

## Lesson B3–3

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# Measuring Timber Stands

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**Unit B.** Plant Wildlife Management

**Problem Area 3.** Forest Management

**Lesson 3.** Measuring Timber Stands

### **New Mexico Content Standard:**

**Pathway Strand:** Power, Structural and Technical Systems

**Standard: III:** Apply principles of service and repair to mechanical equipment, structures, biological systems, land treatment, power utilization, and technology.

**Benchmark: III-G:** Use tools in the workplace to demonstrate safe use and proper skills with construction/fabrication hand tools.

**Performance Standard:** 1. Demonstrate proper use of measurement and layout tools. 2. Apply proper use of measurement and layout tools in construction/fabrication of an actual project.

**Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

1. Explain how to calculate board feet.
2. Explain how to measure basal area in standing trees.
3. Explain how to determine tree volume.

**List of Resources.** The following resources may be useful in teaching this lesson:

**Recommended Resources.** One of the following resources should be selected to accompany the lesson:

Rolfe, Gary L., John M. Edgington, I. Irving Holland, and Gayle C. Fortenberry.  
*Forests and Forestry* 6<sup>th</sup> Edition. Upper Saddle River, New Jersey: Prentice Hall  
Interstate, 2003. (Chapter 3).

**Other Resources.** The following resources will be useful to students and teachers:

## List of Equipment, Tools, Supplies, and Facilities

Writing surface  
Overhead projector  
Transparencies from attached masters  
Tree scale sticks  
Wedge prisms  
Diameter tapes  
Tree volume tables

**Terms.** The following terms are presented in this lesson (shown in bold italics):

Basal area  
Board foot  
dbh  
Diameter at breast height  
Log rules  
Lumber overrun  
Taper  
Wedge prism

**Interest Approach.** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

*Like a grain producer who measures the production of his or her crops in bushels, the forester measures production in board feet. In order for the forester to make this calculation the understanding of certain terms and the acquisition of certain skills are necessary. Lead discussion to the first objective of the lesson.*

# Summary of Content and Teaching Strategies

**Objective 1:** Explain how to calculate board feet.

**Anticipated Problem:** How do I calculate board feet?

- I. A **board foot** is a unit of measurement represented by a piece of rough wood 1 foot square and 1 inch thick. In surfaced or finished lumber, width and thickness are based on measurements before surfacing or other finishing.
  - A. Board feet of a piece of lumber can be calculated by multiplying the length of the piece  $\times$  the width of the piece  $\times$  the thickness divided by 12. In this formula the length is measured in feet, while the width and thickness are measured in inches. To determine the board feet in several pieces of lumber that are equal in size, determine the board feet in one piece then multiply that number by the number of similar size pieces.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding the common units of measure used in forestry. Chapter 3 in Forests and Forestry is recommended. Use TM: B3–3A to aid in discussion on this topic.*

**Objective 2:** Explain how to measure basal area in standing trees.

**Anticipated Problem:** How do I measure basal area in standing trees?

- II. The **basal area** (cross-sectional area of a tree at breast height expressed in square feet) is commonly measured to determine the level of stocking of a stand of trees, the amount of timber to remove in thinning an overstocked stand, and timber volume calculations. Basal area may be determined in a number of ways.
  - A. Basal area may be determined by physically measuring each tree with a Biltmore stick, a diameter tape, or calipers. A table is then used to determine the basal area from the recorded measurements.
  - B. One of the easiest methods for estimated basal area is by using angle gauges in optical tree-measuring devices. One type of angle gauge is a **wedge prism**. A wedge prism can be used to determine which trees should be counted and tallied in a timber sample and which should not. Prisms are ground to specified basal area factor size. The factors generally vary from  $2\frac{1}{2}$  to 50, but the most common size is 10. Multiplying the basal area factor of the prism used at a given point in a timber times the number of trees counted with the prism will directly give the square feet of basal area per acre of the trees around that point. When a series of points is taken in a timber stand, average the figures for basal area per acre from all sampling points to obtain the average basal area per acre for the entire stand. Write out equations.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding how to measure basal area in standing trees. Chapter 3 in Forests and Forestry is recommended. Use TM: B3–3C and TM: B3–3D to aid in discussion on this topic.*

