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Interim Hardwood
TREE GRADES
For Factory Lumber



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FOREST SERVICE INTERIM GRADES

HARDWOOD TREES have for many years been measured in such a way that tree volume could be estimated; and in recent years the prediction of tree quality by using tree grades has become of interest to owners, sellers, and buyers of timber. Several tree-grading systems have been developed, but none has been publicized and used on a widespread scale. The Forest Service recently adopted and approved interim hardwood tree grades for factory lumber. The specifications for these tree grades and the associated lumber grade volumes for yellow birch, red maple, and black oak are presented here.

BACKGROUND

There have been several attempts to develop tree grades for hardwoods (*Campbell 1951, 1959; Herrick and Jackson 1957; Hyvarinen 1968; Lucas 1969; Marden 1965; Schroeder 1964*). Most of these have involved single species. The most widely used method was developed by the USDA Forest Service at Carbondale, Illinois (*Herrick and Jackson 1957*). In this system, a tree's grade is equal to the grade of the best 10-foot section of the 16-foot butt log. Another system, used in the Northeast, involves grading each log in the standing tree. For both of these tree-grading methods, lumber grade yields for sample trees were estimated from yields of logs sawed in earlier log-grade studies (*Vaughan et al. 1966*). In other words, the same lumber grade volumes were applied to all sections of sample trees exhibiting comparable diameter and log grade. The estimated lumber grade yields were accepted as actual, and it was understood that variance estimates were not meaningful.

PROCEDURE

Tree Grades

By 1965, a large accumulation of actual lumber grade yield data from hardwood trees was available. We reviewed past tree-grade research and selected yellow birch for a test to verify whether or not the best 10-foot grading system was valid for use with actual yields.

In addition to the best 10-foot section, we planned to test the best 8- and 12-foot sections of the 16-foot butt log, the entire 16-foot butt log, and several versions of the tree-grading system employed by Forest Survey.

Our initial investigation, concerned with the best grading section, utilized data from 195 yellow birch trees. The trees had been selected and measured, and the logs were sawed in Michigan, Vermont, and West Virginia, resulting in dry board volumes and grades. The tree selectors graded the standing trees, using the system employed by Forest Survey. The full range of d.b.h. (diameter at breast height), merchantable height, and quality classes available at each sample location was represented, and all portions of the tree that qualified as local-use or better were processed into factory lumber. (A local-use class log must scale at least 8 inches d.i.b. — diameter inside bark — by 8 feet long and must be one-third sound. The diameter of knots, holes, rot, etc. cannot exceed one-half the diameter of the log at the point of occurrence).

Also, each tree's surface characteristics were recorded on paper diagrams by trained personnel representing all branches of the Forest Service. When the grades from the diagrams were compared with the grades obtained during tree selection, we found that they differed often. We credited this to differences in defect identification between the graders. We chose the grades assigned during tree selection, reasoning that they could most likely be duplicated in normal practice.

A tree was given the grade of the butt 16-foot log, except that, when a 12- or 14-foot section of the 16-foot log was better, the grade of this shorter section was used. The section was graded according to specifications contained in Hardwood Log

Grades for Standard Lumber (*Vaughan et al. 1966*). However, sound end defect and shake were not considered.

Total value per thousand board feet was obtained for each tree (1967 lumber prices). For each tree grade, these values were plotted over d.b.h. Many trees that were placed below the average contained a significant amount of scalable defect in the butt log. The 10-percent level of scalable defect was the most consistent breaking point between trees that were obviously misplaced and trees that were not. The system was modified to have a more stringent interpretation of scalable defect than originally applied.

To supplement the yellow birch data, representative samples of red maple and black oak trees were selected, and the logs were sawed (fig. 1). An analysis similar to that used on yellow birch was conducted; and, as before, the grades assigned during

Figure 1. — Location of study mills (general areas where the sample trees for the species indicated were cut).



tree selection frequently differed from the diagram grades. Once again we chose the grading system used in the field and modified it to include the more restrictive scalable defect rule.

Although the diagrams were not the basis for the final tree grades, they were used for the tests to establish the best grading section. However, the tests were not conclusive. The non-random sampling procedure precluded valid tests of the differences between the several tree-grading systems. Additional data were needed; and, because of the urgent need for tree grades, we decided to forego further tests. For the sample that was available, the plots of total value per thousand board feet over d.b.h. indicated that the tree grades presented here exhibited less within-grade variation than the other trial grading systems.

Lumber Yields

To be useful over time, tree grades should be accompanied by a predictor that is more stable than lumber prices. We developed multiple regression equations for each species and tree grade that predict dry volume by lumber grade (tables 2 to 4). D.b.h.² and merchantable height functioned as independent variables for yellow birch and red maple, and d.b.h.² × merchantable height was added to the model for black oak. If a model did not perform as expected, we eliminated independent variables that were not significant.

The equations were solved for the desired combinations of d.b.h. and merchantable height resulting in board-foot volume tables by tree grade and lumber grade for yellow birch, red maple, and black oak (tables 5 to 7).

The lumber grade volumes were summed for each d.b.h.-height class resulting in predicted total tree volumes. These were compared between tree grades and species and with actual total lumber volumes of the sample trees. In the few instances where the predicted volumes were obviously wrong, we corrected each lumber grade volume using hand-fitted curves through the actual data. These changes have been incorporated in the volume tables.

The practice of hand-fitting discussed above is well established, and at times faster than an extensive search for the proper mathematical model.

We have included the lumber thickness distribution for each species (tables 8 to 10). In nearly all cases, the thickness pattern represents that of sawing for best grade; that is, sawing for the thickest potential board, up to 8/4 inches, without lowering the board grade. A different pattern followed in sawing for grade would cause small differences in yield.

Mean lumber grade yields, standard errors of the residuals, and correlation coefficients are included in tables 11 to 13.

TREE GRADE SPECIFICATIONS

Grading Rules

Table 1 contains the specifications of the interim hardwood tree grades for factory lumber.

Application

The grading rules are for use on standing hardwood trees. Strict attention must be paid to the specifications. A tree's grade is determined by the grade of the butt log, the tree d.b.h., and an estimate of the scalable defect in the grading section. Useful log-grading aids are contained in the following publications:

1. *A guide to hardwood log grading (rev.)*. Ostrander, M. D., and others. 1965. USDA Forest Serv. NE. Forest Exp. Sta., 50 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
2. *Hardwood log grades for standard lumber*. Vaughan, C. L., A. C. Wollin, K. A. McDonald, and E. H. Bulgrin. 1966. USDA Forest Serv. Res. Paper FPL-63, 52 pp., illus. Forest Prod. Lab., Madison, Wis.
3. *Grade defects in hardwood timber*. Lockard, C. R., J. A. Putnam, and R. D. Carpenter. 1963. USDA Agr. Handbook 244, 39 pp., illus.
4. *Defect indicators in sugar maple*. Marden, Richard M., and Charles L. Stayton. 1970. USDA Forest Serv. Res. Paper NC-37, 29 pp., illus. NC. Forest Exp. Sta., St. Paul, Minn.

Those seeking a discussion of how to estimate deductions for sweep and crook are referred to No. 1 above (p. 36 to 37). Because the defect is visible, the deduction for sweep or crook in the standing tree should be comparable to that for a log on the ground.

The chore of estimating interior defect is more difficult and subjective. Some insight into the art of scaling interior cull in trees may be gained from No. 1 above and from the following:

1. *Estimating defect in tree-length hardwoods*. Nyland, Ralph D. 1970. Northern Logger. 18:8.
2. *A photo guide to the patterns of discoloration and decay in living northern hardwood trees*. Shigo, Alex L., and Edwin vH. Larson. 1969. USDA Forest Serv. Res. Paper NE-127, 100 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa.
3. *Shortcuts for cruisers and scalers*. L. R. Grosenbaugh. 1952. USDA Forest Serv. S. Forest Exp. Sta. Occas. Paper 126, pp. 14-15. S. Forest Exp. Sta., New Orleans, La.

