

TREE MEASUREMENT

Objective

Contestants will learn to measure standing trees in order to estimate the volume of forest products that may be obtained from the trees. Since most timber is bought and sold on a volume basis (usually by board foot volume), it is a good idea to have some estimate of total tree volume, volume per acre and volume by product before selling timber.

Contest Rules

1. Any standard tree scale stick may be used. Scale sticks may be purchased from companies such as Forestry Suppliers, Inc., Box 8397, Jackson, MS 39204; Ben Meadows Co., P.O. Box 80549, Atlanta, GA 30366; or TSI Co., Box 206, Flander, NJ 07936.
2. A fixed radius plot will be selected and designated for use in this event. Contestants will be required to give the total volume of sawtimber per acre as determined from the sample plot volume. The plot may be 1/10 acre (37.3 ft radius), 1/5 acre (52.7 ft radius) or 1/4 acre (58.9 ft radius).
3. Contestants will identify 15 trees and estimate their diameters, merchantable heights, and volumes. All values will be recorded. **Please note** - For purposes of this contest tree diameters will be measured and recorded in even 2-inch diameter classes. Tree heights will be measured in 16-foot logs to the nearest full half-log. The smallest tree will be 10 inches DBH (diameter at breast height) and one log merchantable height. Merchantable height will be measured from stump height to an 8-inch top diameter, a major fork or serious defect (hollow or point of decay) which affects greater than half the tree's diameter at that point.
4. Tree volumes will be found in the International 1/4-inch volume table furnished at the contest site (see page 17). **Do not use the volume table on the tree scale stick.**
5. One point will be awarded for each correct tree identification, two points for each correct DBH, and two points for each correct tree height, for a possible total of 75 points. No points will be awarded for individual tree volumes.
6. After all 15 trees have been measured, contestants will determine the total volume in the plot and the volume per acre. Twenty-five points will be allowed for the correct **volume per acre**. Remember, the total volume in the plot must be multiplied by a factor (10 for a 1/10-acre plot, 5 for a 1/5-acre plot and 4 for a 1/4-acre plot) to determine the volume per acre. Point allocation will be 25 for $\pm 5\%$ of the official volume, 20 points for $\pm 10\%$, 15 points for $\pm 15\%$, and no points over $\pm 15\%$.

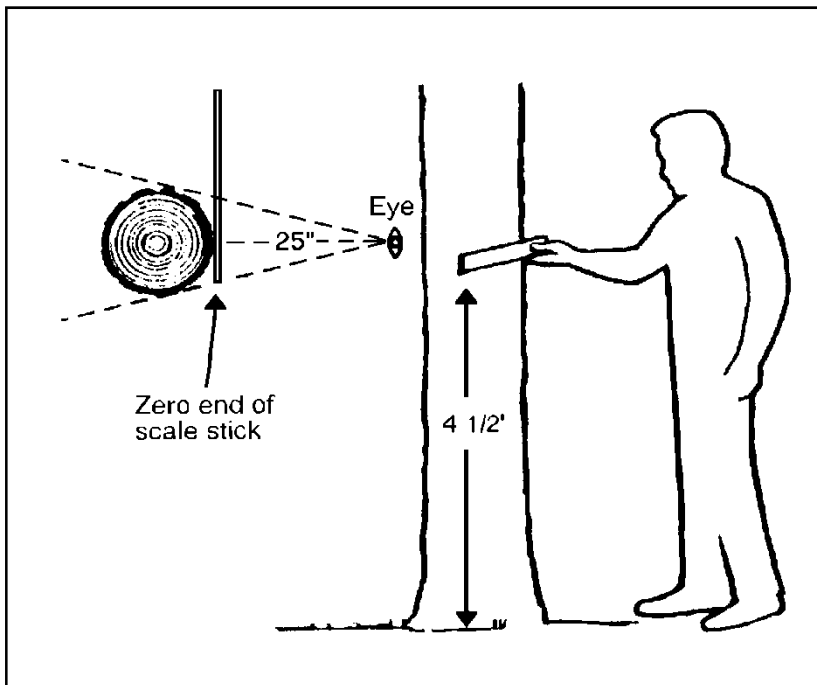
Example: If 4,000 bd. ft. is the official volume per acre, then an answer between 3800 bd. ft. and 4200 receives 25 points; 3600 to 3799 and 4201 to 4400 receives 20 points; 3400 to 3599 and 4401 to 4600 receives 15 points; and under 3400 and over 4600 receives no points.
7. Maximum score for this event is 100 points.

