



TREE TRAILS

1-3

★ SECONDARY ★

★ TREE MEASUREMENT ★

Tree measurement is fundamental to the practice of forestry. Foresters count trees and measure trees. With just a few basic measurements, we can assign values to trees and compare them to each other.

Goal and Objectives

Goal: Students will measure trees and explain how measurement is used to place value on trees and forests.

Objectives: Students will

1. Apply the forester's tree measurement process to measure a tree.
2. Determine the measurements and condition of their trail trees and enter on the Tree Trails website.
3. Construct the relationship between tree measurement and tree health and value.

Materials

General

- Tablet(s) or computer(s) with internet access
- Projector and screen
- GPS unit or phone/tablet with location application
- White board or chart paper and markers
- Tree Trails Portfolio, Student Learning Log/Journal

Handouts

- Tree Trails Data Sheet
- Tree Measurement Guidelines

Activity Materials

- Flexible tape measure
- Yard stick
- (Optional) Cameras or camera phones

Time and Internet Links

Instructional Time: 2-3 sessions, 45 minutes each

- Tree Trails
www.treetrails.org



Instructional Procedures

I. Engage/Excite

1. Conduct a discussion about measurement. Ask students to name various professions that must use exact and precise measurement to assure their work is exercised without disastrous results. The list may include physicians, transportation engineers, construction workers, aircraft specialists, architects, petrochemical employees, etc. Expand the discussion to include different measurement standards used by different professions. Lead students to generalize that each profession depends on its particular type of measurement design.

Teacher Tip: Share with students how people once used their bodies (hand and/or arm spans, body height) to measure. Students may have heard that horses may be measured by hand span.

2. (Optional) Students may have fun generating an illustration, a paragraph, a riddle, etc. about a person who used the wrong measurement for a project. Let students share.
3. Generate a conversation about what type of measurement they think professional foresters use and how they use these instruments for measuring trees. List what they *Know* on a chart/whiteboard or have them add to their Learning Logs.

II. Explore

1. Inform students that, like other professions, foresters measure trees using a standard process and they will use this same standard to measure their trail trees.
2. Provide each student with the Tree Measurement Guidelines handout. Project the guidelines and have them watch or follow along on their tablets/laptops.

Teacher Tip: Foresters round down in tree measurements instead of rounding up, because the tree has not yet reached the higher measurement. They keep to whole numbers because of the relative accuracy of repeatability – roughed up bark and even relative humidity can make small differences, as can having the tape measure less than perfectly perpendicular to the centerline of the trunk.

Teacher Tip: It may be helpful to practice measuring a tree, circumference, diameter, height and crown spread, before presenting the guidelines to students.

3. Have students to read the guidelines and watch the demonstration videos on the Tree Trails website. Then follow with a question and answer session.

Teacher Tip: Students may demonstrate circumference using a cylindrical object. Using the same object, demonstrate diameter and describe how the two measurements are related by the constant, pi.



III. Explain

1. Ask why foresters measure trees. List the responses. Coach students to provide as many reasons as possible. Ask students to check their responses to determine if their reasons included: a. tree size as it contributes to its value and benefits; b. continuous measurement over time allows foresters to monitor a tree's rate of growth; c. a tree's condition is an indicator of the tree's response to its environment; d. measurement is used to plan harvesting, make management decisions and calculate timber yield. Have students Include all the reasons why measurement is important in their Learning Logs.

IV. Extend/Elaborate

1. Have each student retrieve their Tree Trails Data Sheet from their Portfolio and locate the Circumference, Diameter, Crown Spread, Height, and Condition Rating columns. Move the students into their Tree Trail groups. Provide each group with measurements tools. Have students bring their Tree Trail Data Sheet and the Measurement Guidelines with them when they go outside to measure their trees.
2. Ask each group to measure their trail trees as specified in the guidelines and record the information in the appropriate column on their Tree Trail Data Sheet. Have students return to the classroom.
3. Provide the pairs with a laptop/tablet and have them follow along as each step is demonstrated on the projector. Once these steps are completed, closing the data window saves information for the tree.
4. Ask students to notice the left hand side of the screen which lists the annual benefits of the selected trail or tree, either the entire trail or individual trees. This is automatically calculated when the data is entered. Conduct a discussion about the value of their trees. Students may list responses in their Learning Logs.

Teacher Tip: Module 3 further investigates the annual benefits of trees.

V. Evaluate

1. Have students use another method to measure height of a tree. Then compare this method to the first method.

Teacher Tip: Find links to other methods on the Tree Trails Lesson page.