LUMBER GRADE VOLUME AND VALUE ESTIMATION

Use of the lumber grade volume tables requires the following field data for each tree:

- Species.
- Tree grade.
- D.b.h. to the nearest inch.
- Merchantable height to the nearest half-log. (Height is the distance from the top of a 1-foot stump to where local-use material ends. For forked trees, consider only the longest fork).

The predicted volumes are net volumes derived from actual mill yields and should not be adjusted for cull or overrun.

When estimating a tree's value:

1. Consult the appropriate table and record the volumes by lumber grade for the tree in question.
2. Apply current dry lumber prices to the lumber volumes to obtain lumber value per grade.
3. Sum the value of lumber in all grades to arrive at tree value.

If desirable, a lumber grade price may be weighted in proportion to the volume that a mill is producing in each lumber grade-thickness class, as in the following example (Firsts and Seconds lumber grade):

<i>Thickness class</i>	<i>Percent of volume</i>	<i>Price</i>
4/4	50	\$360/M bd. ft.
5/4	25	\$365/M bd. ft.
6/4	25	\$375/M bd. ft.
FAS weighted price = \$365/M bd. ft.		

DISCUSSION

The tree grades presented in this paper have been classed as interim. Lumber grade yields for only three species are available, and these have not been field-tested on trees outside the sample trees. Successful field tests and yields for additional species are necessary to change the grades from interim to standard Forest Service grades.

Because the yields are based on actual sawed lumber volumes, these grades have an advantage over present tree grading systems.

We envision the interim grades and yields being used as is and with local adjustments based on comparison tests of predicted and actual mill-manufactured dry lumber tallies.

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Table 1.— Interim hardwood tree grades for factory lumber

Grade factor	Tree grade 1			Tree grade 2		Tree grade 3
Diameter (minimum i.b. at 17 feet) inches	13	16	20	¹ 11	12	8
D.b.h. (minimum) inches	16	16	16	13	13	10
Length of grading section ² feet	Butt 16			Butt 16		Butt 16
Clear cuttings (on the 3 best faces) ³ :						
Length (minimum) feet	7	5	3	3	3	2
Number on face (maximum)	2	2	2	2	3	Unlimited
Yield in face length (minimum)	5/6	5/6	5/6	4/6	4/6	3/6
Cull deduction, including crook and sweep but excluding shake (maximum) pct.	9	9	9	⁴ 9	9	50

¹Grade 2 trees can be 10 inches i.b. at top of grading section if otherwise meeting surface requirements for small grade 1.

²Whenever a 12- or 14-foot section of the butt 16-foot log is better than the entire log, the grade of the shorter section will become the grade of the tree. This shorter section, when used, is the basis for determining the grading factors such as diameter and cull deduction.

³A clear cutting is a portion of a face free of defects, extending the width of the face. A face is $\frac{1}{4}$ of the surface of the grading section as divided lengthwise.

⁴15 percent crook and sweep or 40 percent total cull deduction permitted in grade 2 if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 if the cull deduction for rot is greater than 9 percent.

Table 2.—Regression equations for yellow birch

Dependent variable: lumber grade	Independent variables		
	Constant	D.b.h. ²	Merchantable height
TREE GRADE 1			
FAS	— 81.6	+0.2508	+0.948
FAS1F	+ 4.9	+ .0627	—
Selects	+ .9	+ .0046	+ .161
No. 1C	—131.3	+ .3091	+2.169
No. 2C	— 46.0	+ .1279	+1.494
No. 3A	— 42.5	+ .0713	+1.326
No. 3B	— 5.0	+ .0373	+ .594
TREE GRADE 2			
FAS	— 26.4	+0.0915	+0.425
FAS1F	— 11.9	+ .0534	+ .288
Selects	+ 3.7	+ .0024	+ .049
No. 1C	— 13.0	+ .1313	+ .598
No. 2C	— 41.6	+ .1138	+1.487
No. 3A	— 6.5	+ .0383	+ .836
No. 3B	— 12.6	+ .0491	+ .785
TREE GRADE 3			
FAS	— 1.1	+0.0076	+0.015
FAS1F	— 5.1	+ .0304	+ .091
Selects	+ 1.3	+ .0023	—
No. 1C	— 35.8	+ .1921	+ .650
No. 2C	— 35.4	+ .1162	+1.638
No. 3A	— 15.1	+ .0657	+ .978
No. 3B	+ 8.1	+ .0437	+ .332

Table 3.—Regression equations for red maple

Dependent variable: lumber grade	Independent variables		
	Constant	D.b.h. ²	Merchantable height
TREE GRADE 1			
FAS	-90.4	+0.2337	+1.492
FAS1F	-46.4	+ .1140	+1.167
Selects	-18.7	+ .0371	+ .453
No. 1C	-53.8	+ .2165	+ .820
No. 2A	-39.6	+ .2129	+ .590
No. 2B	+23.1	—	+ .611
No. 3A	-20.5	+ .0592	+ .464
No. 3B	-25.0	+ .0476	+ .439
TREE GRADE 2			
FAS	-46.1	+0.1699	+0.555
FAS1F	-35.7	+ .1294	+ .662
Selects	- 4.5	+ .0204	+ .249
No. 1C	-46.6	+ .2091	+ .749
No. 2A	- 6.0	+ .0802	+1.086
No. 2B	+21.1	+ .0110	+ .677
No. 3A	- 9.6	+ .0349	+ .426
No. 3B	-19.0	+ .0840	+ .123
TREE GRADE 3			
FAS	-13.4	+0.0416	+0.270
FAS1F	-21.5	+ .0809	+ .404
Selects	- 5.3	+ .0315	+ .132
No. 1C	-30.0	+ .1558	+ .720
No. 2A	-21.1	+ .0792	+1.195
No. 2B	+ 4.1	—	+1.320
No. 3A	- 3.4	+ .0654	+ .115
No. 3B	- 3.1	+ .0442	+ .032

Table 4. — Regression equations for black oak

Dependent variable: lumber grade	Independent variables			
	Constant	D.b.h. ²	Merchantable height	D.b.h. ² × Merchantable height
TREE GRADE 1				
FAS	+44.8	—0.0618	—2.258	+0.006163
FAS1F	+70.9	— .0891	—2.037	+ .005013
Selects	— 5.7	+ .0296	—	—
No. 1C	—28.4	+ .1135	— .319	+ .005598
No. 2C	—16.4	+ .0354	+1.372	+ .001458
SW	— 5.3	—	+ .545	—
No. 3A	+81.3	— .1263	— .228	+ .003056
No. 3B	—27.6	— .0387	+1.572	+ .001249
TREE GRADE 2				
FAS	—17.7	+0.0998	—	—
FAS1F	— 2.5	+ .0656	—0.438	+0.001269
Selects	—15.1	+ .0313	+ .424	— .000571
No. 1C	—84.4	+ .3001	+ .292	+ .003256
No. 2C	— 3.3	+ .0134	— .041	+ .005019
SW	—13.6	—	+ .629	—
No. 3A	+ 2.7	— .0026	+ .856	+ .001574
No. 3B	+11.2	— .0479	+ .930	+ .000673
TREE GRADE 3				
FAS	+ 2.8	—0.0105	—0.308	+0.001659
FAS1F	—11.1	+ .0747	—	—
Selects	+ 4.0	— .0144	— .184	+ .000819
No. 1C	—35.9	+ .2870	—	—
No. 2C	—33.7	+ .1504	+1.281	— .000197
SW	—10.6	+ .0465	+ .711	— .001239
No. 3A	—35.0	+ .2101	+1.880	— .004353
No. 3B	+ 8.6	— .2269	+1.102	+ .006792

Table 5.— Lumber grade volume for yellow birch
[In board feet]

