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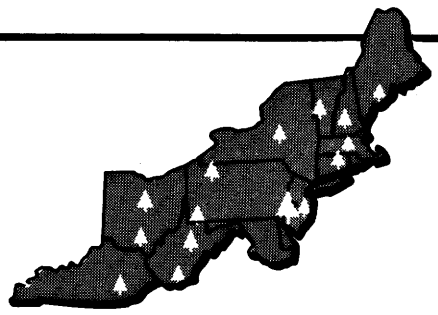

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THE SIGNIFICANCE OF SWEEP IN APPALACHIAN HARDWOOD SAWLOGS

Abstract. Sweep is one of the major stem-form defects in hardwood sawtimber. Some sweep is removed during bucking. But we found sweep of 2 inches or more on 17 percent of the 4,510 logs measured at Appalachian sawmills. Volume deductions for sweep scaled at least 10 percent in 1 of every 7 sample logs and at least 15 percent in 1 of every 9 sample logs. Reduction in the severity of sweep might be obtained by applying the simple rules outlined for buckers.

Many hardwood trees do not grow into perfectly straight stems. Sharp deviations in stem alignment are called crooks. More gradual stem curvatures are called sweep.

The sharp crooks usually are removed and left in the woods when buckers cut the misshapen trees into usable sawlogs. But loggers find it difficult to remove most sawlog sweep without wasting much of the valuable timber resource. So sweepy logs are sent to the sawmills.

Just how prevalent and severe is the sweep in Appalachian hardwood sawlogs? Measurement of 4,510 logs at five mills in three states revealed the following:

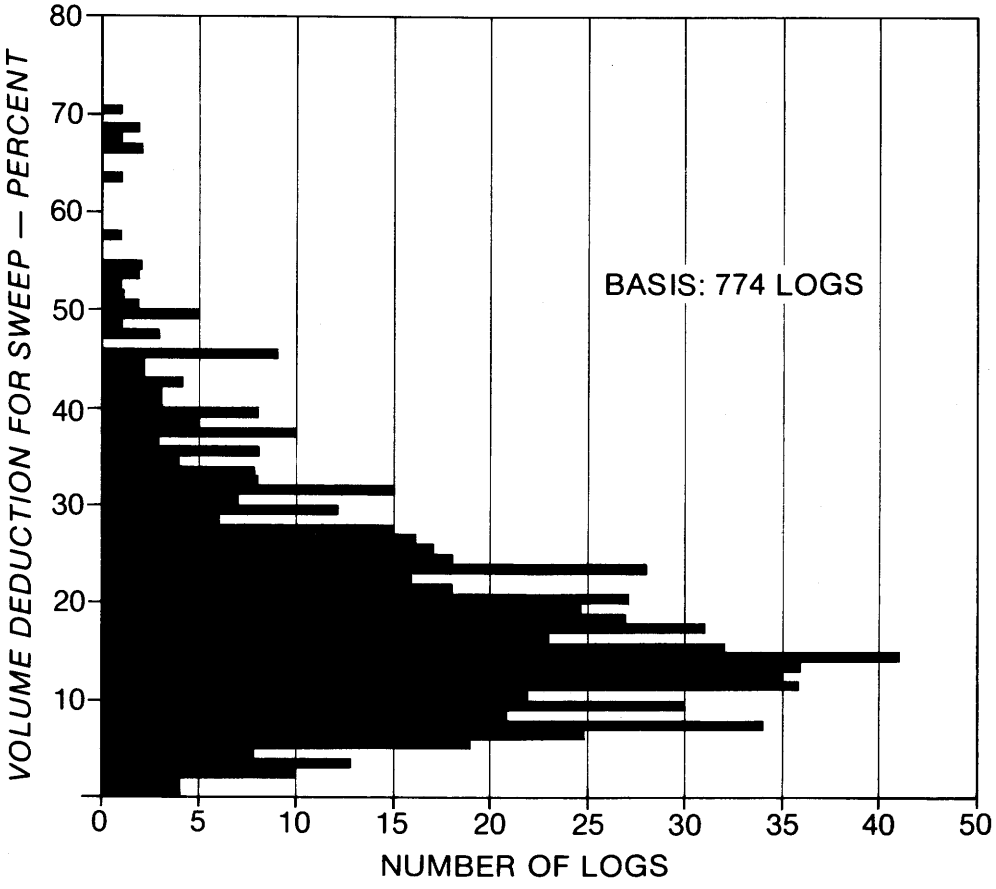
1. Most logs (83 percent) were straight or had only 1 inch of sweep. Sweep was measured in inches of maximum perpendicular deviation from a straight tape stretched from the center of one end to the center of the other end. Sweep of less than 2 inches was not recorded because the formula for computing sweep volume loss gives a zero or negative value when misalignment is only 1 inch in logs 8 feet long and longer.

