Log Evaluation and Grading

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Evaluating Hardwood Logs

- Major objective is to separate lower-quality from higher-quality logs.
FS Log Grades

- The bad: Somewhat complex to learn
- The good: Very good at estimating recovery (value) of the log.
- Many log buyers/yards use simplified versions of the FS grading rules.
Log Grades

- Forest Service Log Grades developed in 60’s and 70’s.
- Based on relationships among log size, surface defects, and grade recovery.
After considering the size and soundness of the log, the grader visually divides the log into four faces.
FS Log Grades

- Each face is examined to locate full-width clear areas or "cuttings".
- The poorest face is disregarded and log grade determined by the poorest of the three faces.
- The biggest difficulty is locating clear cuttings. -- You must be able to recognize defects!
### FS Log Grades

<table>
<thead>
<tr>
<th>Grading Factors</th>
<th>Log grades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
</tr>
<tr>
<td><strong>Position in tree</strong></td>
<td>Butts only</td>
</tr>
<tr>
<td>Scaling diameter, inches</td>
<td>13-15&quot;</td>
</tr>
<tr>
<td>Length without trim, feet</td>
<td>10+</td>
</tr>
<tr>
<td><strong>Required clear cuttings</strong></td>
<td>Min. length, feet</td>
</tr>
<tr>
<td>of each of 3 best faces</td>
<td>Max. number</td>
</tr>
<tr>
<td></td>
<td>Min. proportion of log length required in clear cutting</td>
</tr>
<tr>
<td><strong>Maximum sweep &amp; crook allowance</strong></td>
<td>For logs with less than ¼ of end in sound defects</td>
</tr>
<tr>
<td></td>
<td>For logs with more than ¼ of end in sound defects</td>
</tr>
<tr>
<td><strong>Maximum scaling deduction</strong></td>
<td>40%</td>
</tr>
<tr>
<td><strong>End defect:</strong></td>
<td>See special instructions (page 18)</td>
</tr>
</tbody>
</table>

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*a* From USDA Forest Service Research Paper FPL-63 (13).  
*b* Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1’s.  
*c* Ten-inch logs of all species can be #2 if they otherwise meet requirements for small #1’s.  
*d* A clear cutting is a portion of a face, extending the width of the face, that is free of defects.  
*e* A face is ¼ of the surface of the log as divided lengthwise.  
*f* Otherwise #1 logs with 41-60% deductions can be #2.  
*g* Otherwise #2 logs with 51-60% deductions can be #3.
Factory 1 Examples

Position .................. Butt log
Size ...................... Length 16', diameter 13” at small end
Straightness ............... Straight
Soundness ................. Sound
Cuttings .................. More than 5/6 of its grading-face length is clear
                        in two sections 7 and 8 feet long

Position .................. Upper log
Size ...................... Length 10', diameter 16” at small end
Straightness ............... Straight
Soundness ................ Sound
Cuttings .................. More than 5/6 of its grading-face length is clear
                        in one section 8 feet 6 inches long
Factory 1 Examples

Position ................. Upper log
Size ..................... Length 12’, diameter 20” at small end
Straightness .......... Straight
Soundness ............... Sound
Cuttings ............... 5/6 of its grading-face length is clear in two sec-
tions 8 and 3 feet long

Position ................. Upper log
Size ..................... Length 16’, diameter 20” at small end
Straightness .......... 10 percent deduction for 4” of absolute sweep
Soundness ............... 5 percent deduction for center rot (sweep and
rot deductions less than 40 percent maximum permitted)
Cuttings ............... One cutting 16’
Comments ............... Rot is confined to permissible rot zone and does
not affect clear grading face
Factory 2 Examples

**Position** ............... Upper log
**Size** .................. Length 10’, diameter 11” at small end
**Straightness** ........ Straight
**Soundness** ............. Sound
**Cuttings** ............... More than ¾ of its grading-face length is clear in 
two sections each 4 feet long

**Position** ............... Upper log
**Size** .................. Length 9’, diameter 12” at small end
**Straightness** ........ Straight
**Soundness** ............. Sound
**Cuttings** ............... More than ¾ of its grading-face length is clear in 
two sections 4 and 3 feet long
Factory 2 Examples