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	No. 3A	No. 3B
TREE GRADE 1, 1½ -LOGS							
16	9.6	21.0	5.9	17.0	33.8	11.5	18.8
17	17.2	23.0	6.1	20.0	33.9	12.5	20.0
18	24.7	25.2	6.3	25.0	34.6	13.7	21.3
19	31.7	27.5	6.4	32.3	36.0	15.1	22.7
20	41.5	30.0	6.6	44.4	41.0	17.8	24.2
21	51.8	32.6	6.8	57.1	46.3	20.8	25.7
22	62.5	35.2	7.0	70.4	51.8	23.8	27.3
23	73.8	38.1	7.2	84.3	57.5	27.0	29.0
24	85.6	41.0	7.4	98.8	63.5	30.4	30.7
25	97.9	44.1	7.6	113.9	69.8	33.9	32.6
26	110.7	47.3	7.9	129.7	76.3	37.5	34.5
TREE GRADE 1, 2-LOGS							
16	15.1	21.0	7.2	20.7	40.1	21.3	23.6
17	22.5	23.0	7.4	29.1	41.2	21.8	24.8
18	30.0	25.2	7.5	38.3	43.2	23.0	26.1
19	39.3	27.5	7.7	49.7	48.0	25.7	27.5
20	49.1	30.0	7.9	61.7	53.0	28.5	28.9
21	59.3	32.6	8.1	74.4	58.2	31.4	30.5
22	70.1	35.2	8.3	87.7	63.7	34.4	32.1
23	81.4	38.1	8.5	101.6	69.5	37.6	33.7
24	93.2	41.0	8.7	116.1	75.5	41.0	35.5
25	105.5	44.1	8.9	131.3	81.7	44.5	37.3
26	118.3	47.3	9.2	147.1	88.3	48.1	39.2
27	131.6	50.6	9.4	163.4	95.0	51.9	41.2
28	145.4	54.1	9.7	180.4	102.1	55.8	43.3
29	159.7	57.6	9.9	198.1	109.4	59.9	45.4
30	174.5	61.3	10.2	216.3	116.9	64.1	47.6
TREE GRADE 1, 2½-LOGS							
16	20.5	21.0	8.5	34.6	46.5	28.8	28.3
17	28.8	23.0	8.7	44.8	50.7	31.1	29.5
18	37.6	25.2	8.8	55.6	55.2	33.6	30.8
19	46.9	27.5	9.0	67.0	59.9	36.3	32.2
20	56.6	30.0	9.2	79.1	64.9	39.1	33.7
21	66.9	32.6	9.4	91.8	70.2	42.0	35.2
22	77.7	35.2	9.6	105.1	75.7	45.0	36.8
23	89.0	38.1	9.8	119.0	81.4	48.3	38.5
24	100.8	41.0	10.0	133.5	87.4	51.6	40.2
25	113.1	44.1	10.2	148.6	93.7	55.1	42.1
26	125.9	47.3	10.4	164.4	100.2	58.7	44.0
27	139.2	50.6	10.7	180.8	107.0	62.5	46.0
28	152.9	54.1	10.9	197.8	114.0	66.4	48.0

CONTINUED

Table 5. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	No. 3A	No. 3B
29	167.2	57.6	11.2	215.4	121.3	70.5	50.1
30	182.0	61.3	11.5	233.6	128.9	74.7	52.3
TREE GRADE 1, 3-LOGS							
16	28.1	21.0	9.8	51.9	58.5	39.4	33.1
17	36.4	23.0	10.0	62.1	62.7	41.8	34.3
18	45.2	25.2	10.1	73.0	67.2	44.2	35.6
19	54.4	27.5	10.3	84.4	71.9	46.9	37.0
20	64.2	30.0	10.5	96.5	76.9	49.7	38.4
21	74.5	32.6	10.7	109.1	82.1	52.6	40.0
22	85.3	35.2	10.9	122.4	87.6	55.7	41.6
23	96.6	38.1	11.1	136.3	93.4	58.9	43.2
24	108.4	41.0	11.3	150.9	99.4	62.2	45.0
25	120.7	44.1	11.5	166.0	105.6	65.7	46.8
26	133.4	47.3	11.7	181.8	112.2	69.3	48.7
27	146.7	50.6	12.0	198.1	119.0	73.1	50.7
28	160.5	54.1	12.2	215.1	126.0	77.0	52.8
29	174.8	57.6	12.5	232.8	133.3	81.1	54.9
30	189.6	61.3	12.8	251.0	140.8	85.3	57.1
TREE GRADE 2, 1-LOG							
13	0.0	1.7	4.9	18.8	1.4	13.3	8.3
14	.0	3.2	5.0	22.3	4.5	14.4	9.6
15	1.0	4.7	5.0	26.1	7.8	15.5	11.0
16	3.8	6.4	5.1	30.2	11.3	16.7	12.5
17	6.8	8.1	5.2	34.5	15.1	17.9	14.1
18	10.0	10.0	5.3	39.1	19.1	19.3	15.9
19	13.4	12.0	5.4	44.0	23.3	20.7	17.7
20	17.0	14.1	5.4	49.1	27.7	22.2	19.6
21	20.8	16.3	5.5	54.5	32.4	23.8	21.6
22	24.7	18.6	5.6	60.1	37.3	25.4	23.7
23	28.8	21.0	5.8	66.0	42.4	27.1	25.9
24	33.1	23.5	5.9	72.2	47.7	28.9	28.2
TREE GRADE 2, 1½-LOG							
13	0.0	4.0	5.3	23.5	13.3	20.0	14.5
14	1.7	5.5	5.3	27.1	16.4	21.1	15.9
15	4.4	7.0	5.4	30.9	19.7	22.2	17.3
16	7.2	8.7	5.5	35.0	23.2	23.4	18.8
17	10.2	10.4	5.6	39.3	27.0	24.6	20.4
18	13.4	12.3	5.7	43.9	31.0	26.0	22.1
19	16.8	14.3	5.7	48.8	35.2	27.4	24.0
20	20.4	16.4	5.8	53.9	39.6	28.9	25.9
21	24.2	18.6	5.9	59.3	44.3	30.5	27.9
22	28.1	20.9	6.0	64.9	49.2	32.1	30.0

CONTINUED

Table 5.—Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	No. 3A	No. 3B
23	32.2	23.3	6.1	70.8	54.3	33.8	32.2
24	36.5	25.8	6.3	77.0	59.6	35.6	34.5
TREE GRADE 2, 2-LOGS							
13	2.7	6.3	5.7	28.3	25.2	26.7	20.8
14	5.1	7.8	5.7	31.9	28.3	27.8	22.1
15	7.8	9.3	5.8	35.7	31.6	28.9	23.6
16	10.6	11.0	5.9	39.7	35.1	30.1	25.1
17	13.6	12.7	6.0	44.1	38.9	31.3	26.7
18	16.8	14.6	6.0	48.7	42.9	32.7	28.4
19	20.2	16.6	6.1	53.5	47.1	34.1	30.2
20	23.8	18.7	6.2	58.7	51.5	35.6	32.2
21	27.6	20.9	6.3	64.0	56.2	37.1	34.2
22	31.5	23.2	6.4	69.7	61.1	38.8	36.3
23	35.6	25.6	6.5	75.6	66.2	40.5	38.5
24	39.9	28.1	6.7	81.8	71.5	42.3	40.8
TREE GRADE 2, 2½-LOGS							
13	6.1	8.6	6.1	33.1	37.1	33.4	27.1
14	8.5	10.1	6.1	36.7	40.2	34.4	28.4
15	11.2	11.6	6.2	40.5	43.5	35.6	29.8
16	14.0	13.3	6.3	44.5	47.0	36.7	31.4
17	17.0	15.1	6.4	48.9	50.8	38.0	33.0
18	20.2	16.9	6.4	53.5	54.8	39.3	34.7
19	23.6	18.9	6.5	58.3	59.0	40.8	36.5
20	27.2	21.0	6.6	63.4	63.4	42.3	38.4
21	31.0	23.2	6.7	68.8	68.1	43.8	40.5
22	34.9	25.5	6.8	74.5	73.0	45.5	42.6
23	39.0	27.9	6.9	80.4	78.1	47.2	44.8
24	43.3	30.4	7.0	86.5	83.4	49.0	47.1
TREE GRADE 2, 3-LOGS							
13	9.5	10.9	6.5	37.9	49.0	40.1	33.4
14	11.9	12.4	6.5	41.4	52.1	41.1	34.7
15	14.6	13.9	6.6	45.2	55.4	42.2	36.1
16	17.4	15.6	6.7	49.3	58.9	43.4	37.6
17	20.4	17.4	6.7	53.6	62.7	44.7	39.3
18	23.6	19.2	6.8	58.2	66.6	46.0	41.0
19	27.0	21.2	6.9	63.1	70.9	47.5	42.8
20	30.6	23.3	7.0	68.2	75.3	48.9	44.7
21	34.4	25.5	7.1	73.6	80.0	50.5	46.7
22	38.3	27.8	7.2	79.3	84.9	52.2	48.8
23	42.4	30.2	7.3	85.2	90.0	53.9	51.1
24	46.7	32.7	7.4	91.3	95.3	55.7	53.4

