

Using Common Forest Measurement Tools: A North Dakota Forest Service Field Guide

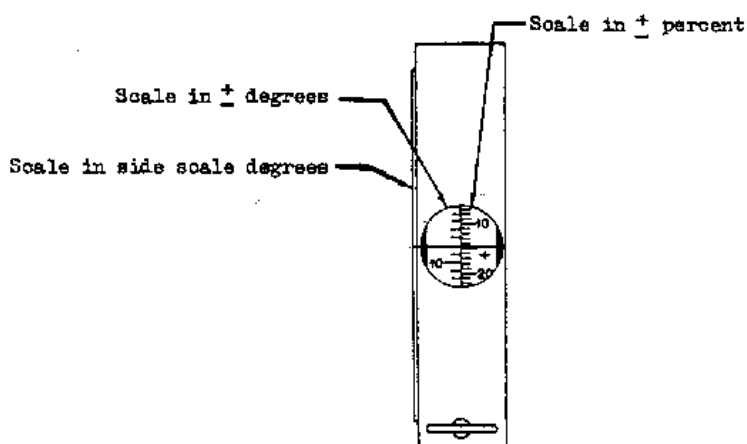
Measuring Tree Height

With a Suunto (Degree and Percent) clinometer:

1. Pace or measure out 50ft or 100ft from the base of the tree. Try 50ft first. If you can see the top of the tree at 50ft feet away then proceed to Step 2. If you cannot easily see the top of the tree from 50ft, then walk an additional 50ft away in the same direction and then proceed to step 2. Walk along the contour when walking away from the tree so that you are level with the base of the tree.
2. Face the tree and hold the clinometer with the red line on the side glass window pointing towards the ground.



Source: Suunto. www.suunto.com



Source: FAO. www.fao.org

3. Look through the level clinometer until the scale reads "0" on both sides.
4. With both eyes open, look into the clinometer and point it at the top of the tree. Record the number from the right-hand scale (percent scale) where the horizontal line is level with the top of the tree.
5. With both eyes open, tilt the clinometer down to the base of the tree. Record the number from the right-hand scale (percent scale) where the horizontal line is level with the base of the tree. You will read a negative number if the tree is on level ground or down slope. You will read a positive number if the tree is up slope.
6. Subtract the second (taken at tree base) number from the first number (taken at tree top). If the second number is negative, then the negative signs cancel and the two numbers are added together.
7. If you took the measurements 50ft from the base of the tree then you divide the number from step 6 by 2. If you took the measurements at 100ft then the number from step 6 is the height of the tree.

EXAMPLE:

Measurements taken 50 feet from base of tree

Top reading: 54

Bottom Reading: -11

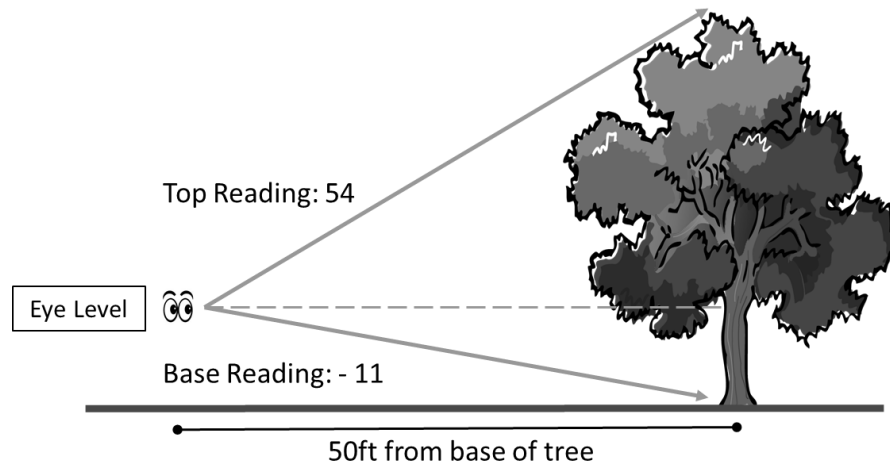
$$54 - (-11) = 54 + 11 = 65$$

Divide by 2 because measurements were taken from 50 feet away.

$$65/2 = 32.5$$

Tree is **32.5 feet** high.