Position .......... Upper log
Size ............... Length 11', diameter 18" at small end
Straightness ...... Deduction of 28 percent for 61/2 inches of absolute sweep (sweep less than 30 percent maximum allowance)
Soundness .......... Sound
Cuttings .......... More than 3/4 of its grading-face length is clear in two sections 5 and 4 feet long

Position .......... Upper log
Size ............... Length 16', diameter 22" at small end
Straightness ...... 9 percent deduction for 4 inches of absolute sweep
Soundness .......... 20 percent deduction for rot (sweep and rot deductions less than 50 percent maximum permitted)
Cuttings .......... Rot limits cutting on grading face, but clear cuttings of 4, 3, and 4 feet give more than the required 3/4 of grading-face length
Factory 3 Examples

Position .......... Upper log
Size .............. Length 8', diameter 8'' at small end
Straightness ...... Straight
Soundness .......... Sound
Cuttings .......... One-half of its grading-face length is clear in two sections, each 2 feet long

Position .......... Upper log
Size .............. Length 12', diameter 14'' at small end
Straightness ...... Straight
Soundness .......... 15 percent rot deduction (less than 50 percent maximum permitted)
Cuttings .......... More than ½ of its grading-face length is clear in two sections, 4 and 3 feet long
Comments .......... Interior rot outside the rot zone limits cuttings
Factory 3 Examples

Position ................. Upper log
Size ................... Length 14', diameter 22'' at small end
Straightness .......... 12 percent deduction for 6'' x 3' of crook on both ends of log
Soundness ............. 15 percent rot deduction (crook and rot less than 50 percent maximum deduction)
Cuttings ............... More than ½ of its grading-face length is clear in three sections, 3, 3, and 2 feet long

Position ................. Upper log
Size ................... Length 16', diameter 22'' at small end
Straightness .......... Straight
Soundness ............. Sound
Cuttings ............... More than ½ of its grading-face length is clear in two sections, 5 and 4 feet long
Crook Deduction

- Measure in inches D & C.
- Measure in feet L and CL.

\[ \text{CrookDeduction} = \left( \frac{C}{D} \right) \times \left( \frac{CL}{L} \right) \]
**Crook Example**

- We have a 16’ log that is 20” in diameter.
- The length of the crook is 4’ and amount of crook is 8”
- The crook deduction is:

\[(8/20) \times (4/16) = .4 \times .25 = 10\%\]
Sweep Deduction

- Measure in inches D & S.
- Measure in feet L.
Sweep Deduction

\[ \text{SweepDeduction} = \frac{(S-F)}{D} \]

Where

- \( F = 1 \) for logs 8 to 10’ long
- 1.5 for logs 11 to 13’ long
- 2 for logs 14 to 16’ long
Sweep Deduction

- Consider a 16’ log, 20” diameter and with 8” of sweep.

\[
\text{SweepDeduction} = \frac{(8-2)}{20}
\]

\[
6/20 = 30\%
\]
Bucking “Making Logs”

- The goal of bucking is to produce logs from each tree that provide the maximum value possible.
- Jim Pickens at Michigan Tech, found that optimal bucking improved value 31%.
Rules for Log Bucking

1) Know your buyer/buyers and what they are looking for with respect to species, size, and quality.

This is true for both graded saw logs and character marked logs for non-traditional uses.
Rules for Log Bucking

2) Know the lower diameter limit for the target log grade. Remember that diameter is measured inside the bark.

3) Always cut to even two foot lengths plus 6 inches. If logs are too short, they are scaled down to the next length increment.
Rules for Log Bucking

4) Make bucking decisions that minimize sweep and crook.

- Sweep in logs reduces the scale volume of the log.

- Sweep can also reduce the grade of the log. A one grade reduction can reduce the value of the log by as much as 50%.
Rules for Log Bucking

5) Identify the best log that can be cut from a tree, then work around that log.

6) Because of the value potential of that log, it is almost always best to make bucking cuts that preserve that log.
Rules for Log Bucking

7) Place defects at ends of logs to increase clear cuttings.
   - Longer clear cuttings allow better lumber to be sawn from a log.
Rules for Log Bucking

8) If adding more length to a log increases the number of faces that are not clear. Then, cut the log to a shorter length.

