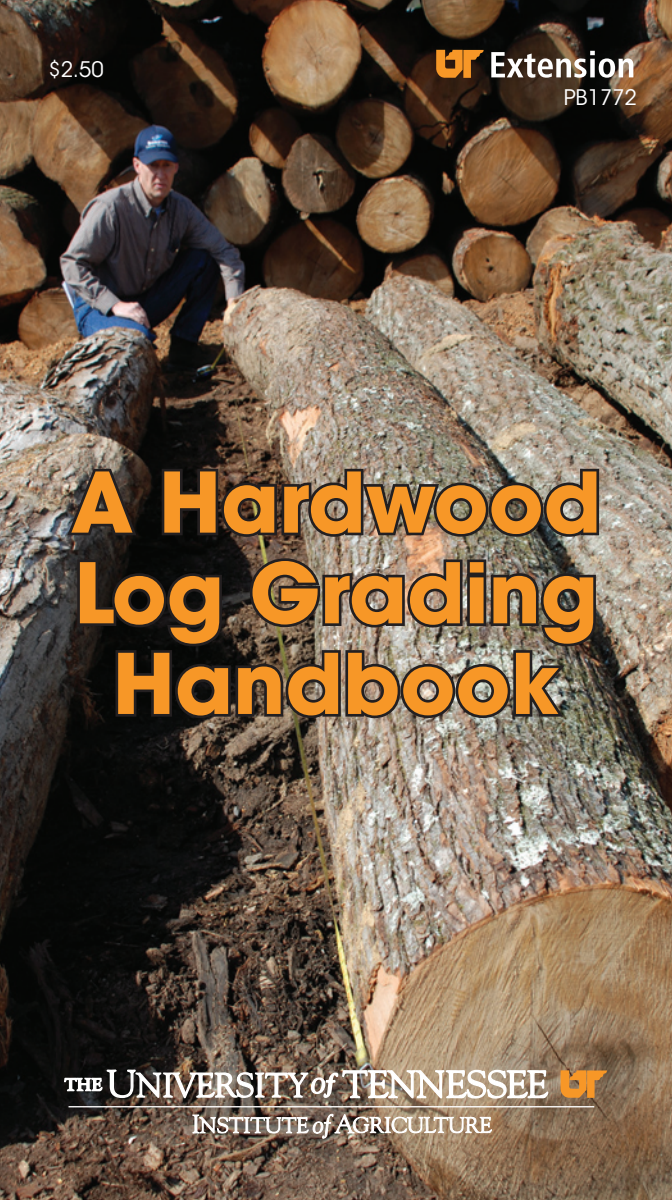
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A Hardwood Log Grading Handbook
THE UNIVERSITY of TENNESSEE
INSTITUTE of AGRICULTURE

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A Hardwood Log Grading Handbook

Adam Taylor
University of Tennessee

A good understanding of log valuation will help landowners, loggers, log buyers and saw millers agree on the fair value for a load of logs. This handbook briefly summarizes common log grading rules for hardwoods. Basic concepts in log scaling, lumber grading and log bucking optimization are also discussed because each of these topics relates to log grading.

How much is a log worth?

There are three main factors that buyers and sellers use to determine the value of a log: **Grade**, **Scale** and **Species**. Grade is a measure of the **quality** of the log and the lumber that will come from the log. **Scale** is a measure of the quantity of lumber within a log. Different **species** can be used for different products and have inherently different value, regardless of the quality of the lumber. Even seemingly minor differences in grade or species can mean a very different value for logs – see below for an example:

Prices paid for logs of different species and grade. An example from East Tennessee in 2009. All values are in dollars per thousand board feet, scaled using the Doyle rule.

	Walnut	Red Oak	Poplar
High grade	$930	$635	$380
Medium grade	$505	$380	$260
Low grade	$260	$230	$165

Log grading is important because it helps buyers and sellers settle on a fair price for a load of logs. Log grades can be used to predict the proportion of high-quality lumber that will be produced from that log. This log grading can also be used to help measure sawmill efficiency.