2. Conduct a discussion about what they found, *Learned* and enjoyed.



VI. Extra Mileage/Attention

Extra Mileage: Have students work in pairs to write a mathematical word problem related to two or three dimensions of their trail tree and give to another pair to solve. Ask student pairs to analyze how they answered the problem, what helped and what deterred them from getting the answer.

Extra Attention: Appoint peer students to accompany students while they take measurements of their trees with their hands and/or arms and let these students present their new measurements in terms of hand span and arm span measurements.

Tree Trails curriculum was developed by Texas A&M Forest Service in cooperation with Texas Urban Forestry Council and was supported by grants from the USDA Forest Service and Keep America Beautiful.



Tree Measurement Guidelines

Getting Started

Rounding Recorded Values

All recorded measurements should be rounded down to the nearest whole number. Rounding a number for tree measurement means to remove the decimal places or fractions of a number and only record the whole number.

Examples: 48.9 feet is recorded as 48 feet, 132 $\frac{3}{4}$ inches is recorded as 132 inches



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Is It One Tree or Two (or More?)

Determine whether a tree has a single trunk or whether it represents two or more stems growing very close to one another. Trunks that have clear separation or include bark at or near the ground line should be considered separate trees; trunks of different species should also be considered separate trees, no matter how close together. When following the circumference rules below, if the point below the lowest fork places the measurement at the ground line, the stems should be considered separate.

Circumference

General Rule

Diameter at Breast Height (DBH) point is 4.5 feet up from the ground. (Example A)

First, find the DBH point. Then, find the smallest trunk circumference between the DBH point and the ground.

Measure and record, in inches, that smallest trunk circumference. If the tree forks, measure below the lowest fork. (Example B)

Also record the height above the ground, in inches, where the measurement was taken for your records.

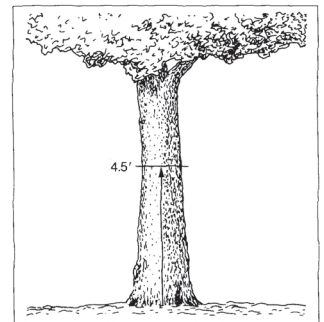
Considerations for Determining DBH Point

Tree on Slope: Measure up 4.5 feet along the axis of the trunk on high and low sides; DBH point is midway between these two planes. (Example C)

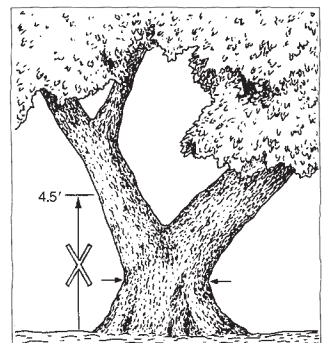
Leaning Tree: Measure 4.5 feet along both the top and undersides of the trunk; DBH point is midway between these two planes. (Example D)

Low Branches: When determining where on the trunk to measure circumference, ignore portions that do not form part of the tree's crown, such as dead branches or forks, and epicormic sprouts, which are ones that grow from the trunk or branches.

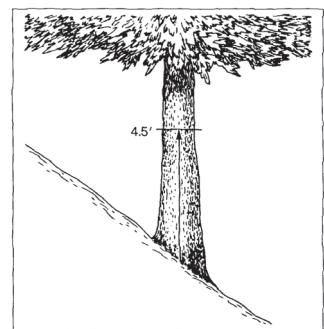
Obstruction at DBH: If there is a bump, burl, branch, or other obstruction at the DBH point, measure the circumference above and below the obstruction and record the smaller value. A buttress that forms between the trunk and root system as a natural feature of the species (e.g. baldcypress, water tupelo) should not be considered an obstruction.



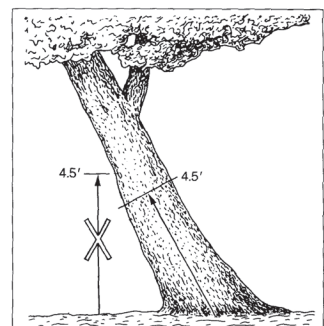
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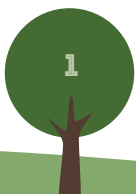
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C



D



Tree Measurement Guidelines

Height

General Rule

Find the vertical distance between the ground line and the tallest part of the live crown. Record the measurement in feet. Also record the method used to determine this value.

