	25	10	10	33	22	163	0	--	--	--	--	--	--	--	--	--	--	--
29	26	10	11	30	23	164	2	--	--	--	--	--	--	--	--	--	--	--
30	26	10	11	29	24	166	1	--	--	--	--	--	--	--	--	--	--	--

1/ In these indices the f.o.b. car price of No. 2 Common, standard length, 1 X 8, kiln dried, S4S boards has an index value of 100.

per MBM, the lumber yielded from the log would have an estimated value of (147 x .75), or \$110.25 per MBM f.o.b. car.

Lumber Grade Yields and Quality Indexes by Tree Grades

The grade-yield data obtained from single logs were re-assembled by trees to give lumber grade yields by tree grade and size; these data were then used to derive tree quality indices in a manner similar to that used to obtain log quality indices. Tree quality indices and grade yields based upon smoothed curves by tree grade and diameter are shown in Table 2

In preparation for the timber sale, the forestry consulting firms of Bishop Brothers and Robert F. Knoth and Company were engaged to do the marking. The entire tract was

divided into a number of smaller blocks and each block handled as a separate unit. Every tenth tree marked for cutting was tallied by tree grade as well as size. This sample provided an estimate of the marked volume and average diameter by tree grades in each block. After weighting the quality index for each grade and size by its proportion of the total volume, an average quality index for the stand was obtained by blocks. In a manner similar to that used with log grades, an estimate of the value per MBM, mill tally, of the dry lumber yielded by each stand was found by multiplying the quality index by the f.o.b. car price of No. 2 Common boards.

The grade-yield study had furnished the appraiser with an estimate of the value of his timber as finished lumber. At this point the Bonnie Doone forester took over and, after

converting the mill tally value to a log scale basis and deducting appropriate manufacturing costs and a margin for profit and risk, obtained a residual value for stumpage.

The entire tract was put on the market with the requirement that separate bids be submitted by individual blocks. After completion of the sale it was of interest to learn that the accepted bids were within a reasonable range of the stumpage price estimated by use of the tree grades. Although this does not prove that the procedure used here is infallible as a predicting mechanism, it does give the seller a promising method by which he can obtain an estimate of the quality of his timber for negotiating purposes. In a similar manner a buyer may also obtain an estimate of the value of a tract of timber under his particular conditions.

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