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Extension FactSheet

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Using the Tree Measuring Stick

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The tree measuring stick is a useful tool for measuring trees and logs. Although not as precise as more specialized tools, it is inexpensive, easy to carry, and accurate enough for most of your tree and log measurement needs. This stick incorporates several tools that are commonly used by foresters and the forest industry, and can help woodland owners better understand and manage their forest resource.

What can you measure with this stick? The stick is primarily used to measure the diameter of standing trees in inches, their height in 16 foot logs, and the volume they contain in board feet or cords. It can also be used to measure diameters of logs and estimate their volume. Additionally, the stick has an angle gauge that can be used to determine basal area—a measurement of tree density or crowding.

Even though the stick is a useful tool, it will not eliminate the woodland owner's need for the assistance of a professional forester. A woodland owner should utilize a professional forester to develop a management plan and to assist with forest management activities such as timber harvests and tree planting.

Measuring Tree Diameter

There are two important factors to keep in mind when measuring tree diameter: 1) the diameter of a tree should be measured at a point on the tree 4½ feet off of the ground (this is known as Diameter at Breast Height or d.b.h.) on the uphill side of the tree, and 2) trees are often not perfectly round; therefore, it is a good idea to take two measurements perpendicular to each other and average them.

When measuring tree diameter be sure to utilize the side of the stick labeled "Tree Scale Stick" (Figure 1) and follow the steps outlined below:

1. Hold the stick 25 inches from your eye and against the tree with the "Tree Scale Stick" side facing you.
   a. Remember, diameter should be measured at 4½ feet from the ground (d.b.h.) on the uphill side of the tree (Figure 2a). It is useful to measure 4½ feet from the ground and note the point on your body where this occurs or carry a walking stick that is 4½ feet tall to determine where to measure diameter.

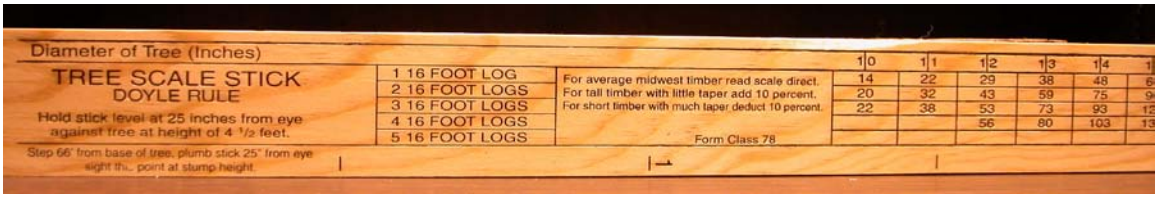

Figure 1. A tree measuring stick showing the "Tree Scale Stick" side.

b. Check the distance between your eye and stick to be sure it is 25 inches (Figure 2b). The "Diameter of Log" scale on the top of the opposite side of the stick is a ruler that can be used to check this distance. Make a mental note of the bend in your arm when the stick is 25 inches from your eye. For accurate diameter measurements it is critical that the stick is 25 inches from your eye. Check this distance frequently until you can consistently hold the stick at 25 inches.

2. Using the "Diameter of Tree (inches)" scale on the top of the tree scale stick, adjust the stick so that the left side ("0" end) of the stick is in line with the left edge of the tree (Figure 2b).
3. **Without moving your head**, shift your line of sight to the right-most visible portion of the tree. Read the diameter from the scale closest to the point where your line of sight and the tree intersect. This is the diameter of the tree in inches. Remember that trees are often not perfectly round. Be sure to take two measurements perpendicular to each other, keeping the stick 4½ feet off the ground on the uphill side of the tree.