MEASUREMENT OF STANDING TREES STUDY GUIDE

When trees are sold as harvested products (sawlogs, veneer logs, or pulpwood), the sale is generally based upon a measured volume. The two measurements used to estimate the volume of a tree are diameter and height. Diameter of standing trees is measured by a time-honored custom, at 4-1/2 feet above ground on the uphill side of the tree (if the tree is on a slope). This is abbreviated as **DBH** (diameter breast height). **Height** of a standing tree might be measured as **total** (the entire height from ground line to the top) or **merchantable**. Merchantable height implies the ability to cut lumber, veneer, or other products from the logs. It is the distance from the stump height to the top of the merchantable material in the tree and varies depending on the products to be made from the tree. The basic unit of height measurement for sawtimber is the log, which is 16 feet in length.

To measure diameter, foresters may use a caliper, diameter tape, or tree scale stick. Since the tree scale stick is to be used in the contest, the method of using it will be explained.

The drawing below shows how the tree scale stick is used to find tree diameter. Use the flat side of the stick, which reads, "Diameter of Tree (in inches)." The instrument on this side of the tree scale stick is called a **Biltmore Stick**. Hold the stick against the tree, perpendicular to the trunk, 25 inches from your eye at a height of 4 1/2 feet above ground on the uphill side of the tree. Once the stick is placed against the tree, close one eye and line up the left end with the edge of the tree's bark. Now, **WITHOUT MOVING YOUR HEAD**, look across the stick to the right hand edge of the tree and read the diameter measurement at the point of intersection. Record the measurement by its proper even 2-inch diameter class. For example; if the tree measures between 15.0 and 16.9 inches it should be recorded as a 16 inch diameter tree.



Even 2-inch Diameter Classes

| <u>If Diameter Measures</u> | <u>Record As</u> |
|-----------------------------|------------------|
| 9.0 - 10.9 | 10 |
| 11.0 - 12.9 | 12 |
| 13.0 - 14.9 | 14 |
| 15.0 - 16.9 | 16 |
| 17.0 - 18.9 | 18 |
| 19.0 - 20.9 | 20 |
| etc. | |

Figure 1. Use of tree scale stick to estimate tree diameter 4 1/2 feet above ground.

To measure height, foresters may use a clinometer, laser hypsometer, relaskop, or tree scale stick. Since the tree scale stick is to be used in the contest, the method of using it is explained below.

To measure the merchantable height of a tree, pace out 66 feet from the base of the tree, to a point where the entire tree can be seen. It is a good idea to stay on the same contour as the tree or slightly up hill from it. Hold the tree scale stick so that the edge of the stick that reads "Number of 16 foot logs" faces you. The instrument on this edge of the tree scale stick is called a **Merritt Hypsometer**. The zero end should point toward the ground. Plumb the stick, at 25 inches from the eye. Sight the zero end to appear to rest at stump height. Stump height, for purposes of this contest, will be measured from one foot above the ground. **DO NOT MOVE YOUR HEAD OR THE STICK.** Look up the stick to a point where the top of the last merchantable cut would be made in the tree (8-inch top diameter, a major fork, or serious defect which affects greater than half the tree's diameter at that point). Read the merchantable height to the nearest **full** half-log. For example, if the merchantable height is slightly more than 2 ½ logs you can record it as 2 ½ logs. But, if the merchantable height is slightly less than 2 ½ logs you must record it as 2 logs.

Practice on pacing is needed to find the 66-foot distance from the tree. The 25-inch distance from your eye to the stick is still the same as in measuring tree diameter.