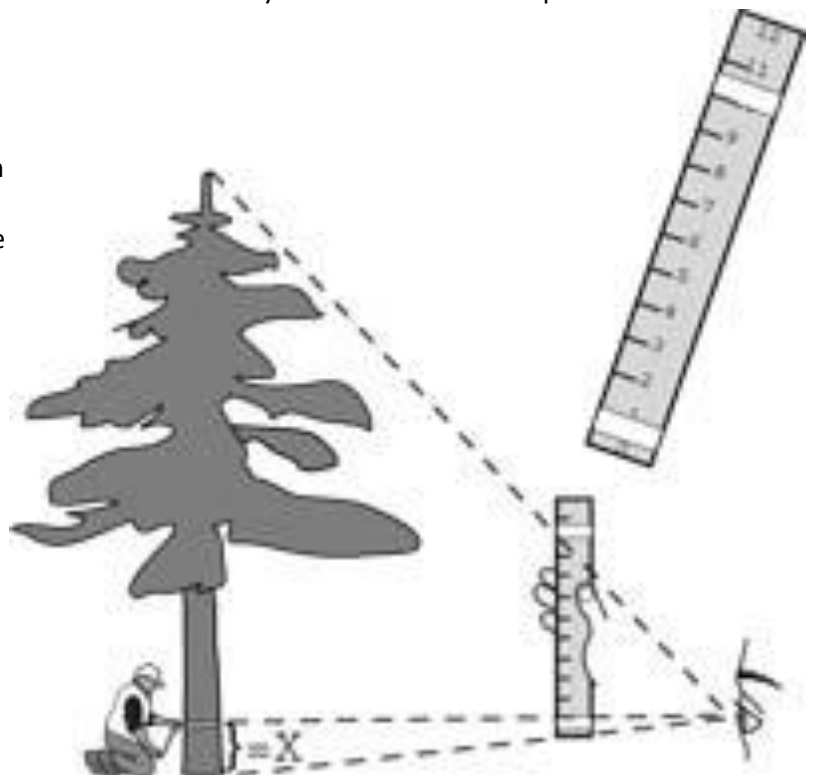
Clinometer Tree Height Example:



With a ruler:

1. On a 12-inch ruler, mark the 1-inch and 10-inch lines with tape.
2. Work in pairs to measure height.
3. Person A stands at the base of the tree.
4. Person B, while holding the ruler up in front of their eyes at arm length, moves back until they can see the whole tree from top to bottom between the 0-inch and the 10-inch mark on the ruler.
5. Person B then moves the ruler until the base of the tree is exactly at 0-inches and the top of the tree is sighted exactly at 10-inches.
6. Person B sights out from the ruler's 1-inch mark to a point on the trunk above the base.
7. Person A marks this spot on the trunk with tape.
8. Measure the distance from the base of the tree to the 1-inch mark (X) on the tree.
9. Multiply by 10 to get an approximate height of the tree.