Veneer, Sawlogs and Other Log Classes

Some hardwood logs are reserved for the production of veneer – thin sheets of wood that are peeled or sliced directly from logs. These logs are usually very high quality, with few if any visible defects. Veneer logs may also be judged on color, growth rate and amount of sapwood versus heartwood. Veneer logs are higher value than sawlogs. More information on veneer, and the grading of veneer logs, can be found in the publication *Factors Affecting the Quality of Hardwood Timber and Logs for Face Veneer.*[1]

Sawlogs are those that are sawn into hardwood lumber and the grading of sawlogs is the subject of this handbook. These logs are also called "factory" logs. Logs that are not of sufficient quality to be a sawlog may be used for cutting pallet stock or railroad crossties, where appearance is not important, or for pulpwood.

This handbook deals only with hardwoods. Softwoods such as pine and spruce are gen-

[1]*Cassens, D.L. 2004. Factors Affecting the Quality of Hardwood Timber and Logs for Face Veneer. Purdue University publication FNR239. Available for download from http://www.ces.purdue.edu/extmedia/FNR/FNR-239.pdf*

erally used for making structural products, for example the studs used for framing a house. Softwoods are graded using different rules that focus on strength-reducing defects.

Log Scaling

Scaling is used to predict the amount of lumber that will be sawn from a log. The amount of lumber is measured in **board feet**, where one board foot is 1" x 12" x 12", or any dimension with the same volume of wood. For example, a board 2" x 6" x 8' contains 8 board feet.

There are different **log rules** that are used for scaling in different regions and for different products. The three most common log scales are the **Doyle** rule, the **Scribner** rule and the **International ¼**" Rule. By tradition, the Doyle Scale is the most commonly used scaling rule used in Tennessee (Table 1.)[2]

The Doyle Rule often underestimates the yield of lumber for small logs and for modern, more efficient sawmills (e.g. band mills). This underestimating can lead to "**overrun**", when the actual yield is more than the scaling predicted. Figure 1 shows a comparison of the Doyle scale to the International ¼" Rule, which more accurately predicts the true yield.

Log prices are normally different depending on the rule used, reflecting the differences in the scale resulting from each rule. Thus, the

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[2]For more information on scaling, and conversions among the log rules, see Understanding Log Scales and Log Rules by Brian Bond. University of Tennessee Extension PB1650. Download available at www.utextension.utk.edu/publications/pbfiles/Pb1650.pdf

Table 1. The Doyle Log Rule.

	Log Length (feet)				
	8	10	12	14	16
Scaling Diameter (inches)	————Yield of Lumber ———— (board feet)				
8	8	10	12	14	16
9	13	16	19	22	25
10	18	23	27	32	36
11	25	31	37	43	49
12	32	40	48	56	64
13	41	51	61	71	81
14	50	63	75	88	100
15	61	76	91	106	121
16	72	90	108	126	144
17	85	106	127	148	169
18	98	123	147	172	196
19	113	141	169	197	225
20	128	160	192	224	256
21	145	181	217	253	289
22	162	203	243	284	324
23	181	226	271	316	361
24	200	250	300	350	400
25	221	276	331	386	441

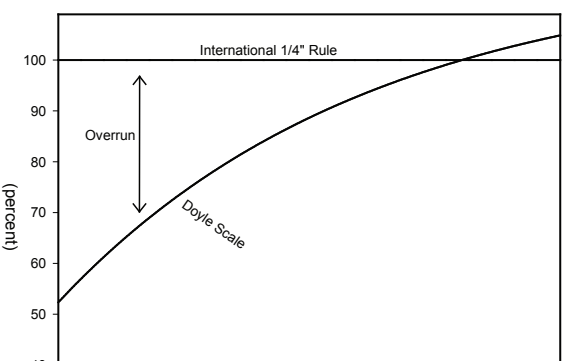


Figure 1. The predicted lumber yield using the Doyle scale compared to the International ¼" rule. The International Rule is fairly accurate for all log diameters, while the Doyle Rule underestimates the true yield of lumber for smaller logs. The actual yield of lumber from a scaled log will vary with mill technology, wood species and other factors.

average log value will be the same regardless of the scaling rule that is used.