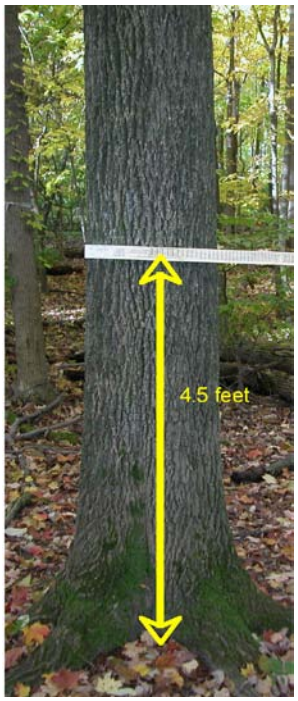

Figure 2a. The stick should be placed against the tree 4½ feet from the ground.

Estimating the Merchantable Height of a Tree (in 16 foot logs)

The merchantable height of a tree, the height to which logs can be cut, is commonly measured in 16 ft. logs and 8 ft. 1/2 logs. To measure merchantable height of a tree with the measuring stick, use the scale along the bottom edge of the "tree scale" side of the stick (Figure 4). When the stick is held vertically the numbers on the scale will be on the right (approximately 6 inches apart). This scale is calibrated to be used at a distance of 66 feet from the base of the tree. Since this scale is used to estimate heights to the nearest 1/2 log (8 ft) pacing 66 feet from the tree is usually an adequate distance measure.

1. Using the "Determining Your Pace" procedure described below, pace 66 feet from the base of the tree. It's a good idea to use a tape measure to verify that the paced distance is correct until you become consistent with your pacing. When possible, avoid pacing in a direction that is uphill or downhill. The accuracy of your pace will decrease if you are pacing on steep or uneven ground.
2. Face the tree to be measured and hold the stick vertically at a distance of 25 inches from your eye (Figure 3). Be sure that the scale "Number of 16 foot logs" is facing you. As with measuring diameter, this distance of 25 inches is critical to obtain accurate measurements. Make sure that the stick is as close to vertical as possible. A forward or backward lean in the stick will cause you to overestimate merchantable heights.
3. Align the base of the stick in line with the top of the stump (about 1 foot above the ground).
4. Sight past the right hand side of the stick to the point on the tree to be measured.

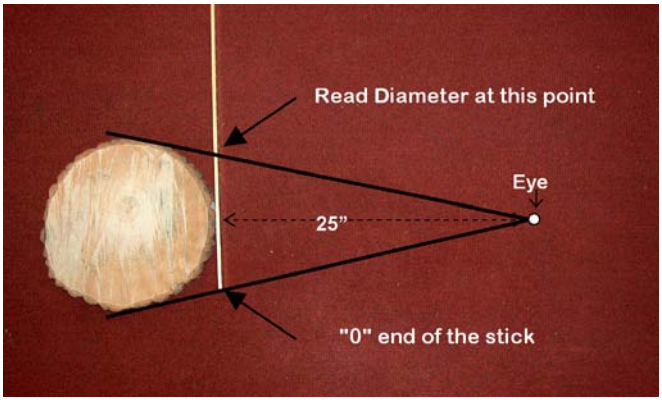

Figure 2b. Make sure the distance from your eye to the stick is 25 inches.

Determining Your Pace

A pace is the length of one or two of your steps. Measure 66 feet on a relatively flat surface, and beginning with your left foot, walk at a comfortable speed and count every time your right foot hits the ground. Determine the number of paces that it takes to cover the 66-foot distance. Repeat this process at least once and determine the average number of paces. Calculate your pace by dividing the distance by the number of paces.

Example: If your right foot hits the ground an average of 13 times over the 100-foot distance, divide 66 feet by 13 to get a pace of 5.1 feet.

