



NEW YORK CITY SOIL AND WATER CONSERVATION DISTRICT

NYC Envirothon Forestry Hands-on Activities

DBH – Diameter at Breast Height

- Measurement taken at breast height (4.5 feet)
- Avoid tree swellings like branch whorls
- If forked and fork begins below 4.5 feet, measure each fork individually
- If forked and fork begins above 4.5 feet, measure the tree as a whole at 4.5 feet

Measuring DBH

1. D-tape (Specially calibrated tape measure)

- Two-sided: one for DBH (“*inches of diameter*”), the other for regular inch measurements
- Stand next to the trunk
- Measure 4.5 feet from the ground (be sure the tape is level)
- Wrap the DBH (be sure to use the proper side) around the trunk at 4.5 feet
- Record the inches

2. Regular measuring tape

- Measure the circumference at 4.5 feet (be sure the tape is level)
- Divide the circumference by π
- Record the result in inches

3. Biltmore stick (Specially calibrated measuring stick)

- Find the side of the stick with “*Tree Scale Stick*” or “*Tree Diameter*”
- Hold the stick 25” from your eye (about an arm’s length) and 4.5 feet from the ground
- Place the left edge of the stick on the left edge of the tree
- Without moving your head (turn your eyes only), read the number at the top of the stick (or off “*Diameter of Tree (inches)*” scale) that corresponds with the right edge of the tree

Height of the Tree

- “Merchantable” height (commercially valuable) of a tree = the length of a tree that is *usable* timber
- From stump height* to a cutoff point at the top
- Cutoff point variable depending on species and number of limbs

*Stump height = the distance between ground level and the top of a stump. Good logging practice dictates stumps be as low as possible (preferably less than 12 inches) to reduce waste of good wood, as well as to minimize visual impact on the logging site.

Measuring the Height

1. Biltmore stick

- Find the side of the stick with “*Merrit Hypsometer*”
- Stand 66 feet from the tree
- Hold the stick 25” away from your eye (at an arm’s length) parallel to the tree trunk
- Align the bottom of the stick corresponding to the point where the tree would be cut (stump height)
- Read the stick upward to where the tree would be cut to yield usable timber
- Record the number to the nearest half log (if there are two separate scales on the hypsometer, be sure to read off “*Qty 16.ft. logs @ 1 Chain (66ft) distance*”)
- Biltmore sticks measure the height of the tree in terms of the number of 16-foot logs
- To convert the height to feet, multiple number by 16



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2. Clinometer

- Stand a convenient distance from the tree, allowing a view of the tree's top and the bottom
- Distance does not have to be 66 feet
- Be sure to stand on level ground as the tree
- Record your horizontal distance from the base of the tree
- Look through the viewer and find the red horizontal line (if you don't see anything, turn it upside down)
- Keeping BOTH eyes open, align the red line with the top of the tree (this may take a few seconds for your eyes to adjust)
- Read the scale on the RIGHT (% scale) and record the number. This is your A (+) reading in %
- Align the red line with the bottom of the tree
- Read the scale again. This is your B (-) reading in %
- Subtract the B from the A
- Multiply the % from above by the distance from the tree
- To get the number of 16-ft logs, divide the height in feet by 16

Example:

A (+) = 63%

B (-) = - 7%

Distance from tree = 66'

$A - B = 63 - (-7) = 70\%$

$70\% \times 66' = 46.2'$

Tree volume

Board feet = unit of tree volume used to estimate available lumber from a particular tree

One board foot = a slab of wood, one foot wide x one foot long x one inch thick

Calculating volume in terms of board feet

- Measure the height of the tree in feet
- Measure the diameter of the tree in diameter
- Calculate the radius of the tree from the diameter (radius = diameter / 2)
- Convert the radius into feet (radius in inches / 12 = radius in feet)
- Find the area of the tree cross-section at breast height (4.5 ft) assuming the tree is a perfect circle (Area = radius x π)
- Calculate the volume of the tree (Area in feet x height in feet)
- Divide the volume by 4 to account for the taper of the tree
- Multiple the adjusted volume by 12 (there are 12 board feet of lumber for every on cubic foot)
- The final number is the number of board feet of lumber

Example:

Height of the tree = 40 feet

Diameter of the tree = 24 inches

$$\text{Radius}(\text{feet}) = \frac{24\text{inches}}{(2 \times 12)} = 1 \text{ ft}$$

Area of the tree cross-section = $1^2 \times 3.14 = 3.14 \text{ ft}^2$

Volume in $\text{ft}^3 = 3.14 \times 40 = 125.6 \text{ ft}^3$

Volume adjustment = $125.6 / 4 = 31.4 \text{ ft}^3$

Volume in board feet = $31.4 \times 12 = 378.6 \text{ board feet}$



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Forestry Worksheet

Measuring the Diameter of a tree			
DBH using d-tape (inches)			
DBH using Biltmore stick (inches)			
Circumference (inches)			
Calculated diameter (inches)			
Measuring the Height of a tree			
Height using Biltmore in 16-ft logs			
Calculated height in feet			
Using a clinometer			
Clinometer reading A (+)		Clinometer reading B (-)	
A – B in %			
Calculated height in feet			
Tree Volume Calculation			
Height of the tree in feet			
Diameter of the tree in feet		Radius of the tree in feet	
Cross Section Area @ 4.5'			
Volume with adjustment (Area x Height x ¼)			
Volume in Board Feet (multiply by 12)			