CENTRAL HARDWOOD NOTES

Grading Hardwood Trees

Tree grading provides a way to evaluate the quality characteristics and value of standing hardwood trees. This is important because the differences in price between high-quality and low-quality end products can be very large. Since hardwood timber varies greatly in quality and value among species, within species, and even within specific geographic areas, timber producers and buyers know that an accurate tree grading system is an objective way to account for quality variation and provide a basis for negotiation between buyers and sellers.

Tree grading provides basic information for managers (Robert Brisbin)

Who Can Use Tree Grades?

Four broad groups of people can benefit directly from a knowledge of tree grades: timber owners and managers, timber appraisers, loggers, and primary processors of forest products. Timber managers need to estimate the relative present and future value of individual trees in a stand before they can make sound decisions on which trees to mark for cutting and which to leave to grow. Similarly, the results of alternative timber management practices cannot be adequately evaluated without predicting the effects on quality as well as on quantity of wood produced.

Timber appraisers must determine the value of timber stands for purchase or sale. Volume estimates by tree grades greatly improves the accuracy of appraisals. Loggers are an important link in manufacturing products from trees. The bucking decisions made after a tree is felled determine, to a large extent, the quality and quantity of products that can be produced from the logs. Tree grades and associated log grades can help the logger decide where to buck to maximize profits. Primary processors need quality standards to estimate the volume of various products that can be produced from a group of trees or logs, and to decide how best to process each tree or log.

What are Tree Grades?

The U.S. Forest Service hardwood tree grades were developed to separate trees into groups of high, average, and low quality. When combined with published lumber grade yields, they accurately predict the quantity and grade of lumber that can be produced from graded trees. Tree grade is based on tree size, surface characteristics, straightness, and soundness of the butt 16-foot section of the tree. The tree grade rules are summarized in table 1. The steps to follow in grading are:

1. Measure the d.b.h. of the tree.
2. Identify all grading defects on the surface of the butt 16-foot section of the tree. Defects include limbs, overgrown knots, bumps, holes, splits, bird peck, and cankers.
3. Locate the best 12-foot section and divide it into four faces.
4. Grade the faces according to the rules that relate to the length, number, and total length of clearcuttings on the faces.
5. Estimate the amount of scalable defect in the 12-foot grading section.

Table 1 .-*Hardwood tree grades for factory lumber*

Grade factor	Tree grade 1	Tree grade 2	Tree grade 3
Length of grading zone (feet)	Butt 16	Butt 16	Butt 16
Length of grading section' (feet)	Best 12	Best 12	Best 12
D.b.h., minimum (inches)	16[2]	1 3	1 0
Diameter, minimum inside bark at top of grading section (inches)	13[2] 16 20	11[3] 1 2	8
Clear cuttings (on the 3 best faces)?			
Length, minimum (feet)	7 5 3	3 3	2
Number on face (maximum)	2	2 3	([5])
Yield in face length (minimum)[6]	5/6 81 percent	4/6 67 percent	3/6 50 percent
Cull deduction, including crook and sweep but excluding shake, maximum within grading section (percent)	9	9'	50

1Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors such as diameter and cull deduction.

[2] In basswood and ash, d.i.b. (diameter inside bark) at top of grading section must be 12 inches and d.b.h. must be 15 inches.

[3] Grade 2 trees can be 10 inches i.b. (inside bark) at top of grading section if otherwise meeting surface requirements for small grade #1 s.

[4] A clearcutting is a portion of a face free of defects, extending the width of the face. A face is 1/4 of the surface of the grading section as divided lengthwise.

[5] Unlimited.

[6] Yield in face length is the total length of the clearcuttings on the grading faces divided by the length of the grading section; i.e., two 5-foot clearcuttings equal 5/6 or 81 percent of the length of a 12-foot grading section.

[7] Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2 if size and surface of grading section qualify as grade 1. If rot shortens the required clearcuttings to the extent of dropping the butt log to grade #2, do not drop the tree's grade to #3 unless the cull deduction for rot is greater than 40 percent.

From: Research Paper NE-333, see References

The results of these steps are used to determine the grade of the tree. The grading system seems difficult to understand at first glance, but it is relatively easy to use after a little training and experience. The detailed grading specifications and procedures are fully explained in Research Paper NE-333, published by the USDA Forest Service (see References).

How are the Tree Grades Used?

If you know the d.b.h., grade, and merchantable height of a tree, you can estimate the amount of lumber by grade that can be produced from that tree. Table 2 is an abbreviated example of a lumber grade yield table for grade #1 northern red oak trees with a merchantable height of 32 feet. For example, a tree with a d.b.h. of 20 inches will produce about 183 board feet of #1 common and better lumber (add board foot yields from first 4 columns), 71 board feet of #2 common lumber, and 48 board feet of #3 common lumber (add board foot yields in last 2 columns). In addition to the lumber yield tables, lumber grade yield equations are available to use with computers.

Table *2.-Predicted lumber grade yields for northern red oak*

D.b.h.	Lumber grades						
(inches)	FAS	FAS1F	Select	#l C	#2 c	#3 A	#3 B
			Tree grade 1				
			Merchantable heiuht-32 feet				
			(Board feet)				
16	16	10	7	46	60	37	4
18	36	18	8	66	65	38	6
20	59	27	9	88	71	39	9
22	84	37	10	113	78	40	12
24	111	48	12	140	84	41	15

Adapted from Research Paper NE-333.

You can multiply the lumber yields in table 2 by lumber prices to estimate the value of lumber contained in the 20-inch Grade #1 red oak as shown in table 3. The lumber prices can be the actual prices that a producer receives for lumber or they can be average prices that are quoted in marketing bulletins. Lumber prices are normally given as dollars per thousand board feet but they are shown as dollars per board feet in table 3 to simplify the illustration. In this example the tree will produce 302 board feet of lumber with a value of $163. You can estimate the value of the tree as it stands in the forest by subtracting harvest, transportation, and processing costs.

Table 3.-Lumber volume and value estimation

Species ----------Northern red oak
Tree grade _____1
D.b.h. _____20 inches
Merchantable height----------32 feet

Lumber grade	Predicted volume	Lumber price	Lumber value
	Board feet	*Dollars/ board foot*	*Dollars*
FAS	59	0.82	48.38
FAS1F	27	.81	21.87
Select	9	.75	6.75
#1 c	88	.64	56.32
#2 c	71	.28	19.88
#3 A	39	.23	8.97
#3 B	9	.10	.90
Total	302		163.07

If you want to learn how to grade hardwood trees, we recommend technical instruction with field practice. Tree and log grading seminars are conducted by the State and Private Forestry branch of the Forest Service, by most state forestry agencies, and by universities with forestry schools. More detailed information is available from any of these organizations.

Reference

Hanks, Leland F. 1976. Hardwood tree grades for factory lumber. Res. Pap. NE-333. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 81 p.

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