Choices include: direct measurement [telescoping pole, climbing], clinometer, hypsometer, relascope, laser rangefinder [w/ or w/o internal clinometer], stick method, pencil method, comparison, or wild guess.

Pencil Method to Measure Height

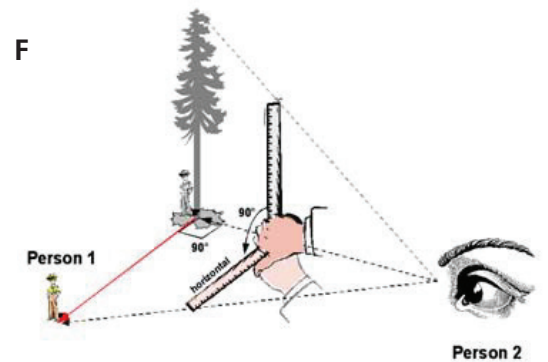
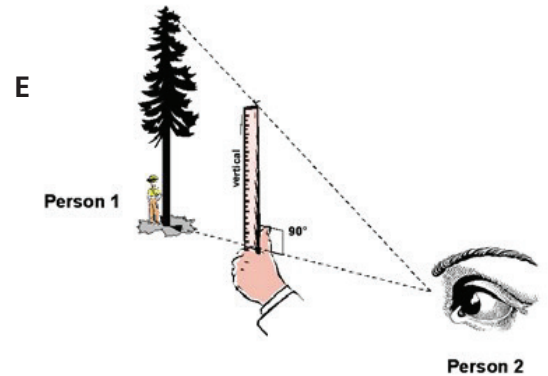
One person stands near the trunk of the tree and the second person stands at a distance where both Person 1 and the top of the tree are visible.

Person 2 holds a ruler (or pencil) upright at arm's length and (carefully!) walks forward or backward until the entire length of their ruler covers the tree from base to top. (Example E)

Still holding the ruler at arm's length, Person 2 turns their wrist right or left so that the ruler is now horizontal, with one end even with the base of the tree.

Now Person 2 instructs Person 1 to move away from the trunk in the direction the ruler is pointed (at a 90 degree angle) until they are standing where the end of the ruler points. (Example F)

Person 1 is now standing roughly the same distance from the trunk as the tree is tall. Use a tape measure to record this distance, in feet.



Crown Spread

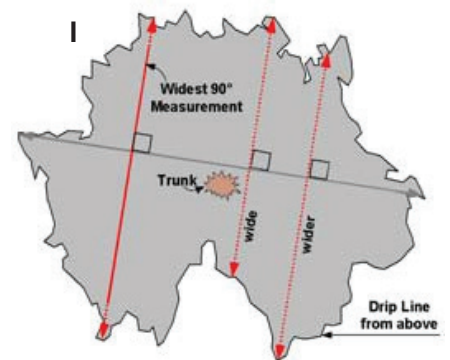
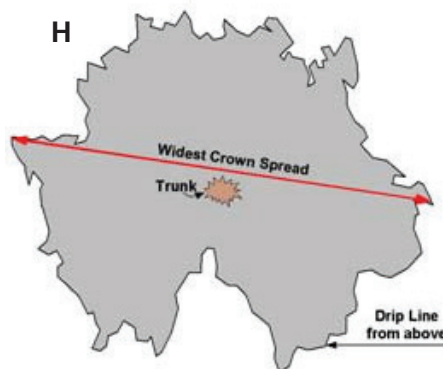
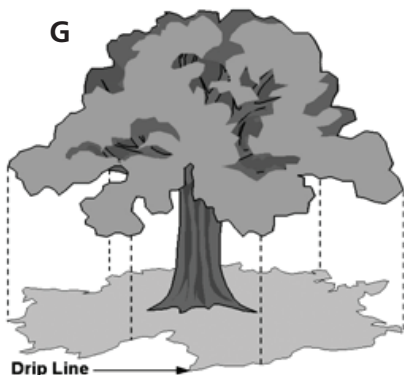
General Rule

Along the drip line of the tree, take two measurements of the crown width, in feet, at right angles, or perpendicular, to one another. Then, average the two perpendicular crown spread measurements.

Drip Line (Example G): the outline on the ground of the outermost leaves of the crown. Include only live portions of the crown.

Measurement 1 (Example H): find the widest crown spread, which is the greatest distance between any two points along the drip line and measure the length, in feet.

Measurement 2 (Example I): turn the measurement line 90 degrees, or perpendicular, from Measurement 1's line, find the widest crown spread along this plane and measure the length, in feet.



Illustrations by
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