Course	Agricultural Science II
Unit	Forestry
Lesson	Measuring Standing Timber and Logs
Estimated Time	Two 50-minute blocks

Student Outcome

Measure standing timber and logs by board-foot volume and cord volume.

Learning Objectives

1. Describe how to measure logs for fuelwood or pulpwood.
2. Describe how to measure logs for lumber.
3. Describe how to measure standing timber.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
   - ☐ PPt 1 – Measuring Diameter
   - ☐ PPt 2 – Measuring Tree Height
2. Handouts
   - HO 1 – Board Foot Volume of Trees by Diameter and Height Classes
   - HO 2 – International 1/4-Inch Log Rule Table
   - HO 3 – Cord Volume Table
   - HO 4 – Measuring Diameter at Breast Height and Merchantable Height
3. *Forestry* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1986.
4. *Forestry Curriculum Enhancement.* University of Missouri-Columbia: Instructional Materials Laboratory, 2008.

Supplemental Information

1. Internet Sites
   - ❑ Forest Landowner's Guide to the Measurement of Timber and Logs. Virginia Cooperative Extension. Accessed May 28, 2008, from http://www.ext.vt.edu/pubs/forestry/420-085/420-085.html.
   - ❑ Measuring Standing Trees: Determining Diameter, Merchantable Height, and Volume. Ohio State University Fact Sheet. Accessed May 28, 2008, from http://ohioline.osu.edu/for-fact/0035.html.
   - ❑ How to Measure Standing Timber. TimberQuote.com. Accessed May 28, 2008, from http://timberquote.com/education/howto/measure.

2. Print
   - ❑ Palmer, B., and J. McKee (ed.). *Forest Management for Missouri Landowners.* Jefferson City: Missouri Department of Conservation, revised 2003. Accessed June 4, 2008, from http://www.mdc.mo.gov/documents/forest/private/forest_manag.pdf.
   - ❑ Slusher, J.P. *How to Measure Trees and Logs* (Guide G5050). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from http://extension.missouri.edu/xplor/agguides/forestry/g05050.htm.

Interest Approach

It is important for producers to be able to determine the value of their produce. Part of that value is based on volume. Just as corn producers must know the number of bushels they produce and sell, tree farmers, foresters, and timber agribusiness personnel must know the volume of the wood products they buy or sell.

Communicate the Learning Objectives

1. Describe how to measure logs for fuelwood or pulpwood.
2. Describe how to measure logs for lumber.
3. Describe how to measure standing timber.

Instructor Directions	Content Outline
Objective 1 *Discuss with students how they would sell fuelwood or pulpwood. Explain what a standard cord is, and demonstrate how to use the formula.*	**Describe how to measure logs for fuelwood or pulpwood.** 1. Fuel wood and pulpwood are sold in cords. 2. Standard cord occupies 128 cubic feet. 3. Formula for determining number of cords: Number of Standard Cords = $\frac{\text{length (feet) x width (feet) x height (feet)}}{\text{128 cubic feet}}$ The number of standard cords in a stack of wood 4 feet x 4 feet x 8 feet = 1 cord Example: Is a level truck bed really equal to a half cord? Yes, if the dimensions were 4 feet x 8 feet x 2 feet = .5 cords. 4. A rick is not a standard measurement. (It is customarily 1/3 to 1/2 cord.) 5. Face cord – one row of wood 4 feet x 8 feet with lengths varying from 18 to 24 inches.
Objective 2 *Discuss with students how logs are measured for sawlogs and for lumber. Refer to HO 1 and 2.* HO 1 – Board Foot Volume of Trees by Diameter and Height Classes	**Describe how to measure logs for lumber.** 1. Logs for sawlogs and lumber are measured in board feet. (A board foot = 144 cubic inches.) 2. Scaling is the normal basis for estimating the number of board feet in a log. 3. By measuring the diameter and length, and then using a log rule, the number of board feet in a log may be estimated.

Instructor Directions	Content Outline
HO 2 – International 1/4-Inch Log Rule Table	a. Diameter measurement – Measure small end of log inside bark. – If log is not perfectly round, take two measurements at right angles to each other and use the average diameter. b. Length – Measure length in even feet (10, 12, 14, 16, etc.). – If the log is in between an even number of feet, measure to the smaller even number. c. Log rule – Used to estimate board foot volume from the diameter and length measurements of logs. – Over 50 log rules in the United States. – International 1/4-Inch and Doyle are common log rules. Example: A log which is 15.5 feet long and has a D.I.B. of 18 inches = 200 board feet using the International Log Rule.
Objective 3 *Discuss and demonstrate procedures for measuring standing timber with the students. After this demonstration, have students practice measuring trees in the school yard. Refer to HO 1, 3, and 4 and PPt 1 and 2.* *Note: The discussion below refers to the example of a cruising stick in the Student Reference. Other cruising sticks may have different scales, formulas, and instructions.* HO 1 – Board Foot Volume of Trees by Diameter and Height Classes HO 3 – Cord Volume Table	**Describe how to measure standing timber.** Timber is often sold on a stumpage basis (selling timber from standing trees). The tree's diameter at breast height (d.b.h.) and the merchantable height are used to determine board foot or cord volume. 1. Measuring diameter at breast height (d.b.h.) a. Breast height is 4-1/2 feet above ground on the high side of the base of the tree b. Cruising stick is used to find a quick estimate of tree height and diameter c. Hold cruising stick 25 inches from eye against tree at breast height. d. Line up zero end with the outside edge of the tree. e. Without moving head and using only one eye, read figure nearest where line of sight crosses stick and edge of tree. f. Number indicates breast height diameter in inches.

Instructor Directions	Content Outline
HO 4 – Measuring Diameter at Breast Height and Merchantable Height PPt 1 – Measuring Diameter PPt 2 – Measuring Tree Height	2. Measuring merchantable (usable) height a. Use cruising stick b. Measure from stump (12 inches from ground) to point on tree beyond which merchantable logs cannot be cut. – Sawlogs – diameter 8 inch top, inside the bark – Can occur lower on tree if tree is forked or deformed c. Measuring height – Pace out 50 feet from tree to a point free of obstructions and level with tree. – Look at tree and decide at what point last cut will be made (merchantable height). – Hold stick <u>vertically</u> 25 inches from eye. – Move stick up and down until lower end is even with line of sight of stump height. – <u>Without moving head</u>, shift your eyes upward to the point where you decide the last cut will be made. – Point where line of sight passes the stick amounts to a reading in terms of 16 foot logs. (Make sure stick is held vertically and not tilted backward or forward.) Computing volume of standing trees 1. Diameter at breast height (d.b.h.) and merchantable height are used to compute tree volume. 2. Board foot volume table a. Read diameter breast height (d.b.h.) down left column b. Read merchantable height across top row c. Point of intersection = board foot volume of tree 3. The cord volume table is read the same way as the one above but results in estimation of cordwood volume.
Application	Other activities: 1. Have students break into teams and measure trees on school grounds to determine stacks of cordwood or logs. 2. Have students measure the tallest tree at their home or farm.

Instructor Directions	Content Outline
Closure/Summary	Whether measuring trees or logs for sawlogs or cordwood, a fast estimation of the volumes of wood products may be obtained by finding the diameter, the length, and using the appropriate log rule or volume table.
Evaluation: Quiz	Answers: 1. a 2. 65 board feet 3. 4-1/2 4. 279 board feet 5. 12 6. 25 7. a 8. d