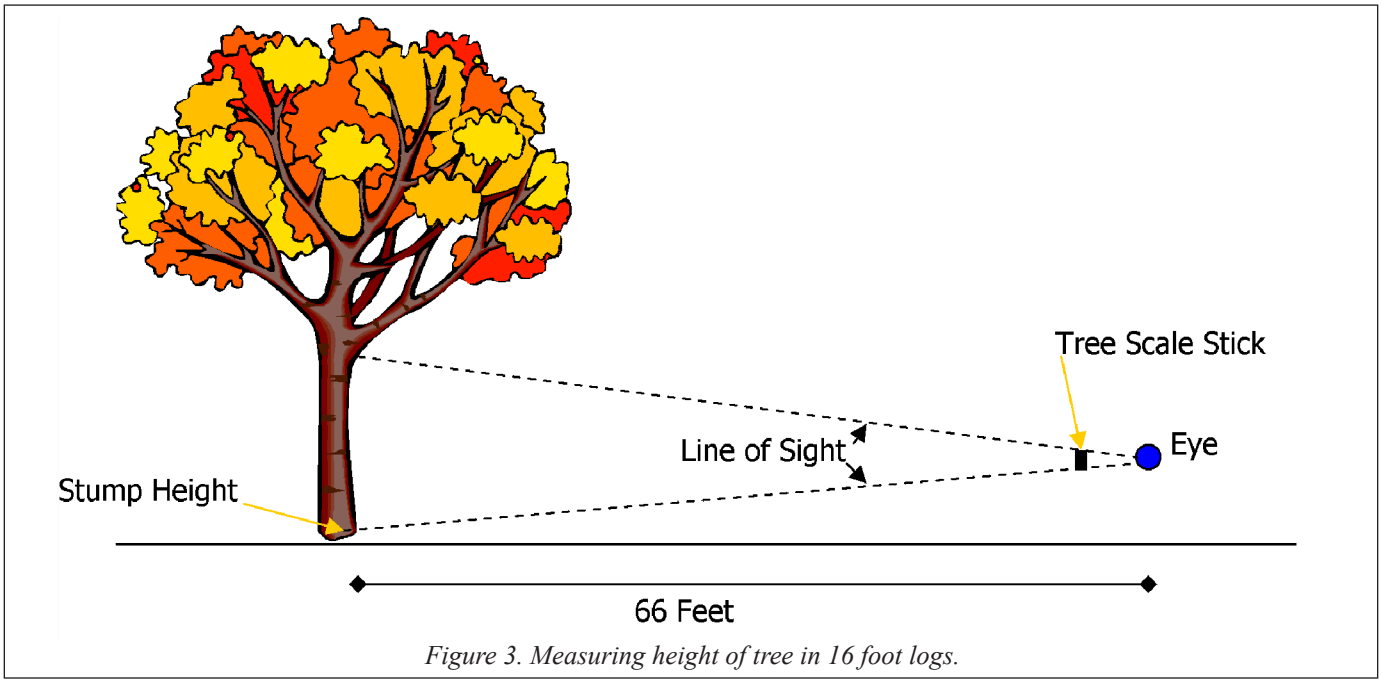

Figure 3. Measuring height of tree in 16 foot logs.

5. Read the height from the scale closest to the point where your line of sight and the tree intersect. This is the merchantable height of the tree in logs. The numbers on the scale marked 1, 2, 3, 4, and 5 correspond with the top of each 16 foot log. Dashes without numbers represent 1/2 logs. Measure the usable height only. That is usually at the point on the tree where it reaches a minimal usable diameter or is indicated by heavy branching, forks, etc. Ten and four inches are commonly used as minimum diameters for sawlogs and pulpwood, respectively. However, these can vary depending on the quality of the wood and the products to be produced.

Estimating Tree Volume

After the diameter and height in 16 foot logs have been determined for a tree, the tree's volume in board feet can be read from the table on the Tree Scale Stick (Figure 4).

1. Find the diameter of the tree (same scale used to measure tree diameter) at the top of the column.
2. Find the merchantable height of that tree in 16 foot logs along the left side of the table.

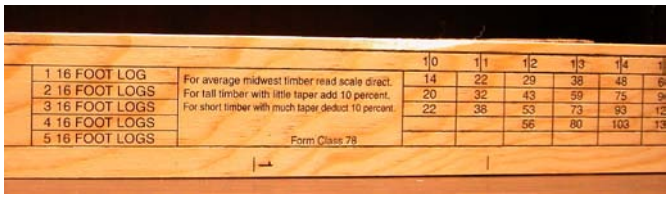

Figure 4. Using the diameter and height in 16 foot logs, read the volume of board feet in the tree.