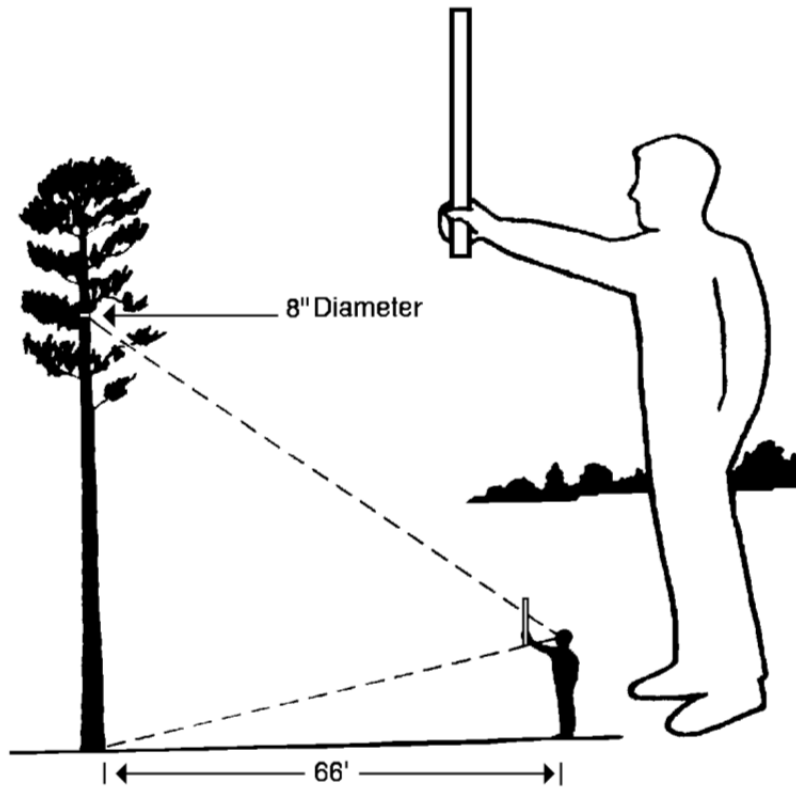


Figure 2. Use of tree scale stick to estimate merchantable height.

VOLUME TABLE

To use this table, first measure the diameter at breast height (DBH) of a tree and place it into the proper even 2-inch diameter class (see page 15). Next measure the merchantable height of the tree in 16-foot logs to the nearest full half log. Read down the left hand column until you come to the row containing the DBH. Then, move across from left to right until you come to the column containing the tree merchantable height at the top. At the intersection of that row and column you will find the merchantable volume of the tree. Read and record each tree volume directly and separately. **FOR CONTEST PURPOSES, DO NOT USE THE VOLUME TABLE ON THE TREE SCALE STICK.**

International ¼ inch Log Rule -- Form Class 78

VOLUME (board feet) BY NUMBER OF 16-FOOT LOGS

| DBH | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 |
|-----------|------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 10 | 36 | 48 | 59 | 66 | 73 | ----- | ----- | ----- | ----- |
| 12 | 56 | 74 | 92 | 106 | 120 | 128 | 137 | ----- | ----- |
| 14 | 78 | 105 | 132 | 153 | 174 | 187 | 200 | ----- | ----- |
| 16 | 106 | 143 | 180 | 210 | 241 | 263 | 285 | ----- | ----- |
| 18 | 136 | 184 | 233 | 274 | 314 | 344 | 374 | ----- | ----- |
| 20 | 171 | 234 | 296 | 348 | 401 | 440 | 480 | 511 | 542 |
| 22 | 211 | 290 | 368 | 434 | 500 | 552 | 603 | 647 | 691 |
| 24 | 251 | 346 | 441 | 523 | 605 | 664 | 723 | 782 | 840 |
| 26 | 299 | 414 | 528 | 626 | 725 | 801 | 877 | 949 | 1,021 |
| 28 | 347 | 482 | 616 | 733 | 850 | 938 | 1,027 | 1,114 | 1,201 |
| 30 | 403 | 560 | 718 | 854 | 991 | 1,094 | 1,198 | 1,306 | 1,415 |
| 32 | 462 | 644 | 826 | 988 | 1,149 | 1,274 | 1,400 | 1,518 | 1,637 |
| 34 | 521 | 728 | 934 | 1,119 | 1,304 | 1,447 | 1,590 | 1,727 | 1,864 |
| 36 | 589 | 826 | 1,063 | 1,274 | 1,485 | 1,650 | 1,814 | 1,974 | 2,135 |
| 38 | 656 | 921 | 1,186 | 1,428 | 1,670 | 1,854 | 2,038 | 2,224 | 2,410 |
| 40 | 731 | 1,030 | 1,329 | 1,598 | 1,868 | 2,081 | 2,294 | 2,494 | 2,693 |

TREE MEASUREMENT SCORE SHEET

| State | Group No. | Contestant's Name | | | |
|----------------------------------------------------|----------------------|-------------------|---------------------------------|-------------------------|-------|
| No. | Species (1 point) | DBH (2 pts) | Height 16 ft logs (2 pts) | Volume Board Feet | Score |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | | | | | |
| 15 | | | | | |
| Total board foot volume in plot | | | | | |
| Total board foot volume per acre | | | | | |
| (a) Subtotal of Tree Scores (75 points possible) | | | | | |
| (b) Score for Volume Per Acre (25 points possible) | | | | | |
| Contestant Score (a + b) | | | | | |

Plot Size _____