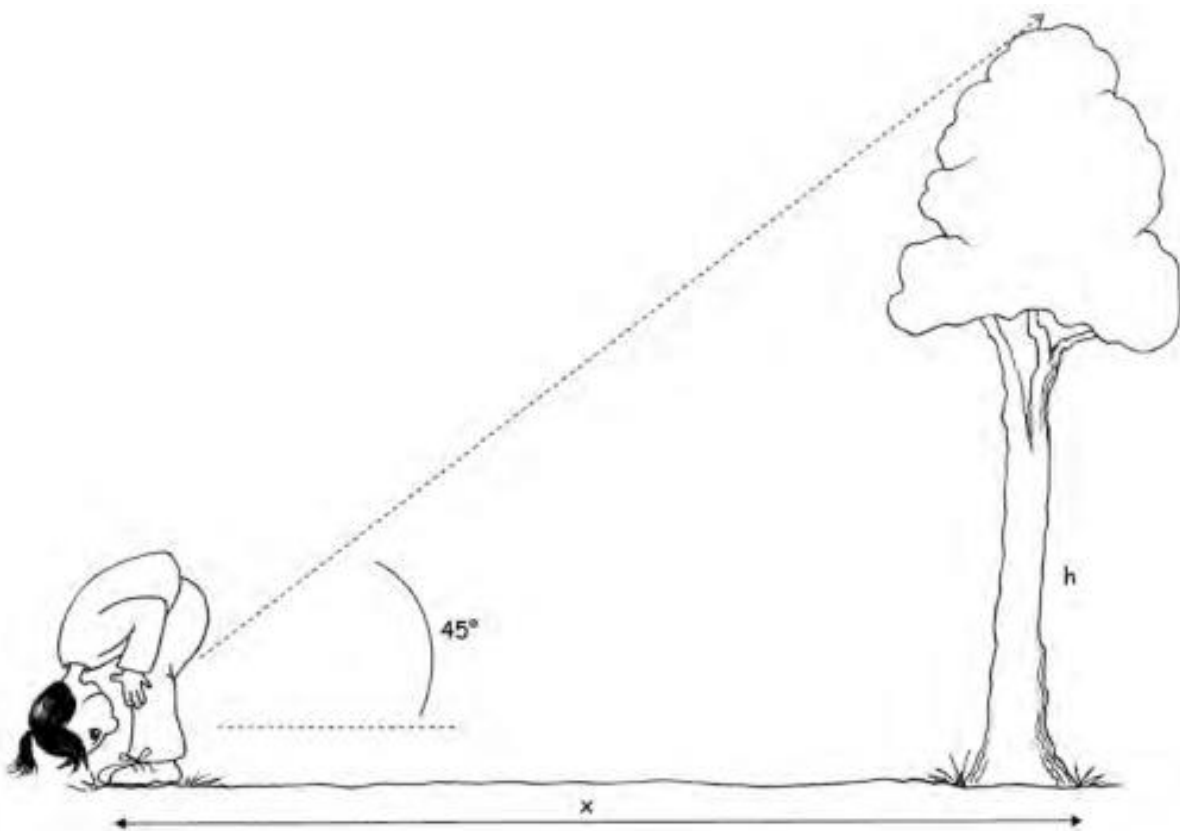
Source: Minnesota DNR
www.dnr.state.mn.us



Without tools (Native American Method):

1. The length of the measurer's pace must be known. If unknown this can be estimated by walking out 10 paces and measuring this distance. Dividing by 10 gives the average pace length. This should be done several times to make sure the pace length is consistent.
2. Stand with your back against the tree to be measured.
3. Walk slowly away from the tree, stopping at intervals to bend over and sight the tree by looking through your legs while holding your ankles.
4. When the top of the tree is just visible between your legs, turn around, and walk back to the tree while counting the number of paces back to the tree. The distance paced out is roughly equal to the height of the tree.

Note: Results from this method will vary due to differences in paces and angles of view for sighting the tree. This method should be done several times, with multiple people to compare results.



Source: Science and Plants for Schools UK
www.saps.org.uk/

Measuring Tree Diameter

With a Diameter Tape (D-tape) or Combination Loggers' Tape:

1. Diameter is measured at what is called Diameter at Breast Height (DBH). This is 4.5 feet (1.37 meters) up the trunk from the base of the tree. If the tree you are measuring is on a slope, measurements should be taken on the uphill side of the tree.
2. Diameter tapes and combination logging tapes are usually two-sided. One side has length in inches and the other side has the diameter equivalents of circumference. Measurements are usually given in inches and tenths of inches.
3. Wrap the tape horizontally around the tree at DBH, while standing on the uphill side of the tree.
4. Pull the tape all the way around the tree and read the diameter off the diameter equivalents of circumference side of the tape. Reading the measurement off the other side of the tape will give you the circumference of the tree, not its diameter.