- Adding 2 feet to a log adds at most 25% to the gross scale.
- A reduction of 1 log grade reduces log value by nearly 50%! 
Rules for Log Bucking

9) Sometimes a jump-cut or a cull-section should be removed.
Log Grading and Bucking

- Two inter-related concepts.
Log Scaling

- Logs are bought and sold by scale volume.
- Three different scales are commonly used.

Low-value logs for pulp or fuel are commonly sold by weight.
Log Scaling

<table>
<thead>
<tr>
<th>Log Rule</th>
<th>Year Introduced</th>
<th>Kerf Size</th>
<th>Taper Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doyle</td>
<td>1825</td>
<td>5/16</td>
<td>Yes</td>
</tr>
<tr>
<td>Scribner</td>
<td>1846</td>
<td>1/4</td>
<td>No</td>
</tr>
<tr>
<td>Int. 1/4</td>
<td>1906</td>
<td>1/4</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- Doyle underestimates volume for logs under 23 inch diameter.
- Scribner doesn’t consider taper and underestimates for long logs.
- International 1/4 most fair.
Log Scaling

- Consider a 16’ log that measures 10” on the small end.
  - Doyle: 36 bdft
  - Scribner: 60 bdft
  - Int. 1/4: 65 bdft

A bdft is 12” wide x 12” long x 1” thick
Log Scaling

Don’t forget to subtract the crook or sweep deduction to obtain the true sale volume!

If our log has 4” of sweep, the deduction would be 33%!

\[ \text{Int } \frac{1}{4} \text{ Scale 65} - 0.33 \times 0.65 = 44 \text{ bdft} \]
Log Valuation

- Once grade and volume are known, a value can be determined!
- It can be difficult to learn local log prices.
## Log Valuation

<table>
<thead>
<tr>
<th>Species</th>
<th>Prime</th>
<th>Select</th>
<th>Number 1</th>
<th>Number 2</th>
<th>Number 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Red Oak</td>
<td>700</td>
<td>675</td>
<td>375</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>White Oak</td>
<td>600</td>
<td>450</td>
<td>400</td>
<td>250</td>
<td>200</td>
</tr>
<tr>
<td>Black Cherry</td>
<td>700</td>
<td>600</td>
<td>400</td>
<td>300</td>
<td>175</td>
</tr>
<tr>
<td>White Ash</td>
<td>650</td>
<td>600</td>
<td>450</td>
<td>325</td>
<td>200</td>
</tr>
<tr>
<td>Hard Maple</td>
<td>950</td>
<td>850</td>
<td>650</td>
<td>450</td>
<td>300</td>
</tr>
<tr>
<td>Yellow-Poplar</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>110</td>
<td>-</td>
</tr>
<tr>
<td>White Pine</td>
<td>-</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>100</td>
</tr>
</tbody>
</table>

- Prices for common species per 1000 bdft, Int ¼ Scale. (Northeast Timber Exchange)
### Log Valuation

NTE uses a simplified version of the USFS log grade rules.

<table>
<thead>
<tr>
<th>NTE Grade</th>
<th>USFS Grade</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>High Grade F1</td>
<td>3 Clear Face, 16” Min Diameter</td>
</tr>
<tr>
<td>Select</td>
<td>Factory 1</td>
<td>3 Clear Face, 14” Min Diameter</td>
</tr>
<tr>
<td>Number 1</td>
<td>Factory 2</td>
<td>3 Clear Face, 12” Min Diameter</td>
</tr>
<tr>
<td>Number 2</td>
<td>Factory 3</td>
<td>2 Clear Face, 10” Min Diameter</td>
</tr>
<tr>
<td>Number 3</td>
<td>Construction</td>
<td>1 Clear Face, 8” Min Diameter, USFS Construction Grade has no clear face requirement</td>
</tr>
</tbody>
</table>
Log Valuation

- Given a Red Oak log
  - 16’6” long
  - 14” small end diameter
  - 3 clear faces
  - Upper story log grades as Factory 2
  - Int. ¼ scale volume 135 bdft
  - Approximate NTE grade would be a “Number 1”
Log Valuation

- To calculate value

\[
\frac{375}{1000} \times 135 \text{ bdft} = 50
\]

= $50
Log Valuation

- Of course, if the log had sweep or crook, the volume would be reduced.
- If severe enough the grade would be reduced.
Questions?