Special rules for certain species or products are used in some locations. For example, some buyers use a "cedar rule" for predicting the lumber yield from eastern redcedar logs, which are small and irregularly shaped.

Species is another important factor in determining log value. For example, top grade walnut, cherry or hard maple logs can be worth two- or three-times as much as hickory, soft maple or poplar logs of the same size and quality. This is because the products made from those species are worth more and there are fewer top quality logs of the high-value species available. Species differences may

be stated explicitly in some log grading rules. Other log grading rules grade all species of logs in the same way, with buyers paying different prices for logs of the same grade but of different species.

There are regional differences in pricing of logs and lumber products, because the wood quality of certain species is thought to be superior in some areas. For example, cherry logs from the northeastern United States are believed to contain higher-quality lumber and thus higher prices are paid for cherry logs from that area. There are also local variations in log prices. For example, if there are many sawmills within a reasonable hauling range of a timber harvest, this can increase the demand – and thus the price paid – for logs. Finally, prices paid for logs can vary substantially with fluctuations in demand due to seasonal changes and overall economic trends.[3]

Log Grading — Relation to Lumber Grading

Most hardwood logs are sawn into lumber. The value of this lumber, and thus of the log, is determined in part by the **lumber grade**. The grade of hardwood lumber is determined by a visual inspection of each board according to rules developed by the National Hardwood

[3]Information on prices trends in log and lumber markets are available from a number of sources including the including Tennessee Division of Forestry (www.state.tn.us/agriculture/forestry/tfbp.html), the Hardwood Market Report (www.hmr.com/), the Hardwood Review (www.hardwoodreview.com/) and TimberMart South (www.tmart-south.com/tmart/)

Lumber Association (NHLA - Table 2). The most important factors in determining lumber grade are **width**, **length** and **yield of defect-free wood** ("clear cuttings").

As shown in Table 2, high-grade lumber must be relatively long, wide and clear of defects. **Therefore high grade logs must be long, large in diameter and contain mostly clear wood**. Larger logs are also preferred in log grading because they cost less to process per unit of lumber produced.

Table 2. Summary of the NHLA hardwood lumber grading rules. Adapted from NHLA, 2003.

Grade	Lumber Requirements				
	Min. Board Length (feet)	Min. Board Width (inches)	Clear cuttings (poor face)		
			Total yield	Min. size	Max. number
FAS (the top grade)	8	6	83.3%	4″ x 5′ 3″ x 7′	4*
Selects	6	4	83.3% (good face)		
1 Common	4	3	66.6%	4″ x 2′ 3″ x 3′	5*
2 Common	4	3	50%	3″ x 2′	7*
3 Common (the lowest grade)	4	3	33.3%	3″ x 2′	–

**The maximum number of cuttings allowed depends on board size. The actual number is usually fewer.*

Although low-quality logs will produce some high-grade lumber, higher-grade logs produce a higher proportion of better quality lumber. That is why high-grade logs have a higher value. An example is given in the table below.

Grade and value of lumber produced from black cherry logs of different grades. Expressed as board feet of 4/4 (1" thick) lumber sawn from 16" diameter, 12' long logs, based on prices for Appalachian hardwoods in 2009.

Log Grade	FAS & Select	#1 C	#2 C	#3 C	Total Lumber Value
High (F1)	59	20	17	12	$111
Medium (F2)	28	38	22	20	$79
Low (F3)	15	46	23	23	$65

Log Grading Methods

Unlike lumber grading, there is no one system that is widely accepted for grading logs. The United States Forest Service has developed a log grading system based on the yield of "**clear cuttings**" from faces of the log. Alternatively, many buyers use a "**clear face**" system, where the number of clear (defect-free) faces on the logs is the basis for determining quality. Some sawmills also buy logs on the basis of **weight**. Buying by weight assumes an average grade for the whole load.

