

4-H Virtual Forest User's Guide

Let's Cruise!

Concept

Measuring trees to estimate the volume of timber in a forest is an important part of a forester's job. For example, if a forest landowner decides to sell timber, they must know the timber volume that they own in order to receive a fair price for their product. A forester's tools, along with the measurement techniques used, are based upon mathematic principles that are learned in school at an early age.

This module supports the following SOLs:

Science

Scientific and Engineering Practices

- 3.1 b) estimate length, mass, volume, and temperature; measure length, mass, volume, and temperature in metric and U.S. Customary units using proper tools

Earth Resources

- 4.8 d) forests, soil, and land

Math

Computation and Estimation

- 5.1 The student will estimate, represent, solve, and justify solutions to single-step and multistep contextual problems using addition, subtraction, multiplication, and division with whole numbers.
- 5.4 The student will create and solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of whole numbers.

Measurement and Geometry

- 5.10 The student will identify and describe the diameter, radius, chord, and circumference of a circle.
- 6.1 a) Identify and describe chord, diameter, radius, circumference, and area of a circle.

Module Description

Introduction. The “introduction” frame describes the importance of tree measurements:

“Measuring trees to estimate the volume of wood in a forest is called timber cruising. It is an important part of a forester’s job. If a forest landowner decides to sell timber, the forester must measure the timber volume to ensure the landowner receives a fair price for their trees. A forester’s equipment, along with the measurement techniques used, are based on mathematical principles that we learned in school.”

Click the arrow to proceed to learn more about measuring the tree on the right.

Tree age and growth rate. To figure out a tree's age without felling it, foresters use an increment borer. Each ring inside the tree signifies a year's growth. When rings are close together, it indicates slow growth. Proper forest management aims for trees with good growth rates to minimize pest issues and maximize both volume and value.

Watch the video to learn more about how the increment borer is used.

Notice that the core sample pictured has alternating light and dark growth rings. The light rings are called earlywood or springwood. They grew early in the year when water was plentiful. More water means thinner cell walls, causing the wood to look light to our eye. The darker growth rings are called latewood or summerwood. They grew later in the year when less water was available. As a result, the cell walls are thicker and look darker to our eyes. One light ring plus one dark ring make one year, so count one or the other to get the age of the tree, but not both.

Merchantable height. A tree’s worth isn't just in its height, but in its merchantable height - the part that's usable for making products. This is measured from about 1 foot above the ground to a major fork or a certain diameter.

When comfortable with this concept, the student clicks the 'Next' arrow to proceed to an interactive activity. Here, the student can click and drag a ruler to measure the merchantable height of the illustration. The bottom of the ruler should be aligned with the dotted line near the base of the tree. The dotted line just beneath the fork of the tree indicates the cut off point. Read the number that corresponds with this line and select this number from the choices at the bottom of the screen. The correct answer is “3.5”.

What is this Tree’s Diameter? Diameter is measured at 4.5 feet above the ground (diameter at breast height, or DBH) using a measuring tape, Biltmore stick, or calipers.

When comfortable with this concept, the student once again clicks on the 'Next' arrow to proceed to an interactive activity. Here, the student can click and drag a Biltmore stick to measure the diameter of the tree. The left edge of the stick should be aligned with the left edge of the tree. Read the number that corresponds with the right edge of the tree and select it from the options at the bottom. The correct answer is “18”.

What is the volume of this tree? Students will now have an opportunity to determine the tree's volume themselves using the volume table shown. To determine the subject tree's volume, find the number of logs along the top (3.5), and the diameter along the side (18). Read down and across from these numbers to find and click on the tree's volume. For example, a tree 12 inches in diameter with a merchantable height of 1.5 logs will have a volume of 56 board feet. (The dimensions of one board foot are 1" by 12" by 12"). Our tree contains 344 board feet.

What is This Tree Worth? Do you want to know what this tree is worth? Here's how we find out...

1) Our tree is a sawtimber tree, meaning that it will be sawn into lumber. This type of tree is purchased in units called "thousand board feet" abbreviated as MBF. You already figured out that our tree has 344 board feet. To convert this to MBF we divide by 1,000 resulting in 0.344 MBF.

2) Now, this tree is worth \$250 per thousand board feet. This value will change depending on distance to markets, how steep the ground is, and even the weather!

3) To calculate the tree's value, multiply \$250 by the number of MBF. Select this number from the options shown.

Clicking the "check your answers" bar will automatically calculate the value for the student. Students should calculate that the tree is worth $0.344 \times \$250 = \86.00 .

Summary. The concluding frame describes the other values that trees provide.

"Trees have many other values beyond their value for products. Did you know a 30-inch tree 75 feet tall that is growing on the west side within 40 feet of your house can save your family \$42 in electricity each year? Moreover, people spend about \$3 BILLION a year on forest-related recreation activities in Virginia, like hiking, fishing, or bird-watching. As you can see, Virginia's forests have a lot of value!"

References

McPherson, G.E., D.J. Nowak, P.L. Sacamano, S.E. Prichard, and E.M. Makra. 1993. Chicago's evolving urban forest. USDA-FS GTR NE-169. 55 p.

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Virginia Department of Forestry. 2001. The Value of Virginia's Forests. VDOF P00100.