**Objective 3:** Explain how to determine tree volume.

**Anticipated Problem:** How do I determine tree volume?

- III. Tree volume tables are available to facilitate estimating the number of board feet, cubic feet, or cords in standing trees. The volume tables are designed to indicate a specific volume for a tree of a certain **diameter at breast height (dbh)** and height.
- A. Tree volume tables that give the merchantable content of the standing timber are generally derived from **log rules**, or tables that measure the volume of individual logs. Volumes indicated on log rules are derived by formulas or graphic means. There are over 50 different log rules used in the United States, and the values assigned to trees or logs vary considerably. The more common rules are the Doyle, Scribner, International, Maine, Spaulding, and Herring.
1. The Doyle rule indicates less volume for small-diameter logs than does the other commonly used rules. The **lumber overrun**, or the production of more lumber than the log rule allows, tends to be high for logs less than 28 inches, but it is excessive for logs less than 16 inches. In this rule, an arbitrary deduction is made for lumber processing losses from the volume of a cylinder. The Doyle rule is most frequently used for the purchase of sawtimber and sawlogs.
  2. The Scribner rule is preferred by forestry agencies in the United States. It is derived by graphic means and estimates the amount of 1-inch lumber that can be sawn from logs of specific dimensions. This rule, like the Doyle rule, is most frequently used for the purchase of sawtimber and sawlogs. Many forest agencies, including the USDA Forest Service, have adopted this rule for timber sale purposes. The Scribner rule gives a lumber overrun for large logs.
  3. The International log rule, like the Doyle, is derived by a formula and is the only rule that adds volume for taper. **Taper** is a term that describes the gradual diminution of diameter in a tree trunk. It provides one of the highest estimates of volume of any of the log rules and closely approaches the actual quantity of lumber that can be cut from a tree or log without the normal provision for a slight lumber overrun. This rule is no longer used for making timber sales, but it continues to be useful for forest survey and research purposes.

*There are many techniques that can be used to assist students in mastering this material. Students need text material to aid in understanding how to measure basal area in standing trees. Chapter 3 in Forests and Forestry is recommended.*

**Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in

determining which objectives need to be reviewed or taught from a different angle. Questions at end of chapters in the textbook may also be used in the review/summary.

**Application.** Determine the basal area and lumber volume of a local wooded area. Contact your local forester for assistance.

**Evaluation.** Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

## **Answers to Sample Test:**

### **Part One: Matching**

1 = d, 2 = b, 3 = a, 4 = e, 5 = c, 6 = f

### **Part Two: Completion**

1. angle gauges
2. formulas; graphic
3. Doyle
4. Doyle; Scribner
5. International

### **Part Three: Short Answer**

1. 56
2. 48
3. 108

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# Test

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## Lesson B3–3: Measuring Timber Stands

### Part One: Matching

*Instructions.* Match the term with the correct response. Write the letter of the term by the definition.

- |               |                   |                |
|---------------|-------------------|----------------|
| a. Board foot | c. Log rules      | e. Taper       |
| b. dbh        | d. Lumber overrun | f. Wedge prism |

- \_\_\_\_\_ 1. The production of more lumber than the log rule allows.
- \_\_\_\_\_ 2. Diameter at breast height.
- \_\_\_\_\_ 3. A unit of measurement represented by a piece of rough wood 1 foot square and 1 inch thick.
- \_\_\_\_\_ 4. A term that describes the gradual diminution of diameter in a tree trunk.
- \_\_\_\_\_ 5. Tables that measure the volume of individual logs.
- \_\_\_\_\_ 6. Can be used to determine which trees should be counted and tallied in a timber sample and which should not.

### Part Two: Completion

*Instructions.* Provide the word or words to complete the following statements.