Defects

Defects are features that reduce the quality or quantity of the lumber that will be sawn from the log. For the US Forest Service log grading rule, defects are defined as follows:

- **Grade defects** include anything that reduces lumber value. These include stem bulges, splits, rot and insect or bird holes. Abnormalities on the surface of a log must extend into the log more than 15% of the diameter to be considered a defect (see "Quality Zones" in Figure 2). **Knots**, and **bark distortions** where the tree has grown over old knots, are the most common defects. These are also the most important defects because knots extend to the center of the log and will appear on all the lumber sawn from that part of the log.

  Small bark distortions, that do not clearly indicate an overgrown knot, are not considered to be a defect in 15"+ diameter logs. Horizontal breaks in the bark are not defects. Abrupt **bumps** are defects, but clear cuttings can extend ¼ of the length of the bump. Bumps with gradually sloping sides (length 12+ times the height) can be ignored.

- **End defects** are determined by looking at both ends of the log. Any abnormality in the "**heart center**" (the innermost 1/5 of the diameter) can be ignored for grading purposes. End defects are classified in the following three categories:

  - **Unsound end defects** include knots, decay (rot) and shake. If the defect extends more than half the distance from the heart zone to the bark (both Quality zones – Figure 2), then a clear cutting cannot be taken over it. The distance up the log that

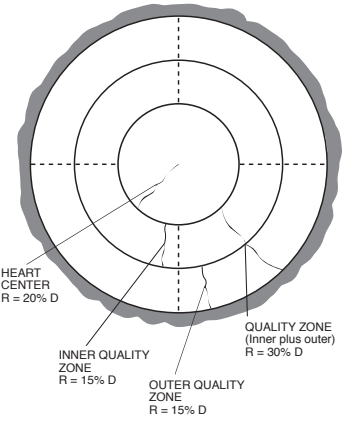


Figure 2. Quality zones in a hardwood log. Abnormalities must occur in both the inner and outer quality zones to be considered a defect for grading purposes. Defects in the heart center are ignored for grading purposes. Adapted from McKenna, 1981.

the defect extends should be estimated; a clear cutting can extend over 1/3 of the estimated length of the defect.

- **Sound end defects** include stain and slight dote (the beginning of rot) and are restricted in Grades 1 & 2.
  - Grade 1 – not more than ½ of either end
  - Grade 2 – not more than 3/5 of either end (limited to ½ of 16" diameter and smaller logs.

- **Specific end defects** include bird peck, wormholes, spots and streaks. If these defects cover more than half the distance from the heart center to the bark under three or more faces at one end, or two faces at both ends, lower Grade 1 & 2 one grade.

- **Scaling defects** reduce the amount, or volume, or useable lumber. Rot and large holes

produce no lumber and thus can reduce not only the grade (quality) of the lumber produced from a log but also the quantity (scale). **Scaling deductions** can be made to account for these defects when scaling the log but these defects are also considered in log grading.

USDA Forest Service Hardwood Sawlog Grading System – a clear cutting method

The Forest Service has developed a system to organize sawlogs into one of three grades. Grade 1 (or "F1", where F stands for 'factory') is the highest (top quality), grade 2 (F2) the next best, and grade 3 (F3) is the lowest grade. The Forest Service grading system predicts the yield of 1 Common and better grades of lumber produced from the log. This is estimated based on the whether the log is a butt or upper cut, the log length and diameter, and the number and location of **defects** on the log.

Table 3 summarizes the requirements for each of the three grades. The factors used in grading are listed in the left-hand column.

- **Position in tree. "Butt"** logs come from the base of the tree and are preferred because there is usually more clear wood in that part of the tree stem. Butt logs can be identified by the flare at the base of the log and the presence of the notch that was used to direct the falling tree. **Upper** logs are also acceptable for all three grades, except smaller grade 1 logs (13" – 15" diameter), which must be butt cuts only.

Table 3. Summary of Forest Service Hardwood Log Grading Rule. Adapted from McKenna, 1981.

