

CHAPTER

7

**MEASURING
TREE DIAMETER**





Measuring Tree Diameter

Tree diameter is closely related to tree value. Generally, the larger the tree the more it is worth. Tree diameters are taken for two primary reasons:

1. To determine stand structure (diameter distribution or number of trees by diameter class); that is, what does the stand look like?
2. To estimate tree volume or weight

Diameter is defined as the distance from one edge of a circle to the opposite end through the center. The radius is half the diameter. Therefore, diameter is measuring the inside or cross-section of the tree at 4½ feet. How do we measure the diameter of the tree without cutting it down? One way is by measuring the circumference of the tree and converting it to diameter (figure 7.1.).

Circumference measures the distance around a circle. To convert circumference to diameter, you divide your circumference measurement by pi, or 3.1416. Example: Using a measuring tape, you measure the circumference of a tree on your property; it is 15 inches in circumference. What is the diameter of that tree?

$$15 \text{ in.} \div 3.1416 = 4.77, \text{ or } 4.8 \text{ in. diameter}$$

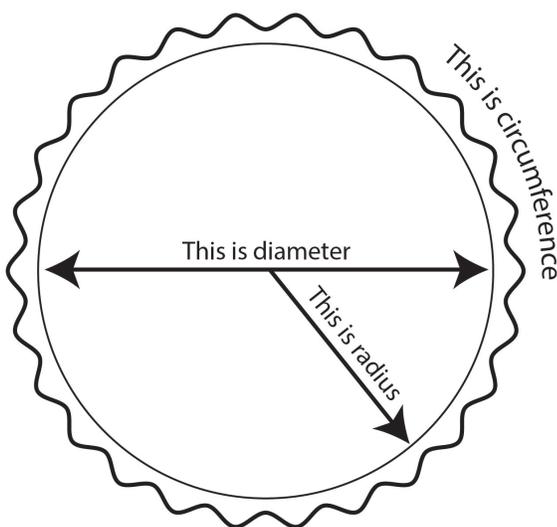


Figure 7.1. Comparison of diameter, circumference, and radius.



A diameter tape is a special tool that converts circumference to diameter measurements.

DIAMETER AT BREAST HEIGHT (DBH)

The most common measure of tree diameter of standing trees is called diameter at breast height (dbh or DBH), which is the diameter of the tree trunk at 4½ feet above ground level on the uphill side of the tree. Measuring tree diameters at this height allows us to keep tree measurements consistent.

Sometimes, however, there is some irregularity about the tree, such as a protruding knot or ring of knots, swelling, forking, or other deformity, and DBH must be taken at another point. Generally, the point of measurement is moved higher on the tree trunk to a point where the deformity is no longer affecting the measurement or estimate of DBH. Figures 7.2 to 7.8 show where DBH should be measured on a tree given different situations.

The most common measure of standing tree diameter is called diameter at breast height (dbh or DBH), which is the diameter of the tree trunk at 4½ feet above ground level on the uphill side of the tree.



A diameter tape is the most popular tool for measuring tree diameter in the southeastern United States.

DIAMETER MEASUREMENT INSTRUMENTS

Calipers, diameter tapes (D-tapes), and Biltmore sticks can all be used to measure tree diameter. Depending on your objectives and forest conditions, one of these forest tools may be better than the other. Let's look at how each of these can be used.

DIAMETER TAPE

This is the most popular instrument for measuring DBH. It is easy to use, reasonably consistent, and easy to carry in the woods. Using a diameter tape, you do not need to convert circumference to diameter. The markings on the tape are such that the math is done for you.

The tape begins with an unmarked section (trailer). The mark at the zero point goes completely across the tape. The other marks on the tape (usually in inches and tenths of inches) are made along the bottom edge only.

To measure diameter, hold the case securely and pull out a short length of the tape. Reach around the tree and catch the loose end in your free hand. Pull the tape straight and taut around the tree, with the hand holding the case crossing over the other hand. The DBH of the tree can be read along the bottom edge of the tape at the 0 line. See video 7.1, *Measuring DBH*, on the Alabama Extension website at www.aces.edu/go/ForestInventoryBasics.