Source: www.forestrysuppliers.com



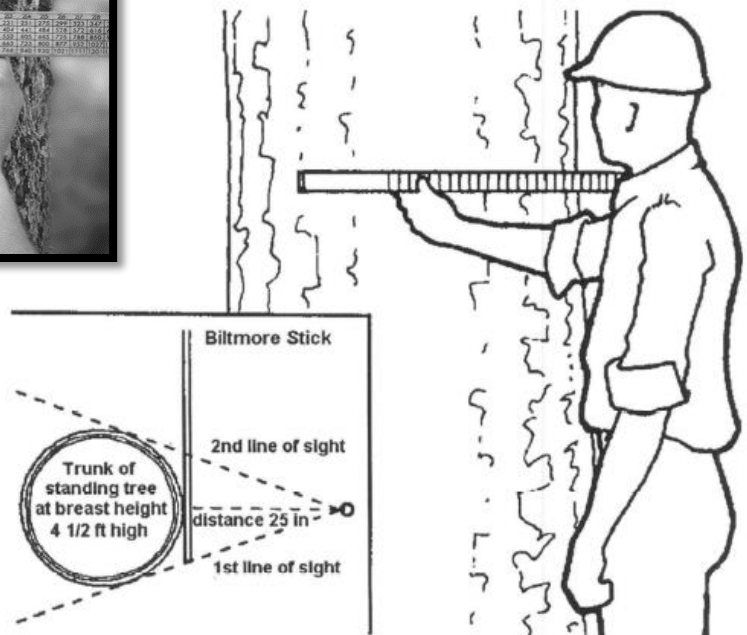
Source: Michigan State University Extension
www.msue.anr.msu.edu

With a Biltmore Stick:

1. Diameter is measured at what is called Diameter at Breast Height (DBH). This is 4.5 feet (1.37 meters) up the trunk from the base of the tree. If the tree you are measuring is on a slope, measurements should be taken on the uphill side of the tree.
2. Hold the Biltmore stick against the tree at DBH, 25in (62.5cm) from your eye. Make sure the side of the stick that reads diameter is facing you. Use the "Tree Scale Stick" side and not the "Log Scale Stick" side.
3. Sight past the zero end of the stick and the edge of the tree.
4. Without moving your head, move your line of sight to the other side of the tree and read the diameter mark closest to where your line of sight passes the edge of the tree.
5. Tree trunks usually are not round. Measure the widest and narrowest part of the trunk, at DBH, and average the two measurements.



Source: www.pixgood.com



Source: Understanding Forest Ecosystems. Cornell University Extension

Measuring Tree Age

With an Increment Borer:

1. An increment borer is a hand-powered drill with a hollow center used to extract a wood core from a tree. Make sure the increment borer is correctly assembled.
2. Choose a section of the tree to be cored into. The area to be cored should be in the center of the trunk, relatively smooth and should not show any external signs of diseases or pests.
3. Place the tip of the augur against the bark of the tree, pointed towards the center of the tree trunk.
4. Turn (clockwise) the sharp augur tip of the borer into the tree bark, while pressing slightly into the tree. The borer will be difficult to press into the wood until the threaded tip is through the bark and into the tree's sapwood.
5. Continue turning the borer handle until you think you have reached the center of the tree or almost the entire length of the borer is in the tree.
6. Slide the extraction tray all the way into the borer. The U-shaped tray should be pointed with the open end upwards so that it can catch the wood core.
7. Turn the borer handle one full turn counter-clockwise. This will break the wood core off into the tray.
8. Slowly pull the tray out of the middle of the borer and carefully set aside.
9. Remove the borer from the tree by turning the handle counter-clockwise.
10. If the wood core passes through the center of the tree then the age can be determined by counting all of the annual rings on the core. If the core did not pass through the center of the tree then the age can be estimated by multiplying the average number of rings per inch by the radius of the tree trunk.



