

# Measuring Up

## Objective:

Students will use a Biltmore stick to measure tree diameter and merchantable height and calculate the amount of wood in a tree.

## Standards of Learning:

Science 6.1, LS.1, BIO.1; (also, a little math)

## Materials:

- Biltmore sticks
- 66-foot yarn lengths (orange)

## Background:

Foresters, landowners, and others who buy or sell timber often need to figure out how much wood is “growing” on a piece of land. They do this by using tools to measure the trees. When you know the species, amount, and quality of timber on the land, you can look at the latest timber market values to estimate how much the wood is worth. Market values for wood change constantly, depending on economic factors.

There are many ways to measure standing timber. The Biltmore stick has been used for many years. It is not the most accurate tool, but it is not expensive, and it easy to learn to use. Before using a Biltmore stick, there are several terms you should know:

DBH stands for “diameter at breast height.” This is standardized at 4 ½ feet and is where a tree’s diameter is measured.

Merchantable height is not the total height of the tree, but the height of commercially valuable material. Subtractions are made for the stump height and for parts of the tree with defects or that are too narrow to be used for timber.

The number of 16-foot logs in a tree is used to calculate timber volume. This is a standard length of wood that sawmills start with, to make many lumber products.

For sawtimber, we usually measure the volume of wood in board feet. One board foot is equal to a piece of wood 12 inches square and 1 inch thick (although this is not the way the wood will eventually be cut.)

## **In the Forest:**

Choose an area of the forest where it is easy to see the tops of large trees (such as the parking area or the edge of any open area). Students will work in small groups. Give each group a Biltmore stick and a 66-foot roll of yarn. Designate several large trees for each group to measure. Group members should take turns, so that each person gets to measure a tree.

*\* Whether measuring tree height or diameter, a Biltmore stick should be held 25 inches from the eye. For easy reference, the Biltmore sticks in this kit are marked in red 25 inches from the end with the drilled hole. Smaller students may not be able to reach 25 inches; in this case, they should hold the stick as far away as they can. (Measurements will be off somewhat, but that is not critical for this lesson.)*

To measure DBH: Using the side that says “Tree Scale Stick”, hold the stick against the tree trunk, 4 ½ feet off the ground. (Estimate based on your own height.) Move the stick until the left edge is even with the left side of the trunk. Without moving the stick or your head, move your eyes to the right side of the tree trunk and read the diameter, in inches, from the top edge of the stick.

To measure merchantable height: Have your partner hold one end of the yarn and stand at the base of the tree. Take the other end of the yarn and walk 66 feet (length of the yarn) from the tree, staying on the same level (i.e., not moving downhill or uphill). Hold the Biltmore stick vertically, turning it so that you can read the narrow edge with numbers from 20 to 80. Line up the bottom of the stick with a stump height about 1 foot from the ground. Without moving the stick or your head, move your eyes to the point where the tree has its first major defect, such as a Y-split. (If there is none, make a guess about where the trunk diameter is less than 8 inches.) Read the measurement from the narrow edge of the stick.

To calculate the number of 16-foot logs in the tree, turn the stick so that the edge labeled “Merritt Hypsometer” faces you, and read the number of logs. Round down to the nearest whole number. (Alternatively, you can simply divide the merchantable height by 16 and round down to the nearest whole number.)

To calculate timber volume:

Using the “Tree Scale Stick” side, find your tree’s number of logs in the far left column, and move your finger across to the column for your tree’s diameter. The number in the table where these intersect is the number of board feet in the tree.

## **Back in the Classroom:**

Combine data from all groups into a table. Find the class average DBH, merchantable height, and timber volume.

### **Questions for Review/Discussion:**

- Why might someone need to know how much wood is in a tree?
- What are some reasons people harvest timber?
- What are some advantages and disadvantages of using a Biltmore stick to measure timber?
- Suppose the types of trees you measured are currently worth \$200 per 1000 board feet. What would be the dollar value of your largest tree? The total dollar value of trees the class measured?
- What was the average amount of wood in the trees your class measured? Suppose your property had an average of 100 trees of this size per acre. Using \$200 per 1000 board feet, what would be the dollar value of timber per acre?
- What could be done with the "leftover" wood in your tree that is not used for timber?
- What are the advantages and disadvantages of leaving the trees in place instead of harvesting them?