CONTINUED

Table 5. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	No. 3A	No. 3B
TREE GRADE 3, 1-LOG							
10	0.0	0.0	1.5	0.0	2.4	7.1	17.8
11	.1	.0	1.6	.0	4.9	8.5	18.7
12	.2	.7	1.6	2.3	7.5	10.0	19.7
13	.4	1.5	1.7	7.1	10.4	11.7	20.8
14	.6	2.3	1.8	12.3	13.6	13.4	22.0
15	.8	3.2	1.8	17.8	17.0	15.3	23.2
16	1.1	4.1	1.9	23.8	20.6	17.4	24.6
17	1.3	5.1	2.0	30.1	24.4	19.5	26.0
18	1.6	6.2	2.0	36.8	28.5	21.8	27.6
19	1.9	7.3	2.1	43.9	32.8	24.3	29.2
20	2.2	8.5	2.2	51.4	37.3	26.8	30.9
TREE GRADE 3, 1½-LOGS							
10	0.0	0.1	1.5	0.0	15.5	14.9	20.4
11	.2	.8	1.6	3.0	18.0	16.3	21.4
12	.4	1.5	1.6	7.5	20.6	17.8	22.4
13	.5	2.2	1.7	12.3	23.5	19.5	23.5
14	.7	3.0	1.8	17.5	26.7	21.2	24.6
15	1.0	3.9	1.8	23.0	30.1	23.2	25.9
16	1.2	4.9	1.9	29.0	33.7	25.2	27.3
17	1.5	5.9	2.0	35.3	37.5	27.4	28.7
18	1.7	6.9	2.0	42.0	41.6	29.7	30.2
19	2.0	8.1	2.1	49.1	45.9	32.1	31.8
20	2.3	9.2	2.2	56.6	50.4	34.7	33.5
21	2.6	10.5	2.3	64.5	55.2	37.3	35.3
22	2.9	11.8	2.4	72.8	60.2	40.2	37.2
TREE GRADE 3, 2-LOGS							
10	0.1	0.9	1.5	4.2	28.6	22.8	23.1
11	.3	1.5	1.6	8.2	31.1	24.1	24.0
12	.5	2.2	1.6	12.7	33.7	25.7	25.0
13	.7	2.9	1.7	17.5	36.7	27.3	26.1
14	.9	3.8	1.8	22.7	39.8	29.1	27.3
15	1.1	4.7	1.8	28.2	43.2	31.0	28.6
16	1.3	5.6	1.9	34.2	46.8	33.0	29.9
17	1.6	6.6	2.0	40.5	50.6	35.2	31.4
18	1.8	7.7	2.0	47.2	54.7	37.5	32.9
19	2.1	8.8	2.1	54.3	59.0	39.9	34.5
20	2.4	10.0	2.2	61.8	63.5	42.5	36.2
21	2.7	11.2	2.3	69.7	68.3	45.2	38.0
22	3.1	12.5	2.4	78.0	73.3	48.0	39.9
23	3.4	13.9	2.5	86.6	78.5	51.0	41.8
24	3.8	15.3	2.6	95.6	83.9	54.0	43.9

CONTINUED

Table 5. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	No. 3A	No. 3B
TREE GRADE 3, 2½-LOGS							
12	0.6	2.9	1.6	17.9	46.9	33.5	27.7
13	.8	3.7	1.7	22.7	49.8	35.1	28.8
14	1.0	4.5	1.8	27.9	52.9	36.9	29.9
15	1.2	5.4	1.8	33.4	56.3	38.8	31.2
16	1.4	6.3	1.9	39.4	59.9	40.8	32.6
17	1.7	7.3	2.0	45.7	63.7	43.0	34.0
18	2.0	8.4	2.0	52.4	67.8	45.3	35.5
19	2.2	9.5	2.1	59.5	72.1	47.7	37.2
20	2.5	10.7	2.2	67.0	76.6	50.3	38.9
21	2.9	11.9	2.3	74.9	81.4	53.0	40.7
22	3.2	13.3	2.4	83.2	86.4	55.8	42.5
23	3.5	14.6	2.5	91.8	91.6	58.8	44.5
24	3.9	16.1	2.6	100.8	97.1	61.9	46.6

Table 6. — Lumber grade volume for red maple

[In board feet]

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2A	No. 2B	No. 3A	No. 3B
TREE GRADE 1, 2-LOGS								
16	20.5	23.9	6.3	33.2	40.2	42.7	11.3	1.4
17	28.1	26.9	7.3	39.5	46.0	42.7	13.0	3.2
18	35.7	30.1	8.4	46.0	52.1	42.7	14.6	4.9
19	43.5	33.5	9.6	52.8	58.5	42.7	16.4	6.5
20	50.8	36.5	10.6	59.0	64.4	42.7	18.0	8.1
21	60.4	41.2	12.2	67.9	73.2	42.7	20.5	10.0
22	70.5	46.1	13.8	77.2	82.3	42.7	23.0	12.1
23	81.0	51.2	15.4	87.0	91.9	42.7	25.7	14.2
24	92.0	56.6	17.2	97.1	101.9	42.7	28.4	16.5
25	103.4	62.2	19.0	107.8	112.3	42.7	31.3	18.8
26	115.3	68.0	20.9	118.8	123.2	42.7	34.4	21.2
TREE GRADE 1, 2½-LOGS								
16	31.6	32.1	9.7	37.4	41.8	47.5	14.3	5.1
17	38.7	34.9	10.6	43.7	47.8	47.5	16.0	6.6
18	45.0	37.2	11.4	49.1	53.0	47.5	17.2	8.0
19	53.6	41.4	12.8	57.2	60.9	47.5	19.4	9.7
20	62.8	45.9	14.3	65.6	69.2	47.5	21.7	11.6
21	72.3	50.6	15.8	74.5	77.9	47.5	24.2	13.6
22	82.4	55.5	17.4	83.8	87.0	47.5	26.7	15.6