Grading Factor		Grade 1 (F1)			Grade 2 (F2)				Grade 3 (F3)
Position in tree		Butt only	Butt or upper		Butt or upper				Butt or upper
Diameter		13"-15"	16"-19"	20"+	11"	12"+			8"+
Length		10'+			10'+	8'-9'	10'-11'	12'+	8'+
Clear cuttings on 3rd best/2nd worst face	Length	7'	5'	3'	3'				2'
	Number	2	2	2	2			3	No limit
	Yield	5/6			2/3	3/4	2/3	2/3	½
Sweep	If < ¼ of end in sound defects	15%			30%				50%
	If > ¼ of end in sound defects	10%			20%				35%
Total scaling deduction		40%			50%				50%

- **Diameter.** The diameter of a log for grading (and scaling) is the diameter **inside the bark at the small end**. Most logs are not truly round, so two (or more) diameter measurements should be made and the average value used. The grading rule specifies minimum diameters because larger diameter logs tend to contain a higher proportion of defect-free wood and because high-grade lumber must be wide.

- **Length.** The length of a log for log grading and scaling is the length in feet, **without trim**. Most log buyers require 4" or 8" of trim allowance.

- **Clear cuttings.** As in the lumber grading rules, clear cuttings are the basis of the Forest Service log grading system. Clear cuttings are sections of the log that are free from defects. Clear cuttings are determined on the grade face.

  - **Choosing the grade face.** The grade face is determined by dividing the surface of the log into four equal faces. This should be done such that one face is the "worst" – i.e. it contains the most defects (Figure 3). The next best face is the grade face. The other two faces should be at least as good, or better, than the grade face

  - **Clear cutting length.** The minimum length of a clear cutting is specified. Higher grade logs require longer cuttings. All cuttings must be the full width of the face.

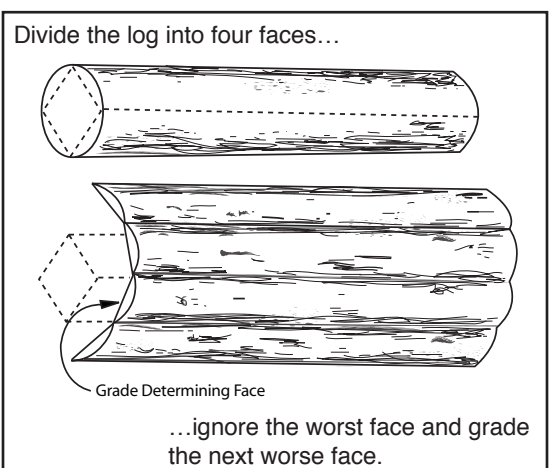


Figure 3. Determining the grade face of a log.
Adapted from Rast et al, 1973.

- **Maximum number of clear cuttings.** For grade 1 (F1) logs, only two cuttings are allowed on the grade face. Some F2, and all F3 logs, can have 3 cuttings.

- **Clear cutting yield**. The yield of clear cuttings on the grade face is calculated as the total length of the cuttings divided by the total length of the log (no trim). Higher grade logs must have a higher yield. Table 4 provides calculations of total clear cutting lengths for different log lengths.

- **Maximum Sweep**. Curved logs are more difficult to process and they produce a lower yield of good-quality lumber. Therefore the log grading rule specifies the maximum

Table 4. Total cutting lengths required in each grade. *Adapted from McKenna, 1981.*

Log length (feet)	Grade 1 (F1) (5/6 yield)	Grade 2 (F2) (2/3 yield)	Grade 3 (F3) (1/2 yield)
8	–	6′ (3/4 yield)	4′
10	8′4″	6′8″	5′
12	10′	8′	6′
14	11′8″	9′4″	7′
16	13′4″	10′8″	8′

amount of sweep that is allowed for each grade. Sweep is measured as the maximum deviation of the log from a straight line (Figure 4). The **sweep deduction** can be determined using Table 5. The rule permits less sweep allowance for logs with sound defects covering more than 1/4 of either end.

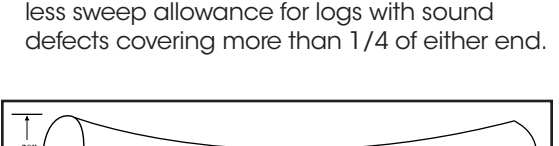


Figure 4. Measuring sweep on a curved log. This log has 8" of sweep. From McKenna, 1981

Example: A 14′ long log, with a 20″ scaling diameter, has 8″ of sweep. The sweep deduction is 30% (Table 5).