1. One of the easiest methods for estimated basal area is by using \_\_\_\_\_ in optical tree-measuring devices.
2. Volumes indicated on log rules are derived by \_\_\_\_\_ or \_\_\_\_\_ means.
3. The \_\_\_\_\_ rule indicates less volume for small-diameter logs than does the other commonly used rules.
4. The \_\_\_\_\_ and \_\_\_\_\_ rules is most frequently used for the purchase of sawtimber and sawlogs.
5. The \_\_\_\_\_ log rule is no longer used for making timber sales, but it continues to be useful for forest survey and research purposes.



# CALCULATING BOARD FEET

**Definition:** One board foot (bf) is a board that is 1 foot square and 1 inch thick. (The dimensions are 1' × 12" × 1".)

**Formula:** bf = length × width × thickness divided by 12. (Length is measured in feet; width and thickness are measured in inches.)

**Example 1:** The number of bf in a board that is 12 feet long, 6 inches wide, and 1 inch thick is determined as follows:

$$\frac{12 \times 6 \times 1}{12} = \frac{72}{12} = 6 \text{ bf}$$

**Example 2:** The number of bf in a board that is 14 feet long, 4 inches wide, and 2 inches thick is determined as follows:

$$\frac{14 \times 4 \times 2}{12} = \frac{112}{12} = 9.33 \text{ bf}$$

**Note:** To determine the bf in a stack of boards when all the boards are of equal size, determine the bf in one board and multiply that by the number of boards.

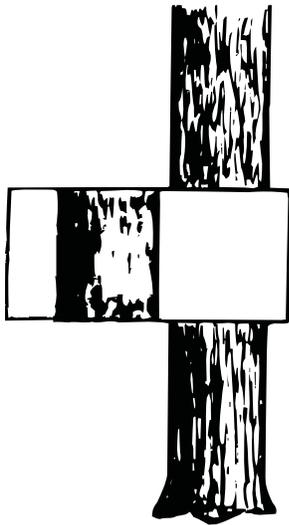
# BASAL AREA OF TREES BY DBH CLASSES

<b>dbh</b>	<b>Basal Area</b>	<b>dbh</b>	<b>Basal Area</b>
<i>Inches</i>	<i>Square feet</i>	<i>Inches</i>	<i>Square feet</i>
2	0.022	14	1.069
4	0.087	16	1.396
6	0.196	18	1.767
8	0.349	20	2.181
10	0.545	22	2.640
12	0.785	24	3.142

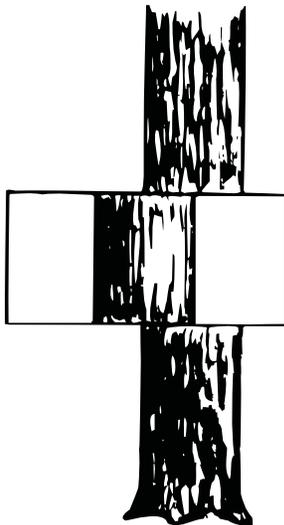
## **STEPS IN USING A WEDGE PRISM**

- 1. Hold the prism at eye level directly over the point to be used to sample the timber stand.**
- 2. Look through the prism, and count the number of trees that should be tallied. The face of the largest edge of the prism should be at right angles to the line of sight, and the top edge of the prism should be horizontal to the level ground.**
- 3. Multiply the tree count at this point by the basal area factor of the prism to get the basal area per acre in square feet around this sampling point.**

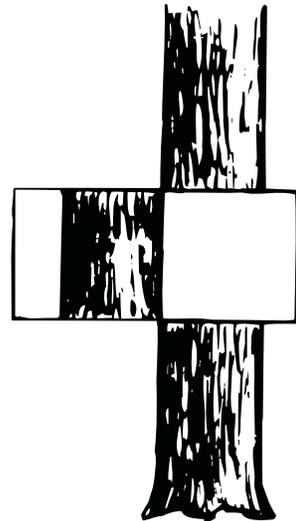
# THE WEDGE PRISM



**Don't tally**



**Tally**



**Borderline  
tally every other one**

*(Courtesy, Interstate Publishers, Inc.)*