CONTINUED

Table 6. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2A	No. 2B	No. 3A	No. 3B
23	92.9	60.6	19.0	93.5	96.6	47.5	29.4	17.7
24	103.9	65.9	20.8	103.7	106.6	47.5	32.2	20.0
25	115.3	71.5	22.6	114.3	117.1	47.5	35.1	22.3
26	127.3	77.3	24.5	125.4	127.9	47.5	38.1	24.7
TREE GRADE 1, 3-LOGS								
16	41.0	38.8	12.5	41.0	43.2	52.4	16.9	8.3
17	48.8	42.6	13.8	48.1	50.2	52.4	18.9	9.8
18	56.9	46.6	15.1	55.7	57.7	52.4	21.0	11.5
19	65.6	50.8	16.4	63.7	65.6	52.4	23.1	13.3
20	74.7	55.2	17.9	72.2	73.9	52.4	25.5	15.1
21	84.3	59.9	19.4	81.0	82.6	52.4	27.9	17.1
22	94.3	64.8	21.0	90.3	91.8	52.4	30.4	19.1
23	104.8	69.9	22.7	100.1	101.3	52.4	33.1	21.3
24	115.8	75.3	24.4	110.3	111.4	52.4	35.9	23.5
25	127.3	80.9	26.2	120.9	121.8	52.4	38.8	25.8
26	139.2	86.7	28.1	131.9	132.6	52.4	41.8	28.2
TREE GRADE 1, 3½-LOGS								
16	53.0	48.1	16.2	47.5	47.9	57.3	20.6	11.8
17	60.7	51.9	17.4	54.7	55.0	57.3	22.6	13.3
18	68.9	55.9	18.7	62.3	62.4	57.3	24.7	15.0
19	77.5	60.1	20.1	70.3	70.3	57.3	26.9	16.8
20	86.6	64.6	21.5	78.7	78.6	57.3	29.2	18.6
21	96.2	69.2	23.0	87.6	87.3	57.3	31.6	20.6
22	106.3	74.1	24.6	96.9	96.5	57.3	34.1	22.6
23	116.8	79.3	26.3	106.6	106.1	57.3	36.8	24.8
24	127.8	84.6	28.0	116.8	116.1	57.3	39.6	27.0
25	139.2	90.2	29.9	127.4	126.5	57.3	42.5	29.3
26	151.1	96.0	31.7	138.5	137.4	57.3	45.5	31.8
TREE GRADE 1, 4-LOGS								
16	64.9	57.5	19.8	54.1	52.7	62.2	24.4	15.3
17	72.6	61.2	21.0	61.2	59.7	62.2	26.3	16.9
18	80.8	65.2	22.3	68.8	67.1	62.2	28.4	18.5
19	89.5	69.4	23.7	76.8	75.0	62.2	30.6	20.3
20	98.6	73.9	25.1	85.3	83.3	62.2	32.9	22.1
21	108.1	78.6	26.7	94.2	92.0	62.2	35.3	24.1
22	118.2	83.5	28.2	103.5	101.2	62.2	37.8	26.1
23	128.7	88.6	29.9	113.2	110.8	62.2	40.5	28.3
24	139.7	94.0	31.7	123.4	120.8	62.2	43.3	30.5
25	151.2	99.5	33.5	134.0	131.2	62.2	46.2	32.8
26	163.1	105.4	35.4	145.0	142.1	62.2	49.2	35.3

CONTINUED

Table 6. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2A	No. 2B	No. 3A	No. 3B
TREE GRADE 2, 2-LOGS								
13	0.4	7.4	6.9	12.7	42.3	44.6	9.9	0.0
14	5.0	10.8	7.5	18.4	44.5	44.9	10.9	1.4
15	9.9	14.6	8.1	24.4	46.8	45.2	11.9	3.8
16	15.2	18.6	8.7	30.9	49.3	45.6	13.0	6.4
17	20.8	22.9	9.4	37.8	51.9	45.9	14.1	9.2
18	26.7	27.4	10.1	45.1	54.7	46.3	15.3	12.2
19	33.0	32.2	10.8	52.9	57.7	46.7	16.6	15.3
20	39.6	37.2	11.6	61.0	60.8	47.2	18.0	18.5
21	46.6	42.5	12.5	69.6	64.1	47.6	19.4	22.0
22	53.9	48.1	13.3	78.6	67.6	48.1	20.9	25.6
23	61.5	53.9	14.3	88.0	71.2	48.6	22.5	29.4
24	69.5	60.0	15.2	97.8	74.9	49.1	24.1	33.3
TREE GRADE 2, 2½-LOGS								
13	4.8	12.6	8.9	18.7	51.0	50.0	13.3	0.1
14	9.4	16.1	9.5	24.3	53.2	50.3	14.3	2.4
15	14.3	19.9	10.0	30.4	55.5	50.7	15.3	4.8
16	19.6	23.9	10.7	36.9	58.0	51.0	16.4	7.4
17	25.2	28.2	11.4	43.8	60.6	51.4	17.5	10.2
18	31.1	32.7	12.1	51.1	63.4	51.7	18.7	13.1
19	37.4	37.5	12.8	58.8	66.4	52.2	20.0	16.2
20	44.1	42.5	13.6	67.0	69.5	52.6	21.4	19.5
21	51.0	47.8	14.5	75.6	72.8	53.0	22.8	23.0
22	58.3	53.4	15.3	84.6	76.3	53.5	24.3	26.6
23	66.0	59.2	16.3	94.0	79.9	54.0	25.9	30.4
24	74.0	65.3	17.2	103.8	83.6	54.5	27.5	34.3
TREE GRADE 2, 3-LOGS								
13	9.3	17.9	10.9	24.7	59.7	55.5	16.7	1.1
14	13.8	21.4	11.5	30.3	61.8	55.8	17.7	3.4
15	18.8	25.2	12.0	36.4	64.2	56.1	18.7	5.8
16	24.0	29.2	12.7	42.9	66.7	56.4	19.8	8.4
17	29.6	33.5	13.3	49.8	69.3	56.8	20.9	11.2
18	35.6	38.0	14.1	57.1	72.1	57.2	22.2	14.1
19	41.9	42.8	14.8	64.8	75.1	57.6	23.4	17.2
20	48.5	47.8	15.6	73.0	78.2	58.0	24.8	20.5
TREE GRADE 3, 1-LOG								
10	0.0	0.0	0.0	0.0	5.9	25.2	5.0	1.8
11	.0	.0	.6	.4	7.6	25.2	6.4	2.8
12	.0	.0	1.3	4.0	9.4	25.2	7.9	3.8
13	.0	.0	2.1	7.9	11.4	25.2	9.5	4.9
14	.0	.8	3.0	12.1	13.5	25.2	11.3	6.1
15	.3	3.2	3.9	16.6	15.8	25.2	13.2	7.4

CONTINUED

Table 6. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2A	No. 2B	No. 3A	No. 3B
16	1.6	5.7	4.9	21.4	18.3	25.2	15.2	8.7
17	2.9	8.3	5.9	26.5	20.9	25.2	17.3	10.2
18	4.4	11.2	7.0	32.0	23.7	25.2	19.6	11.7
19	5.9	14.2	8.2	37.8	26.6	25.2	22.0	13.4
20	7.6	17.3	9.4	43.8	29.7	25.2	24.6	15.1
TREE GRADE 3, 1½-LOGS								
10	0.0	0.0	1.0	2.9	15.5	35.8	5.9	2.1
11	.0	.0	1.7	6.1	17.2	35.8	7.3	3.0
12	.0	.0	2.4	9.7	19.0	35.8	8.8	4.0
13	.1	1.9	3.2	13.6	21.0	35.8	10.4	5.1
14	1.2	4.1	4.0	17.8	23.1	35.8	12.2	6.3
15	2.4	6.4	5.0	22.3	25.4	35.8	14.1	7.6
16	3.7	8.9	5.9	27.2	27.9	35.8	16.1	9.0
17	5.1	11.6	7.0	32.3	30.5	35.8	18.3	10.4
18	6.6	14.4	8.1	37.8	33.2	35.8	20.5	12.0
19	8.1	17.4	9.2	43.5	36.2	35.8	23.0	13.6
20	9.7	20.6	10.5	49.6	39.3	35.8	25.5	15.3
TREE GRADE 3, 2-LOGS								
10	0.0	0.0	2.1	8.6	25.1	46.3	6.8	2.3
11	.3	1.2	2.7	11.9	26.7	46.3	8.2	3.3
12	1.2	3.1	3.5	15.5	28.5	46.3	9.7	4.3
13	2.3	5.1	4.2	19.4	30.5	46.3	11.3	5.4
14	3.4	7.3	5.1	23.6	32.7	46.3	13.1	6.6
15	4.6	9.6	6.0	28.1	35.0	46.3	15.0	7.9
16	5.9	12.1	7.0	32.9	37.4	46.3	17.0	9.2
17	7.3	14.8	8.0	38.1	40.0	46.3	19.2	10.7
18	8.7	17.6	9.1	43.5	42.8	46.3	21.5	12.2
19	10.3	20.6	10.3	49.3	45.7	46.3	23.9	13.9
20	11.9	23.8	11.5	55.4	48.8	46.3	26.4	15.6
TREE GRADE 3, 2½-LOGS								
12	3.4	6.3	4.5	21.2	38.1	56.9	10.6	4.5
13	4.4	8.3	5.3	25.1	40.1	56.9	12.3	5.6
14	5.6	10.5	6.2	29.3	42.2	56.9	14.0	6.8
15	6.8	12.9	7.1	33.9	44.5	56.9	15.9	8.1
16	8.0	15.4	8.0	38.7	47.0	56.9	17.9	9.5
17	9.4	18.0	9.1	43.8	49.6	56.9	20.1	11.0
18	10.9	20.9	10.2	49.3	52.4	56.9	22.4	12.5
19	12.4	23.9	11.4	55.0	55.3	56.9	24.8	14.1
20	14.0	27.0	12.6	61.1	58.4	56.9	27.4	15.9
TREE GRADE 3, 3-LOGS								
13	6.6	11.6	6.4	30.9	49.6	67.5	13.2	5.9