- **Total scale and sweep deduction.** The rules limits the amount of unusable wood in a log. The **defect length factor multiplied by the defect cross-section factor equals**

Table 5. Sweep deduction (percent). *Adapted from McKenna, 1981.*

Sweep (inches)		Diameter at the small end inside the bark (inches)											
8-10 foot logs	14-16 foot logs	8	10	12	14	16	18	20	22	24	26	28	30
-	3	12	10	8	7	6	6	5	5	4	4	4	3
3	4	25	20	17	14	12	11	10	9	8	8	7	7
4	5	38	30	25	21	19	17	15	14	12	12	11	10
5	6	50	40	33	29	25	22	20	18	17	15	14	13
6	7		50	42	36	31	28	25	23	21	19	18	17
7	8			50	43	38	33	30	27	25	23	21	20
8	9				50	44	39	35	32	29	27	25	23
9	10					50	44	40	36	33	31	29	27
10	11						50	45	41	38	35	32	30
11	12							50	45	42	38	36	33
12	13								50	46	42	39	37
13	14									50	46	43	40
14	15										50	46	43
15	16											50	47
16	17												50
11-13 foot logs													
3		19	15	12	11	9	8	8	7	6	6	5	5
4		31	25	21	18	16	14	12	11	10	10	9	8
5		44	35	29	25	22	19	18	16	15	13	12	12
6			45	38	32	28	25	22	20	19	17	16	15
7				46	39	34	31	28	25	23	21	30	18
8					46	41	36	32	30	27	25	23	22
9						47	42	38	34	31	29	27	25
10							47	42	39	35	33	30	28
11								48	43	40	37	34	32
12									48	44	40	38	35
13										48	44	41	38
14											48	45	42
15												48	45
16													48

the scale deduction (Table 6). **The scale deduction is then added to the sweep deduction to give the total scale and sweep deduction.**

Example: The log in previous example has a 6″ diameter round hole in the butt end that extends 4′ (30%) up the log. The defect length factor is 0.5 and the defect cross-section factor is 8 (Table 6). The total scale deduction is 0.5 x 8 = 4. The total scale and sweep deduction is 4 + 30 (from the previous example) = 34%.

Grading a Log Using the Forest Service System

The process for grading a log is relatively simple. The biggest challenge is identifying the location and extent of defects.

- **Step 1**. Measure **diameter and length**. This is also required for scaling the log. Note if the log is a butt or upper section.
- **Step 2**. Find the **grade face**. Faces should be arranged to produce the highest grade log possible. Ignore the worst face and grade the next worst (or third best) face. Seams that can be positioned between two faces can be ignored.
- **Step 3**. Determine the size, number and yield of **clear cuttings** on the grade face.
- **Step 4**. Check that **sweep and scale deductions** are within the allowed limits.

The requirements listed Table 3 are the minimum requirements for logs for each grade. Each log must meet all of the require-

Table 6. Scaling deduction factors. To determine the scale deduction, multiply the length factor by the cross-section factor.

Adapted from McKenna, 1981.

Length factors										
	Length of log that has defect (percent)									
Log diameter (inches)	10	20	30	40	50	60	70	80	90	100
8	1.2	2.4	3.5	4.7	5.9	7.1	8.2	9.4	10.6	11.8
9	.9	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.0
10	.7	1.4	2.1	2.8	3.6	4.3	5.0	5.7	6.4	7.1
11	.6	1.1	1.7	2.3	2.9	3.4	4.0	4.6	5.2	5.8
12	.5	1.0	1.4	1.9	2.4	2.9	3.3	3.8	4.3	4.8
13	.4	.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
14	.3	.7	1.0	1.4	1.7	2.0	2.4	2.7	3.1	3.4
15	.3	.6	.9	1.2	1.5	1.8	2.1	2.4	2.6	2.9
16	.3	.5	.8	1.0	1.3	1.5	1.8	2.0	2.3	2.6
17	.3	.4	.7	.9	1.1	1.4	1.6	1.8	2.0	2.3
18	.2	.4	.6	.8	1.0	1.2	1.4	1.5	1.8	2.0
19	.2	.4	.5	.7	.9	1.1	1.2	1.4	1.6	1.8
20	.2	.3	.5	.6	.8	1.0	1.1	1.3	1.4	1.6
21	.2	.3	.4	.6	.7	.9	1.0	1.2	1.3	1.4
22	.1	.3	.4	.5	.7	.8	.9	1.0	1.2	1.3
23	.1	.2	.4	.5	.6	.7	.8	1.0	1.1	1.2
24	.1	.2	.3	.4	.5	.6	.8	.9	1.0	1.1
25	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0