2. About 17 percent of the logs had sweep of 2 inches or more. Eleven percent of the logs had sweep of 4 inches or more:

Sweep (inches)	*Logs (number)*	*Logs (percent)*
0 to 1	3,725	82.6
2	69	1.5
3	205	4.6
4	231	5.1
5	113	2.5
6	88	2.0
7	40	.9
8	24	.5
9	10	.2
10 or more	5	.1
	4,510	100.0

3. In those logs in which sweep caused a calculated volume loss, deductions for sweep ranged from 1 to 70 percent of gross log volume (fig. 1). The median deduction was 17 percent. Sweep deductions were com-

Figure 1.—Distribution of volume losses due to sweep in Appalachian hardwood logs.



puted from the modified Forest Service formula: percent volume deduction = [(maximum sweep deviation in inches) — (log length in feet ÷ 8)] ÷ [small end diameter inside bark].

4. In 1 out of every 7 sample logs, sweep deductions amounted to 10 percent or more. For 1 out of every 9 sample logs, sweep deductions were 15 percent or more.

Effect on Production and Economics

The fact that only 17 percent of the logs had enough sweep to influence log scale may tend to obscure the importance of this defect. So let me illustrate sweep effects in other terms.

Suppose one of the sample mills saws about 5 million board feet per year. Suppose further that the frequency and severity of sweep resembles the conditions we found. If allowances for sweep were disregarded, the overestimate of annual volume could reach 150,000 board feet. And overpayment for this extra log volume could easily amount to $12,000.

Most sawmills reduce the detrimental impact of sweep by deducting a portion of the gross volume when scaling. If either stumpage price or logging costs are based on correctly scaled net volume, then the sawmill does not pay for undeveloped lumber from logs with heavy sweep. But if sweep deductions are inaccurate, someone in the marketing chain (seller, producer, or buyer) gains or loses money to the benefit or detriment of the others.

Effect on Grade

We did not grade the logs used in this sample. Therefore we cannot describe the influence that sweep had upon either log grade or lumber grade. But we can logically theorize that sweep adversely affected grade.

Our observations showed that more than half the logs with sweep had volume deductions greater than 15 percent. So, any potential grade 1 logs in this category would have automatically been reduced to grade 2. They exceeded the maximum grade 1 sweep limitation of 15 percent imposed by the Forest Service grading system. About one-sixth of the logs had sweep volume deductions greater than 30 percent. Thus any potential grade 1 or grade 2 logs in this category would have been reduced to grade 3 because of grading system sweep limitations.

Of course, even small amounts of sweep will reduce the yield of better grade lumber from a log. Grade losses are due to heavier trimming, edging, and shorter boards than would have been produced from straight logs with similar size, taper, and grade characteristics. Also, when a saw bites into a sweepy log, grade defects in the heart show up sooner on faces perpendicular to the direction of sweep.

Potential Remedies

To reduce sweep, loggers often cut short logs. They do this to reduce scaling penalties and to achieve better utilization of the curved tree stems. But short logs obviously yield short lumber.

Short logs are objectionable because many sawmills have customers who prefer long lumber and pay premium prices for it. Furthermore, short logs require more handling and processing time per unit of lumber produced. So the trade-offs between short and long logs with regard to sweep must be carefully considered by company managers.

We know that once a tree has been bucked, a major decision affecting grade and volume yields has already been made. Of course, log conversion practices in the sawmill naturally influence the lumber grade and volume recovered. But the condition of the logs is a primary determinant of lumber recovery. So, perhaps a simple guideline would help to reduce the detrimental effects of sweep and still allow the manufacture of longer logs and lumber.

We recommend the following rule-of-thumb for bucking trees with sweep. Our calculations show that, if such a rule had been used in developing the logs we measured, volume deductions for sweep would have been cut in half:

Tree section	*Maximum sweep allowance (inches)*
Butt log	3
Upper log	4

Commonsense exceptions should be allowed to obtain logs at least 8 feet long and to more fully utilize stem sections in trees with unusual form characteristics.

Why do we suggest a greater allowance for sweep in upper logs especially when the larger butt logs could tolerate more sweep with a lower percentage scaling deduction? First, the mid- and upper-stem portions are usually more curved than the lower stem. Thus acceptance of greater sweep in upper logs would permit the manufacture of longer logs and lumber even though some volume would be lost. Second, grade declines with increasing height above the butt. So, significant losses in lumber quality are less likely to occur in upper logs with greater sweep.

How could this rule-of-thumb be applied in the woods? First, it could be done by ocular inspection. Remember that only 1 out of 6 logs had sweep critical enough to cause scale deductions. So, loggers are doing a fairly good job already. Ocular inspection might be enough to change the bucking location on tree sections with moderate to heavy sweep.

Second, loggers could use a self-retracting tautline or tape with a hook on one end. The line could be stretched along the side of the curved bole section perpendicular to the direction of major sweep. If the line deviated more than 3 or 4 inches from the center of the bole at any point, the proposed log length could be reduced to meet the sweep standards.

Application of this rule-of-thumb to sweepy timber should allow production of the longest

possible logs, yet hold volume deductions from sweep to acceptable levels. The standards are stringent enough to nearly eliminate grade deductions due to sweep. Of course, cutters must realize that final bucking decisions must be based on other important factors such as stem defects, log diameter and length, and unusual form or grade characteristics.

Reference

Ostrander, M. D., and others.
1965. A GUIDE TO HARDWOOD LOG GRADING. (REVISED). USDA Forest Serv. NE. Forest Exp. Sta. 50 p., illus. Upper Darby, Pa.

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