FACT SHEET

No. 9

Timber & Timber Harvesting in West Virginia

September, 2001

Rules Used In Estimating Tree and Log Volumes

Forest products are usually measured in board feet, cubic feet, cords and tons. Logs to be sawn into boards are measured in board feet or cubic feet and pulpwood and chipwood in cords and tons, but tonnage can be used in measuring any product. Board feet was historically chosen because it expressed the contents of the log in terms of the finished product. A board foot is a piece of lumber one inch thick, 12 inches wide and 12 inches long.

A log rule estimates the number of board feet that can be expected to be sawn from a log of given dimensions under standard sawing practices. The actual volume, however, is influenced by the log diameter, length, amount of defect and taper. Many different rules, in excess of 50, have been developed for varying regional customs, markets, species and log sizes. The three used in West Virginia are the Doyle, Scribner and International one-quarter inch. None of the three gives a totally accurate estimate of the board feet that will actually be cut from a particular log. Therefore, both the buyer and the seller must be fully aware of the limitations of the rule to be used in a timber sale. The parties should consider the overrun (in excess of the estimate) expected from sawing a log scaled with a particular rule. When both sides are aware of the difference, the fair price is set by supply and demand.

Differences occur when thicker lumber is sawed because less kerf (path of the saw) is removed as dust, when a band saw is used (thinner than a circle saw), and when short board lengths can be sold. Another money difference is that in the past, sawdust, bark and slabs were strictly waste. Current policy is to use the dust for pellets, charcoal, boiler fuel and fiber board; slabs as chipwood for pulp and oriented strand board; and the bark for mulch.

The Doyle and International ¼" rules are based on mathematical formulas which use the volume of a cylinder with deductions for kerf, slabs, edgings and shrinkage. The Scribner is based on a diagram where inch thick boards were drawn on circles representative of the inside bark diameter of the small end of the log with the kerf also

drawn between the boards. The Doyle is an old rule, dating to 1870, but it has excessive overrun in logs up to about 28 inches in diameter. The International ¼" rule dates from 1906. It is based on 4 foot sections to allow for taper and four individually figured sections are added to get the 16 foot log volume. It is considered to be the most accurate of the three. The Scribner was developed sometime before 1846. The minimum board width is assumed to be 4 inches and the volume is rounded to the nearest 10 feet.

It is customary to cut logs either 4 or 6 inches longer than the recorded log length to provide for a trim allowance. The extra length allows trimming at the mill to remove dirt and end splintering. Logs are cut in even 2-foot lengths. In scaling, deductions are made for defects inside the log that may or may not be removed as edgings and trimmings. The deduction is made by visually determining the width and length of an imaginary box that will enclose the defect. An inch is usually added to the width and length measurements to provide for kerf and any irregularities in shape of the defect. The length of the defect is the nearest 2-foot length above the actual length of the defect. Deductions are also made for crook and sweep in the log, but this can be almost entirely eliminated by cutting out the offending section in the woods.

The International ¼" scale for a 12-inch DBH, one 16-foot log tree yields 56 board feet. The Scribner volume for the same size tree is 47 (84%) board feet and the Doyle is 29 (52%) board feet. Comparable figures for a 16" tree are 106 , 95 (85%) and 72 (68%) board feet; for a 20" tree 171, 157 (92%) and 135 (80%) board feet and for a 24" tree 251, 234 (93%) and 216 (86%) board feet. The Scribner and Doyle scales equalize at about 32" at 441 and 440 board feet; the International and Doyle at 38" at 656 and 655 board feet. The percentages are just as striking for 2 and 2.5 log trees which are definitely more common in the upper size ranges.

A cubic foot is a piece of wood 1 foot x 1 foot x 1 foot. When using cubic measurements, wood is usually measured in units of 100 cubic feet (CCF) called cunits. The U. S. Forest Service has adopted the cunit as the standard unit of measurement for its timber sales. In cubic foot scaling, the average middle diameter of the log, inside bark, and the total length are used. There is no trim allowance although logs are measured to the nearest 1/10 inch and rounded to the nearest foot. The middle diameter of the log can be calculated by averaging the inside bark diameters of the large and small ends. Diameters are generally rounded to the nearest inch. On butt logs a somewhat different procedure is sometimes used.

Hardwood logs should be sorted into veneer class, factory class and tie and construction class. The veneer class is worth much more than the others and the lumber class is worth more than tie logs. Consequently, when timber is sold as one class, the landowner usually loses some value. The yield of 1 common or better lumber, for example, for factory log grades 1,2 and 3 for yellow poplar is 77%, 46% and 20%. For red oak it is 73, 46 and 18.

Weight measurements are used and are technically sound, but the availability of scales is often a problem. The chief question is always "what is the weight required for

1,000 board feet of lumber?" Actual weights vary due to log size, time of year, time since the trees were felled, proportion of heartwood, tree species, health of trees (defect), specific gravity , etc. The pounds per thousand board feet also varies by the log rule used and whether green, kiln dried, or air dried. Red oak, for example, for green 12-inch diameter logs scaled with the Doyle scale weighs 13,550 pounds, by the Scribner 11,000 pounds, and by the International ¼" 9,150 pounds. One thousand board feet of red oak lumber weighs 5,800 pounds green, 3,950 pounds when air dried, 3,650 pounds when dried to 12% moisture, and 3,550 pounds when dried to 8% moisture. Hickory, black locust and white oak are the only Appalachian species that are somewhat heavier.

Since pulp is measured by weight, weight is also a good measure of pulpwood quantity if the moisture content is known or closely estimated.

(Prepared by William H. Gillespie.)

This publication is distributed free by the Timber Committee, West Virginia Forestry Association, P. O. Box 718, Ripley, WV 25271. Please call (304-372-1955) or write for additional copies, topics or for a list of speakers and their availability.