CONTINUED

Table 6. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2A	No. 2B	No. 3A	No. 3B
14	7.7	13.7	7.2	35.1	51.8	67.5	14.9	7.1
15	8.9	16.1	8.1	39.6	54.1	67.5	16.8	8.4
16	10.2	18.6	9.1	44.4	56.5	67.5	18.9	9.8
17	11.6	21.3	10.1	49.6	59.1	67.5	21.0	11.2
18	13.0	24.1	11.2	55.0	61.9	67.5	23.3	12.8
19	14.6	27.1	12.4	60.8	64.9	67.5	25.7	14.4
20	16.2	30.3	13.6	66.9	67.9	67.5	28.3	16.1

Table 7. — Lumber grade volume for black oak

[In board feet]

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	SW	No. 3A	No. 3B
TREE GRADE 1, 2-LOGS								
16	7.3	18.0	1.9	36.4	31.0	12.2	66.7	23.1
17	11.7	21.7	2.9	46.0	38.0	12.2	65.8	23.1
18	16.5	25.6	3.9	56.3	45.0	12.2	64.8	23.2
19	21.5	29.7	5.0	67.1	52.5	12.2	63.8	23.2
20	26.7	34.3	6.2	78.5	60.4	12.2	62.6	23.2
21	32.3	37.2	7.4	90.5	63.8	12.2	61.5	23.3
22	38.1	40.3	8.7	103.1	67.3	12.2	60.3	23.3
23	44.2	43.5	10.0	116.2	71.0	12.2	59.0	23.4
24	50.6	46.9	11.4	130.0	74.8	12.2	57.6	23.5
25	57.2	50.4	12.8	144.3	78.9	12.2	56.2	23.5
26	64.1	54.0	14.3	159.3	83.0	12.2	54.8	23.6
TREE GRADE 1, 2½-LOGS								
16	7.3	18.0	1.9	45.3	62.5	16.5	71.2	38.2
17	11.7	21.7	2.9	56.4	65.6	16.5	71.0	38.6
18	16.5	25.6	3.9	68.2	68.9	16.5	70.9	39.0
19	21.2	29.7	5.0	80.7	72.4	16.5	70.8	39.4
20	28.4	34.1	6.2	93.9	76.0	16.5	70.6	39.8
21	36.0	38.6	7.4	107.7	79.9	16.5	70.4	40.3
22	43.9	43.4	8.7	122.2	83.9	16.5	70.3	40.8
23	52.2	48.4	10.0	137.4	88.1	16.5	70.1	41.3
24	60.9	53.7	11.4	153.2	92.5	16.5	69.9	41.8
25	70.0	59.1	12.8	169.8	97.1	16.5	69.7	42.3
26	79.4	64.8	14.3	187.0	101.9	16.5	69.5	42.9
27	89.2	70.7	15.9	204.9	106.9	16.5	69.3	43.5
28	99.3	76.9	17.5	223.4	112.0	16.5	69.0	44.1
29	109.9	83.2	19.2	242.7	117.4	16.5	68.8	44.8
30	120.8	89.8	21.0	262.6	122.9	16.5	68.6	45.4

CONTINUED

Table 7. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	SW	No. 3A	No. 3B
TREE GRADE 1, 3-LOGS								
16	7.3	18.0	1.9	54.2	76.5	20.9	75.6	53.3
17	11.7	21.7	2.9	66.8	80.0	20.9	76.3	54.0
18	16.5	25.6	3.9	80.2	83.7	20.9	77.0	54.8
19	21.5	29.7	5.0	94.3	87.6	20.9	77.8	55.6
20	30.1	33.8	6.2	109.2	91.7	20.9	78.6	56.4
21	39.7	40.0	7.4	124.9	96.0	20.9	79.4	57.3
22	49.7	46.5	8.7	141.3	100.5	20.9	80.3	58.2
23	60.2	53.4	10.0	158.5	105.3	20.9	81.2	59.1
24	71.2	60.5	11.4	176.5	110.2	20.9	82.1	60.1
25	82.7	67.9	12.8	195.2	115.4	20.9	83.1	61.2
26	94.6	75.6	14.3	214.7	120.8	20.9	84.2	62.2
27	107.0	83.7	15.9	235.0	126.4	20.9	85.3	63.4
28	119.9	92.0	17.5	256.0	132.2	20.9	86.4	64.5
29	133.3	100.6	19.2	277.8	138.2	20.9	87.5	65.7
30	147.1	109.6	21.0	300.3	144.4	20.9	88.7	67.0
31	161.3	118.8	22.8	323.6	150.8	20.9	90.0	68.3
32	176.1	128.4	24.6	347.7	157.4	20.9	91.3	69.6
33	191.3	138.2	26.6	372.6	164.3	20.9	92.6	71.0
34	207.0	148.4	28.5	398.2	171.4	20.9	94.0	72.4
TREE GRADE 1, 3½-LOGS								
16	7.3	18.0	1.9	63.1	90.5	25.3	80.0	68.5
17	11.7	21.7	2.9	77.2	94.3	25.3	81.5	69.5
18	16.5	25.6	3.9	92.1	98.4	25.3	83.1	70.6
19	21.5	29.7	5.0	107.9	102.7	25.3	84.8	71.7
20	31.7	33.5	6.2	124.6	107.3	25.3	86.5	73.0
21	43.3	41.4	7.4	142.1	112.1	25.3	88.3	74.2
22	55.5	49.6	8.7	160.4	117.1	25.3	90.3	75.6
23	68.3	58.3	10.0	179.7	122.4	25.3	92.3	77.0
24	81.6	67.3	11.4	199.7	127.9	25.3	94.4	78.5
25	95.5	76.7	12.8	220.7	133.7	25.3	96.6	80.0
26	109.9	86.5	14.3	242.4	139.6	25.3	98.9	81.6
27	124.9	96.6	15.9	265.1	145.8	25.3	101.3	83.2
28	140.5	107.2	17.5	288.5	152.3	25.3	103.7	84.9
29	156.7	118.1	19.2	312.9	158.9	25.3	106.3	86.7
30	173.4	129.4	21.0	338.1	165.9	25.3	108.9	88.6
31	190.7	141.1	22.8	364.1	173.0	25.3	111.7	90.5
32	208.5	153.2	24.6	391.0	180.4	25.3	114.5	92.4
33	226.9	165.6	26.6	418.8	188.0	25.3	117.4	94.5
34	245.9	178.5	28.5	447.4	195.8	25.3	120.4	96.6
TREE GRADE 2, 1½-LOGS								
13	0.0	3.3	0.0	0.0	18.4	1.5	29.2	28.2
14	1.9	5.9	.0	.0	22.0	1.5	30.2	27.4