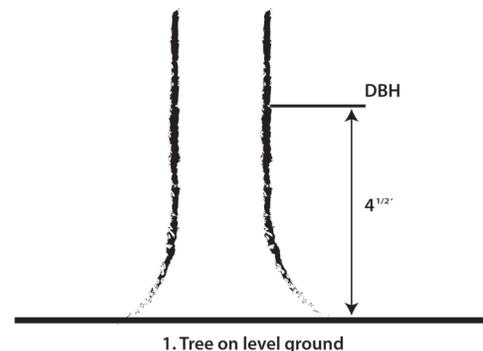
Calipers can be used to measure tree diameter of standing or downed trees.

CALIPERS

Tree calipers make a direct measurement of tree diameter. Calipers are held at breast height (4½ feet above the ground on uphill side of tree). The arms of the caliper are placed on the tree trunk, perpendicular to the sides of the tree. The diameter between the two arms is read from the scale (usually in inches and tenths of an inch). The calipers must be held at the same angle as the lean of the tree, if lean is present.

Two measurements at right angles to each other should be observed on each tree. The average is taken of the two measurements as DBH. A common mistake is when calipers are held too low (below 4½ feet), resulting in an overestimation of DBH.

Caliper measurements can be inconsistent; that is, several people can measure the same tree and get somewhat varying diameters. This is particularly true as trees become more noncircular.



1. Tree on level ground

Figure 7.2. Where to measure the DBH of a tree on level ground with no defects.

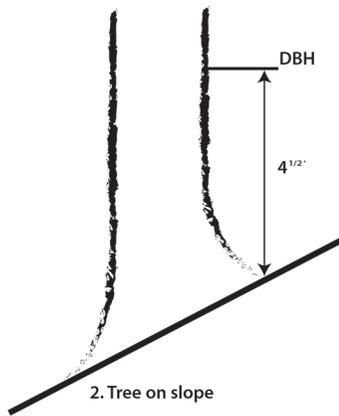


Figure 7.3. To measure DBH of a tree on sloping ground, measure on the uphill side of the tree.

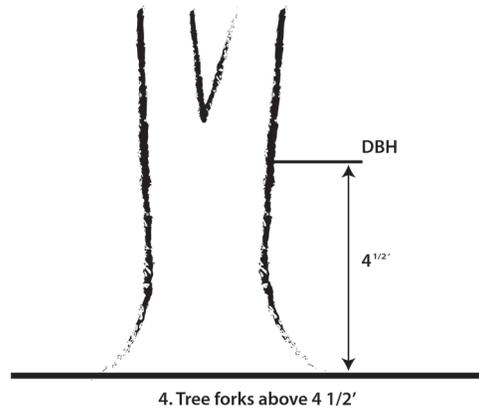


Figure 7.5. To measure a tree forked at or above 4½ feet, measure the diameter at 4½ feet above the ground (at DBH) and count as one tree.

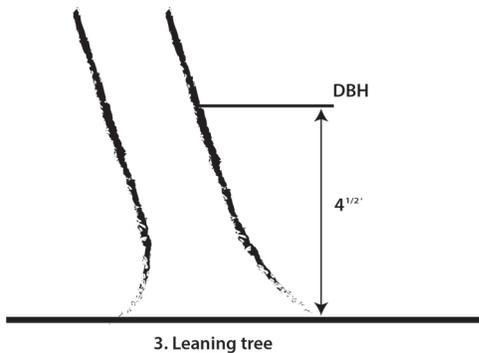


Figure 7.4. To measure the DBH of a leaning tree, measure the tree perpendicular to the lean of the tree or parallel to the ground, or on the backside of the lean.

Without moving your head (moving only your eyes), glance to the other side of the tree. Where the line from the edge of the tree to your eye intersects the stick is the measurement of diameter (graduated to the nearest 2 inches only; do not attempt to interpolate).

As with calipers, two measurements of DBH should be observed and averaged. Biltmore sticks tend to be held too high on the tree, thus underestimating DBH. Manufactured Biltmore sticks can be purchased from forestry equipment suppliers, or personalized Biltmore sticks can be made to match your natural arm reach.

BILTMORE STICK

The Biltmore stick is a graduated stick that allows for quick estimation of diameters to the nearest 2 inches. The stick is held against the tree at breast height, 25 inches from the eye. The zero end of the stick is moved so that when you look along the end of the stick you are looking at one side of the tree at breast height.