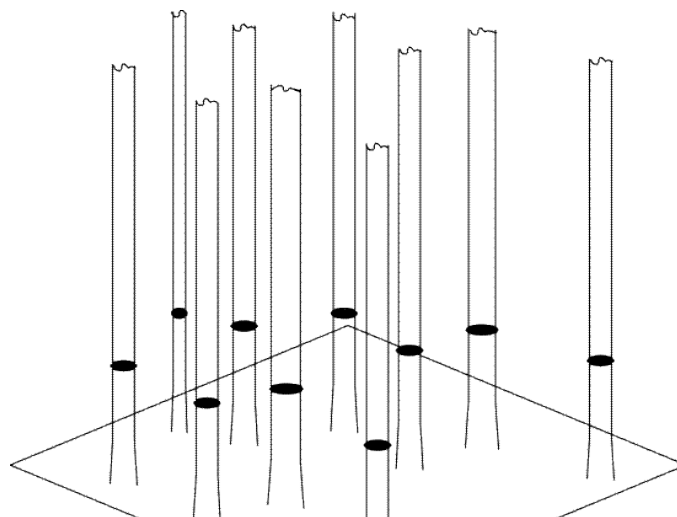
Source: University of Arizona
www.uanews.org

Source: [The Woodland Workbook](#).
Oregon State University Extension

Measuring Basal Area

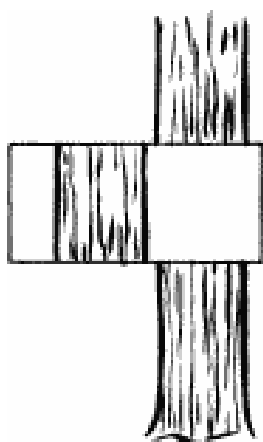
With a Wedge Prism:

1. Basal Area (BA) is the cross-sectional area of a tree or a group of trees at Diameter at Breast Height (DBH). DBH is 4.5 feet up the tree from the base of the trunk. The total basal area of a group of trees can be estimated with a wedge prism.
2. Mark the center of the group of trees you want to estimate the Basal Area of and stand with the prism over this point.
3. Hold the prism at arms length, parallel to the ground, and look through the prism
4. While keeping the prism over the center mark, rotate around the center mark to look through the prism at every visible tree.
5. Keep a tally count of the number of trees that are “in” or “out.” **“In”** trees are large enough, or close enough to the prism, that the image in the prism is not distorted enough for the prism image to be completely out of line with the actual tree. **“Out”** tree are so small, or far away from the prism, that the image is greatly distorted and the prism image does not line up with any part of the actual tree. **“Borderline”** trees have the edge of the prism image in line with the opposite side of the actual tree. Every other borderline tree should be tallied.
6. Count the final tally once all visible tree have been looked at through the prism and determined to be **In**, **Out**, or **Borderline**.
7. Multiply the tally by the Basal Area Factor (BAF) indicated on the prism to estimate the Basal Area for the group of trees you are in. A BAF of 10 is commonly used in North Dakota. For example, if you tallied 9 trees for all visible trees then the Basal Area would be 90ft²/acre.

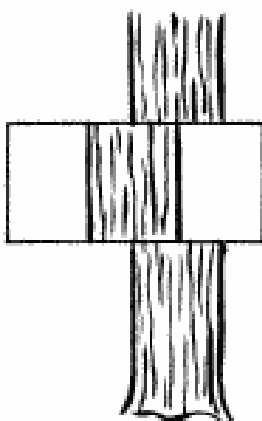


Basal Area (BA) of a group of trees

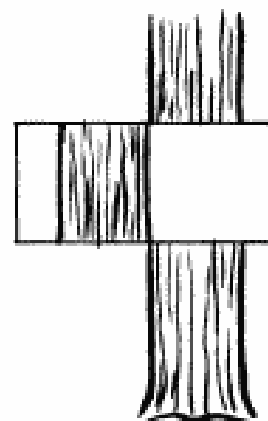
Source: University of Missouri - School of Natural Resources
www.oak.snr.missouri.edu



Don't Tally



Tally



**Borderline
Tally Every Other One**

Source: Georgia's Forest Landowner Manual. University of Georgia Extension