CONTINUED

Table 7. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	SW	No. 3A	No. 3B
15	4.8	8.6	.0	7.7	25.9	1.5	31.2	26.4
16	7.9	11.6	.0	19.5	30.1	1.5	32.3	25.5
17	11.2	14.8	.2	31.9	34.5	1.5	33.5	24.4
18	14.7	18.1	.8	45.2	39.2	1.5	34.7	23.3
19	18.4	21.7	1.5	59.2	44.1	1.5	36.0	22.1
20	22.3	25.4	2.2	73.9	49.3	1.5	37.4	20.9
21	26.4	29.4	2.9	89.4	54.8	1.5	38.8	19.6
22	30.7	33.5	3.6	105.7	60.6	1.5	40.3	18.2
23	35.2	37.8	4.4	122.7	66.6	1.5	41.9	16.8
24	39.9	42.3	5.3	140.5	72.9	1.5	43.6	15.3
TREE GRADE 2, 2-LOGS								
13	0.0	3.3	0.7	0.0	24.9	6.6	38.2	36.6
14	1.9	5.9	1.1	4.2	29.6	6.6	39.5	35.8
15	4.8	8.6	1.5	15.9	34.6	6.6	40.9	35.1
16	7.9	11.6	1.9	28.5	40.0	6.6	42.4	34.3
17	11.2	14.8	2.3	41.8	45.8	6.6	44.0	33.4
18	14.7	17.9	2.7	56.0	51.8	6.6	45.6	32.5
19	18.4	21.9	3.2	70.9	58.3	6.6	47.4	31.5
20	22.3	26.0	3.7	86.7	65.1	6.6	49.3	30.5
21	26.4	30.4	4.3	103.3	72.2	6.6	51.2	29.4
22	30.7	34.9	4.8	120.6	79.7	6.6	53.3	28.3
23	35.2	39.7	5.4	138.8	87.5	6.6	55.4	27.1
24	39.9	44.7	6.0	157.8	95.7	6.6	57.7	25.8
25	44.7	49.9	6.7	177.6	104.2	6.6	60.0	24.6
26	49.8	55.3	7.3	198.3	113.1	6.6	62.5	23.2
27	55.1	60.9	8.0	219.7	122.3	6.6	65.0	21.8
28	60.6	66.8	8.7	241.9	131.9	6.6	67.6	20.4
TREE GRADE 2, 2½-LOGS								
13	0.0	3.3	3.3	0.0	31.3	11.6	47.2	44.9
14	1.9	5.9	3.6	11.7	37.1	11.6	48.8	44.3
15	4.8	8.6	3.8	24.1	43.3	11.6	50.6	43.7
16	7.9	11.6	4.1	37.5	50.0	11.6	52.5	43.1
17	11.2	14.8	4.4	51.7	57.0	11.6	54.4	42.4
18	14.7	17.7	4.7	66.7	64.5	11.6	56.6	41.7
19	18.4	22.0	5.0	82.7	72.5	11.6	58.8	40.9
20	22.3	26.6	5.3	99.4	80.8	11.6	61.1	40.1
21	26.4	31.3	5.6	117.1	89.6	11.6	63.6	39.2
22	30.7	36.3	6.0	135.6	98.8	11.6	66.2	38.3
23	35.2	41.6	6.4	154.9	108.4	11.6	68.9	37.4
24	39.9	47.0	6.8	175.2	118.5	11.6	71.8	36.4
25	44.7	52.7	7.2	196.3	129.0	11.6	74.7	35.4
26	49.8	58.7	7.6	218.2	139.9	11.6	77.8	34.3
27	55.1	64.8	8.1	241.0	151.3	11.6	81.0	33.2
28	60.6	71.2	8.5	264.7	163.1	11.6	84.3	32.0

CONTINUED

Table 7. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	SW	No. 3A	No. 3B
TREE GRADE 2, 3-LOGS								
13	0.0	3.3	6.0	6.8	37.8	16.6	56.2	53.3
14	1.9	5.9	6.1	19.1	44.7	16.6	58.1	52.8
15	4.8	8.6	6.2	32.3	52.0	16.6	60.3	52.4
16	7.9	11.6	6.3	46.5	59.9	16.6	62.5	51.9
17	11.2	14.8	6.4	61.5	68.3	16.6	64.9	51.4
18	14.7	17.5	6.6	77.5	77.2	16.6	67.5	50.8
19	18.4	22.2	6.7	94.4	86.6	16.6	70.2	50.3
20	22.3	27.1	6.9	112.2	96.5	16.6	73.0	49.7
21	26.4	32.3	7.0	130.9	107.0	16.6	76.0	49.0
22	30.7	37.7	7.2	150.5	117.9	16.6	79.2	48.4
23	35.2	43.4	7.4	171.1	129.4	16.6	82.5	47.7
24	39.9	49.4	7.5	192.5	141.3	16.6	85.9	46.9
25	44.7	55.6	7.7	214.9	153.8	16.6	89.5	46.2
26	49.8	62.0	7.9	238.1	166.7	16.6	93.2	45.4
27	55.1	68.7	8.1	262.3	180.2	16.6	97.0	44.5
28	60.6	75.7	8.3	287.4	194.2	16.6	101.1	43.7
29	66.3	82.9	8.6	313.4	208.7	16.6	105.2	42.8
30	72.2	90.4	8.8	340.4	223.7	16.6	109.5	41.9
TREE GRADE 3, 1-LOG								
10	0.0	0.0	1.0	0.0	1.6	3.5	9.2	14.5
11	.0	.0	1.0	.0	4.7	4.0	12.1	12.0
12	.2	.0	.9	5.5	8.1	4.7	15.4	9.3
13	.6	1.6	.9	12.7	11.7	5.3	18.9	6.3
14	1.1	3.6	.9	20.4	15.7	6.0	22.7	3.1
15	1.5	5.8	.8	28.7	20.0	6.8	26.7	.0
16	2.0	8.1	.8	37.6	24.5	7.6	31.1	.0
TREE GRADE 3, 1½-LOGS								
10	0.0	0.0	0.2	0.0	11.7	8.2	20.7	28.7
11	.0	.0	.3	.0	14.7	8.5	22.9	27.4
12	.0	.0	.4	5.5	18.1	8.9	25.4	25.9
13	.4	1.6	.5	12.7	21.7	9.3	28.0	24.3
14	1.2	3.6	.7	20.4	25.7	9.8	30.9	22.6
15	2.1	5.8	.8	28.7	29.9	10.3	33.9	20.7
16	3.0	8.1	1.0	37.6	34.4	10.8	37.2	18.7
17	3.9	10.5	1.2	47.1	39.2	11.3	40.7	16.6
18	5.0	13.2	1.4	57.1	44.3	11.9	44.4	14.4
19	6.0	15.9	1.6	67.8	49.7	12.6	48.3	12.0
20	7.2	18.8	1.8	78.9	55.4	13.2	52.4	9.5
TREE GRADE 3, 2-LOGS								
12	0.0	0.0	0.0	5.5	28.1	13.2	35.4	42.5
13	.2	1.6	.2	12.7	31.7	13.4	37.2	42.3