3. Follow the corresponding height in 16 foot logs across the table until it intersects with the corresponding diameter. The number in the box represents the estimated board foot volume of the tree using the Doyle Log Rule with a Form Class of 78 (assumes that the tree diameter inside the bark at the top of the first log is 78% of the d.b.h.). There are numerous log rules used in the United States. Doyle is by far the most commonly used log rule in Ohio.

Example: A tree that measures 18 inches d.b.h. and is 3–16 foot logs in merchantable height would contain an estimated 215 board feet of timber.

What is a board foot?

A board foot is a piece of wood that contains 144 cubic inches, commonly visualized as a piece of wood 12 inches square and 1 inch thick.

Defect Deductions

It is very difficult to estimate the amount of defect present in a standing tree because the entire defect is not visible. Trees can have a number of defects (knots, holes, branch stubs, or hollows due to past fire or other damage) that can cause all or a portion of the tree to be unusable. Deductions should be made for estimated loss due to these defects. Trees that are over 50 percent defect are commonly labeled "cull" and are often not utilized for lumber. Based on the tree's apparent defects, use your judgment in making deductions that reduce the volume between 10 and 50 percent.

Estimating Cordwood

The amount of cordwood for use as firewood or to be sold as pulp can be estimated using the "Cords Per Tree" table found on the "Log Scale" of the stick (Figure 5).

1. Find the diameter of the tree under the DBH (inches) column located on the left side of the adjacent tables.
2. Find the estimated ***total height*** of the entire tree along the top edge of the table.
3. Follow the corresponding diameter across the table until it intersects with the corresponding total height. The number in the box represents the estimated number of cords of wood found in the tree. This is a rough estimate only as the actual amount depends greatly on the tree's branch structure.

Example: A 20-inch dbh tree that is 60 feet tall contains approximately 0.630 cords of wood.

Most 1/2-ton pickups can hold approximately 1/3 to 1/2 cord of wood depending on how high and how well the wood is stacked. In other words, most pickups haul about a rick of wood.

Considerable variation in solid wood content of a cord may be encountered due to such factors as how tightly the wood is stacked, the diameter of the wood (larger diameters usually stack better), how well the wood is trimmed, and whether it is split or round.

What is a cord?

The legal unit of measure for firewood in Ohio is the cord, which is the amount of tightly stacked wood contained in a space 4' wide x 4' high x 8' long and containing 128 cubic feet. A rick or face cord is another unit of measure often used and is 4' high x the length of preferred wood x 8' long. In other words, three 16" ricks (3 x 16" = 48") = 1 cord and two 24" ricks (2 x 24" = 48") = 1 cord.

Log Scale Stick (Doyle Rule)

The log scale stick is a tool for use in estimating the volume of logs. Use the following steps to estimate the volume of a log:

1. Measure the length of the log. Typically logs are measured in two-foot intervals. Keep in mind that a minimum of 6–8 inches must be provided for trimming of the lumber that the log will yield. Therefore, a log that measures 16'6" would be labeled a 16 foot log. If a log measures 16'1" it will be labeled a 14 foot log in order to allow enough trim allowance at the mill.
2. Measure the diameter of the log inside the bark (dib) at the small end utilizing the "inches" scale on the top of the "Log Scale" side of the stick (see Figure 6). If the log is obviously not round, measure at the narrowest and widest points and figure the average diameter.
3. Utilizing the log scale stick table (Figure 6), determine the estimated volume of the log in board feet (Doyle Rule). Find the diameter of the log that you measured in step 2 along the "inches" scale. Next locate the row on the "Log Scale Stick" table that corresponds to the length of the log being scaled. The number where the appropriate column and row intersect is the estimated board foot content of the log.

Example: A log with an average diameter of 15 inches on the small end (inside bark), and a shortest length of 14'6" would have an estimated volume of 106 board feet (Doyle Rule). If there is a need to take a deduction for defect in this log, it is done in the same manner as for standing trees.