Cross-section factors														
Width (short axis) of defect (inches)	Height (long axis) of defect (inches)													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	2	2	3	3	4	4	5	5	6	6	7	7	8	8
3		3	3	4	5	5	6	7	8	8	9	10	10	11
4			4	5	6	7	8	9	10	10	11	12	13	14
5				6	7	8	9	10	11	12	14	15	16	17
6					8	10	11	12	13	15	16	17	18	19
7						11	12	14	15	17	18	19	21	22
8							14	16	17	19	20	22	23	25
9								17	19	21	23	24	26	28
10									21	23	25	27	29	31
11										25	27	29	31	33
12											29	32	34	36
13												34	36	39
14													39	42
15														44

ments for each grade. Logs that do not meet Grade 3 are "cull" or below grade.

Clear Face Grading

Clear face log grading rules are used by many log buyers. Many variations on clear face grading rules exist but, like the Forest Service system, these rules require minimum diameters and lengths for logs. Clear-face log grading rules also divide the log into four equally-sized faces; however, instead of examining the clear cuttings on the grade face, the number of completely clear (defect free) faces are counted. Higher grades require more clear faces. Although no standard clear-face log grading rule exists, figure 5 gives an example of a clear face grading rule.

Grade	Diameter	Length	Clear Faces
Super Prime	18″	14′	4
Prime 1	18″	12′	4
Prime 2	15″	10′	4
Select 1	16″	10′	3
Select 2	15″	10′	3
#1	14″	8′	2
#2	12″	8′	1
#3	10″	8′	0

Notes:
- Poplar minimum 20″ diameter for Prime
- White oak, Hickory and Beech - minimum length of 10′

Figure 5. An example of a clear face grading rule. Note that this rule is specific to this mill – other log buyers will have different requirements.

The Log Grading Rules Compared

The US Forest Service Log Grading Rule

The Forest Service system for grading logs has a number of advantages. As a published standard it can be widely used and understood. It is also independent of tree species, so any log can be graded using the same method. However, the biggest advantage is that it can be used to predict the amount of high-grade lumber that will be produced from a log. The Forest Service system was developed over many years by measuring over 20,000 logs and grading the lumber that was produced from those logs. Based on those measurements, the following predictions are possible:

Grade 1 (F1)	…logs will produce…	60%+	…1Common or better lumber
Grade 2 (F2)		40-60%	
Grade 3 (F3)		Less than 40%	

Clear Face Rules

Some people prefer clear face grading rules because they can be simple to apply; there is no need to calculate clear cutting yield. Clear face rules usually have more than three grades, which allows for more price levels for logs of different quality.

Weight Scaling

When buying logs by weight, an average grade (and scale) of the logs in the load is assumed. Weight scaling has the advantage of being easy and fast; however, it provides very

little information about the quality and quantity of lumber that will be produced.

Tree Grading

The principles of log grading can be applied to standing trees to estimate the value of the log contained within the bole. Table 7 shows a summary of a tree grading system developed by the United States Forest Service. This tree grading system is very similar in many ways to the log grading system.

Because the logs have not yet been cut from the tree, the grading section can be located anywhere in the bottom 16' of the tree. Once the grading section has been located,

Table 7. Summary of US Forest Service Rule for Tree Grading. Adapted from Hanks, 1976.