CONTINUED

Table 7. — Continued

D.b.h. (inches)	FAS	FAS1F	Selects	No. 1C	No. 2C	SW	No. 3A	No. 3B
14	1.3	3.6	.5	20.4	35.6	13.5	39.1	42.0
15	2.6	5.8	.8	28.7	39.8	13.7	41.1	41.8
16	3.9	8.1	1.2	37.6	44.2	13.9	43.3	41.5
17	5.3	10.5	1.6	47.1	49.0	14.2	45.7	41.2
18	6.8	13.2	2.0	57.1	54.0	14.4	48.1	40.8
19	8.4	15.9	2.4	67.8	59.4	14.7	50.8	40.5
20	10.0	18.8	2.9	78.9	65.0	14.9	53.5	40.1
21	11.8	21.9	3.4	90.7	70.9	15.2	56.4	39.7
22	13.6	25.1	3.9	103.1	77.1	15.5	59.5	39.3
23	15.5	28.5	4.4	116.0	83.6	15.8	62.7	38.9
24	17.5	32.0	5.0	129.5	90.4	16.1	66.0	38.4
TREE GRADE 3, 2½-LOGS								
16	4.8	8.1	1.4	37.6	54.1	17.1	49.5	64.2
17	6.7	10.5	2.0	47.1	58.8	17.0	50.6	65.7
18	8.6	13.2	2.7	57.1	63.8	16.9	51.9	67.2
19	10.7	15.9	3.3	67.8	69.1	16.8	53.2	68.9
20	12.9	18.8	4.1	78.9	74.6	16.6	54.6	70.6
21	15.2	21.9	4.8	90.7	80.5	16.5	56.1	72.5
22	17.6	25.1	5.6	103.1	86.6	16.4	57.7	74.4
23	20.1	28.5	6.4	116.0	93.0	16.3	59.3	76.4
24	22.7	32.0	7.3	129.5	99.7	16.1	61.0	78.5
25	25.5	35.6	8.2	143.5	106.7	16.0	62.7	80.7
26	28.3	39.5	9.1	158.2	114.0	15.8	64.6	83.0
27	31.3	43.4	10.1	173.4	121.5	15.6	66.5	85.4
28	34.3	47.5	11.1	189.2	129.3	15.5	68.5	87.8

Table 8. — Thickness distribution by lumber grade for yellow birch, in percent

Lumber thickness (inches)	FAS	FAS1F	Selects	1C	2C	3A	3B
3/8	—	—	—	—	—	0.1	0.2
2/4	—	—	0.1	—	—	—	.1
5/8	0.1	—	—	—	—	—	.3
3/4	.7	0.8	2.9	2.3	1.6	2.9	3.5
4/4	44.4	43.2	56.8	64.5	69.0	71.8	66.3
5/4	40.6	35.4	32.0	27.4	25.3	19.4	10.4
6/4	5.9	11.2	7.2	4.3	2.3	.3	.2
8/4	—	—	—	.1	1.2	5.2	17.9
10/4	8.3	9.4	1.0	1.4	.6	.3	1.1

Table 9. — Thickness distribution by lumber grade for red maple, in percent

Lumber thickness (inches)	FAS	FAS1F	Selects	1C	2A	2B	3A	3B
3/8	—	—	—	—	—	—	0.1	—
5/8	—	—	—	—	—	—	.1	—
3/4	0.2	0.1	—	1.0	1.4	2.4	1.1	4.1
4/4	52.4	58.1	59.2	71.3	64.0	78.7	67.6	82.9
5/4	11.7	18.2	8.9	11.3	12.7	18.1	3.6	13.0
6/4	18.4	16.8	19.1	10.6	1.8	.4	.3	—
7/4	—	.5	—	—	.1	—	.1	—
8/4	17.3	6.3	12.8	5.8	10.6	.4	18.0	—
10/4	—	—	—	—	9.4	—	9.1	—

Table 10. — Thickness distribution by lumber grade for black oak, in percent

Lumber thickness (inches)	FAS	FAS1F	Selects	1C	2C	SW	3A	3B
2/4	0.1	0.1	—	—	0.1	—	—	—
3/4	.7	—	0.5	0.8	.8	1.0	0.6	0.1
4/4	7.6	13.4	26.2	32.9	57.2	64.1	57.9	36.2
5/4	91.2	85.8	71.1	64.6	32.6	15.4	7.7	2.1
6/4	.4	.7	—	.3	.3	—	.2	—
7/4	—	—	—	.1	—	.5	—	.2
8/4	—	—	2.2	1.2	8.4	18.2	27.9	36.2
10/4	—	—	—	—	—	—	3.4	22.5
12/4	—	—	—	.1	.6	.8	2.3	2.7

Table 11. — Mean lumber volumes, standard errors of the residuals, and correlation coefficients for yellow birch

Lumber grade	Mean lumber volume (board feet)	Standard error of the residual (board feet)	Correlation coefficient
TREE GRADE 1 (BASIS: 63 TREES)			
FAS	55.91	43.16	0.729
FAS1F	34.98	20.56	.558
Selects	9.14	9.21	.202
No. 1C	85.20	45.04	.834
No. 2C	65.54	33.08	.681
No. 3A	41.21	19.96	.738
No. 3B	35.08	21.39	.452
TREE GRADE 2 (BASIS: 71 TREES)			
FAS	14.91	18.11	0.556
FAS1F	14.98	12.76	.530
Selects	6.24	7.69	.083
No. 1C	49.65	26.45	.598
No. 2C	49.37	18.54	.815
No. 3A	35.07	17.59	.509
No. 3B	31.37	19.38	.522
TREE GRADE 3 (BASIS: 61 TREES)			
FAS	1.16	2.89	0.325
FAS1F	4.62	6.57	.531
Selects	1.89	4.07	.067
No. 1C	22.96	14.05	.861
No. 2C	37.66	16.60	.819
No. 3A	27.69	14.25	.695
No. 3B	27.69	13.20	.472

Table 12. — Mean lumber volumes, standard errors of the residuals, and correlation coefficients for red maple

Lumber grade	Mean lumber volume (board feet)	Standard error of the residual (board feet)	Correlation coefficient
TREE GRADE 1 (BASIS: 70 TREES)			
FAS	70.26	59.31	0.563
FAS1F	54.88	29.54	.544
Selects	17.71	11.93	.497
No. 1C	70.37	27.92	.772
No. 2A	72.96	31.64	.712
No. 2B	49.97	24.41	.256
No. 3A	23.99	19.69	.483
No. 3B	13.66	9.63	.692
TREE GRADE 2 (BASIS: 80 TREES)			
FAS	22.05	23.41	0.601
FAS1F	26.63	17.24	.648
Selects	10.92	9.52	.326
No. 1C	39.86	21.04	.722
No. 2A	57.94	30.22	.405
No. 2B	50.15	33.83	.178
No. 3A	16.42	16.07	.324
No. 3B	8.95	11.81	.566
TREE GRADE 3 (BASIS: 128 TREES)			
FAS	4.11	8.99	0.533
FAS1F	8.95	13.21	.658
Selects	6.54	6.72	.581
No. 1C	22.48	16.46	.764
No. 2A	37.45	25.03	.609
No. 2B	48.40	28.97	.446
No. 3A	15.71	16.67	.434
No. 3B	8.30	13.11	.364

Table 13.— Mean lumber volumes, standard errors of the residuals, and correlation coefficients for black oak

Lumber grade	Mean lumber volume (board feet)	Standard error of the residual (board feet)	Correlation coefficient
TREE GRADE 1 (BASIS: 71 TREES)			
FAS	54.99	35.24	0.803
FAS1F	53.50	30.78	.753
Selects	11.82	13.98	.426
No. 1C	185.11	72.57	.814
No. 2C	111.66	48.37	.619
SW	20.49	25.14	.216
No. 3A	83.66	31.40	.510
No. 3B	59.93	45.56	.486
TREE GRADE 2 (BASIS: 62 TREES)			
FAS	25.06	24.08	0.655
FAS1F	25.12	16.73	.802
Selects	4.94	6.66	.376
No. 1C	90.54	32.92	.934
No. 2C	74.39	31.93	.837
SW	9.78	10.99	.444
No. 3A	59.95	28.61	.614
No. 3B	37.02	38.53	.312
TREE GRADE 3 (BASIS: 48 TREES)			
FAS	5.19	11.79	0.592
FAS1F	13.15	13.74	.770
Selects	2.96	5.15	.570
No. 1C	57.25	27.89	.916
No. 2C	41.54	22.97	.852
SW	12.52	12.60	.371
No. 3A	42.25	26.53	.608
No. 3B	40.49	39.11	.570



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