DIAMETER CLASSES

When measuring tree diameters, the tool you use determines the precision of your measurement. Diameter tapes are used for more precise measurements, while Biltmore sticks are used for rough estimates.



Biltmore sticks are used for quick, but less precise, estimates of tree diameter.

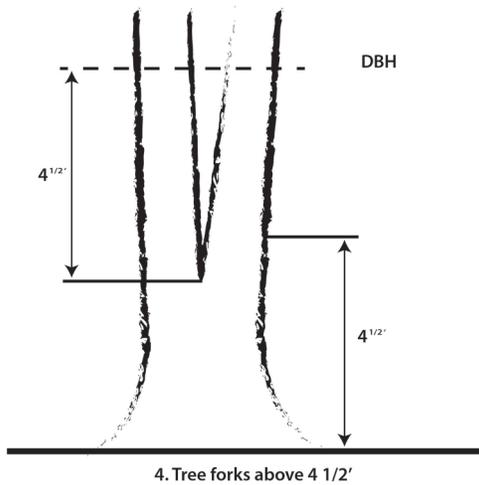


Figure 7.6. To measure a tree forked below 4½ feet, measure as two separate trees.

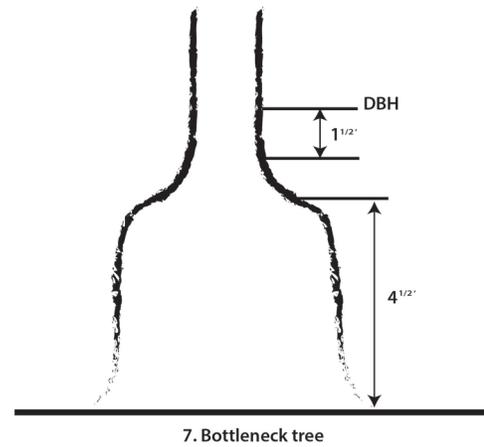


Figure 7.8. Follow this illustration to measure DBH of a bottleneck tree (such as black tupelo or cypress) that is growing in a wet area.

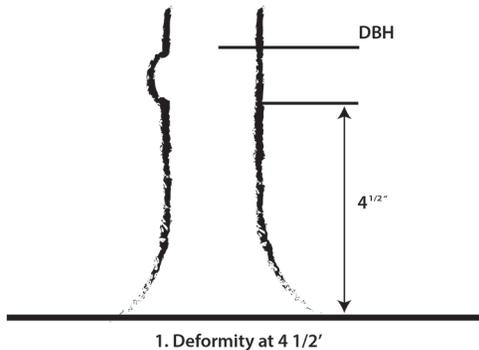


Figure 7.7. A deformity may be caused by knots, turpentine scars, fire scars, etc. To measure DBH of a tree with a deformed bole at 4½ feet, estimate DBH at the nearest point above the deformity if the deformity is large and extends beyond your reach.

There are times when you may need to convert more precise measurements to whole numbers. In forestry these are called diameter classes; that is, all trees within a range of diameters fall into a given class. Appendix A details diameter class ranges for 1-inch class and 2-inch class ranges.

Example: You measure a tree and it is 14.6 inches in diameter. You need to know the 1-inch-diameter class it falls within. Looking in appendix A, you see that trees measuring between 14.6 and 15.5 inches are in the 15-inch class. If it is the 2-inch class you need to know, you see that trees measuring 13.1 to 15.0 inches are in the 2-inch, 14-inch-diameter class. It can be confusing, but it helps to remember that diameters that end in 0.5 round down.

YOUR TURN

1. Determine the breast height for you. To measure DBH accurately, you need to know where 4½ feet falls in relation to how tall you are. Have someone hold one end of your measuring tape or logger's tape at your feet while you pull the tape up toward your head to 4½ feet above the ground. Note where 4½ feet falls on your body. You will use that point as a reference when you measure DBH on trees.
2. Make a Biltmore stick. Using a broom handle, make your own Biltmore stick using the directions in appendix B.
3. Practice measuring tree diameters. Measure the DBH of some trees in your forest using the Biltmore stick you created following the directions in appendix B or using a tape measure or diameter tape. Remember, if you use a regular measuring tape, you must convert the circumference measurement to diameter. If you use a logger's tape or diameter tape, those conversions are considered and you can read diameter directly off the tape. For each tree, take the measurements at breast height or other appropriate location as defined in this chapter.