Basal Area Factor

Basal area (B.A.) per acre is a method of expressing forest stand density. It is the sum, in square feet, of the cross-sections of all of the tree stems (at breast height)

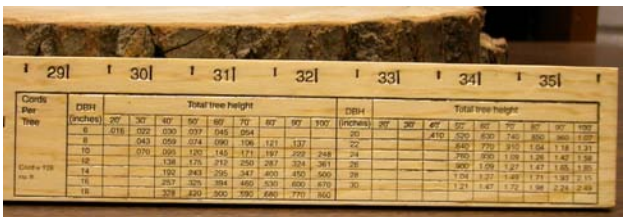

Figure 5. Utilize the "Cords Per Tree" chart to figure the amount of firewood cords in each tree.

Figure 6. Use the "Log Scale Stick Doyle Rule" with the "Diameter of Log (inches)" to estimate the volume of board feet in logs.

in an acre of forest. Basal area includes the bark with the wood. In simple terms, basal area is a measure of the level of crowding of trees in a forest, and it is used by foresters to make thinning, harvesting, and other forest management recommendations.

Near the end of the stick on the log scale side (Figure 7) is a 10 factor angle gauge used to estimate basal area. The gauge is the width of the black square. The factor of the gauge is 10 square feet basal area per acre if the stick is held vertically, with the square perpendicular to the line of sight, and at exactly 25 inches from the eye.

Figure 7. Basal Area Factor Gauge.

To estimate basal area at a given location:

1. Position yourself in the center of the area to be measured, hold the stick as described above, and compare the black square to each tree that can be seen.
2. Any tree whose trunk shows on both sides of the black square (i.e. is wider than the square; Figure 8) is counted. Keeping your feet centered over the same spot, move in a complete circle and tally any tree larger than the gauge. Do not count trees that appear smaller than the width of the square; if a tree appears equal to the width of the square, count it as 1/2 a tree (see Figure 8).
3. When the circle has been completed, multiply the count by 10, the BA factor. If six trees are tallied, the basal area at that sample point would be 60 square feet per acre. If 15 trees are tallied, the BA per acre would be 150 square feet.

To estimate the BA for a forest stand, a number of sample points should be taken, usually a minimum of 10 or at least 1 per acre in large stands. The BA for all sample points should be totaled and averaged to determine an estimate of BA for the stand.

Summary

All of the tools presented on the scale stick will help woodland owners better understand the forest resources found in their woodlands. This information along with the assistance of a professional forester will help woodland owners make informed decisions about the management of their woodlands.

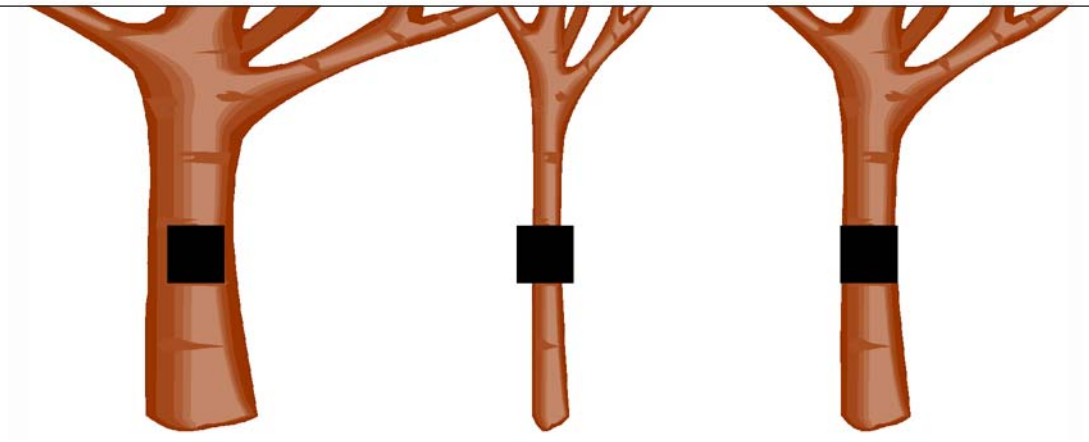

Figure 8. Using the Basal Area Factor Gauge to determine how crowded your forest is.

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