	Grade 1			**Grade 2**		**Grade 3**
Grading section	Best 12' in 16' butt section					
Diameter at breast height (DBH – inches)	16			13		10
Diameter at top of grading section (inside bark – inches)	13	16	20	11	12	8
Clear cuttings (on three best faces)						
Min. length (feet)	7	5	3	3	3	2
Max. number on each face	2			2	3	No limit
Min. yield per face	5/6			2/3		1/2
Cull deduction (percent)	9			9		50

the diameter of the tree is measured at breast height and the scaling diameter at the top of the grading section is estimated. Then, the size and number of clear cuttings on the grade face are determined. Of course, because the tree has not yet been cut, possible end defects are not a factor; only defect indicators on the surface of the tree are considered. Tree grading also can be used to predict the proportion of high-grade lumber that can be sawn from the tree (see Hanks, 1976).

Log Bucking Optimization

After a tree is felled and limbed, it is "bucked" into logs. The location of the bucking cuts on the tree stem can greatly influence the grade, and thus the value, of the resulting logs. Studies have shown that improved bucking practices can increase the average value of logs by 15 to 35%. Loggers should keep the following rules-of-thumb in mind when making bucking decisions:

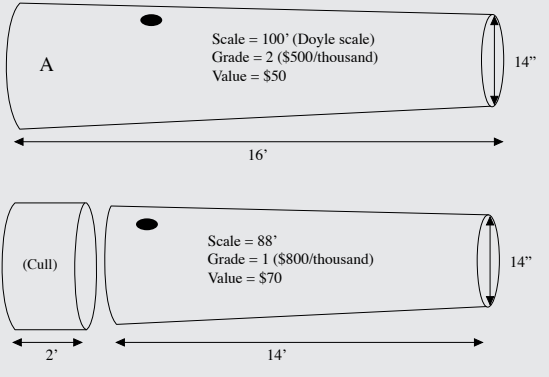
- **Know the market**. Different log buyers use different log grading methods and small differences in the grading system can result in large differences in log values. By being familiar with what the buyer wants, a logger can make bucking decisions that improve the value of the logs cut from trees.

- **Find the best log.** In general, it is best to locate the top grade log from a stem first and then arrange the other bucking cuts around it. Often this highest-value log will be the butt log but in many cases the best-

grade log will be located further up the stem. In some cases, this process will involve discarding cull sections at the butt end. Because of the relatively high value of top-grade logs, it is usually advantageous to lose some scale (volume) if it will result in a higher grade (quality) log.

It is also important to remember that longer lengths of logs do not necessarily have higher value. Although the minimum length requirements for various grades and products must be met, the length of a log should be adjusted (if possible) to yield the highest grade logs from the tree.

Example: In the white oak log pictured below, the grade can be improved from #2 (log A) to #1 (log B) by cutting off the butt 2'. Even though the scale is reduced, the overall value of the log is higher because #1 logs sell for $800/thousand board feet and #2 sell for $500/thousand.



- **Keep logs straight.** As described above, sweep can lower log grade. For this reason, it is often best to buck stems where they curve. The resulting logs will be straighter and could be a higher grade.

- **Put the defects on the end.** Many log buyers will consider the location of defects in a log, especially if they are using the Forest Service's grading system. Defects that are close to the ends of a log are easier for the sawyer to cut around (to produce clear lumber). For this reason, defects near the ends of a log often won't reduce the grade as much as defects that are in the middle.

More information on hardwood log bucking is available on the internet at http://www.hardwoodvip.org/

Summary

A knowledge of how hardwood log values are determined can help buyers and sellers decide on a fair price for timber sales. Measuring incoming log quality can also help sawmills to evaluate the efficiency of their mills. Log values are a function of the grade (quality), scale (size) and wood species. Log grade affects the quality mix of lumber that will be sawn from a log; high quality logs produce a larger proportion of high quality lumber. Log grading rules vary by region and individual buyer but the principles remain the same everywhere: High grade logs have few defects (especially knots), are large in diameter, and are of a minimum length. Small differences in

grade can mean large differences in price, so it is important to understand how grade is determined. Loggers in particular should be familiar with the log market and applicable grading rules so that they can make bucking decisions that maximize the value of logs coming from a tree.

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