Forestry Field Skills

Forestry Tools and Measurements

Measuring a Tree

What types of measurements do foresters take and why?

- Height
- Diameter
- Volume
- Merchantable volume (how much usable wood can you harvest from a tree)
- Age

Pacing

In forestry, 1 chain = 66 ft

In order to measure out distance, you need to know your pace:

1. Measure out a know distance like 100 feet or one chain (66 ft) on flat ground
2. Walk the distance multiple times with your typical stride, counting your paces (2 steps = one pace), and average your counts
3. To find your pace length in feet, divide the total distance by your average number of paces

Example Video:
https://www.youtube.com/watch?v=tbtPD1UpDIM

D-tape - Measuring Tree Diameter

Example Video:
https://www.youtube.com/watch?v=6Qcv9Dr73VQ

- Tape is wrapped around the trunk of the tree to measure circumference
- Tape is graduated to reflect a conversion from circumference to diameter

To take Diameter at Breast Height (DBH):

1. Wrap tape around tree at 4.5 feet from ground on uphill side of the tree (for measurement consistency)
2. Make sure tape is wrapped horizontally and flush with tree bark
3. Read the measurement where the tape overlaps with the 0in mark

Scale Stick/Biltmore Stick - Measuring Tree Diameter

Example Video:
https://www.youtube.com/watch?v=MdrwXysydHc

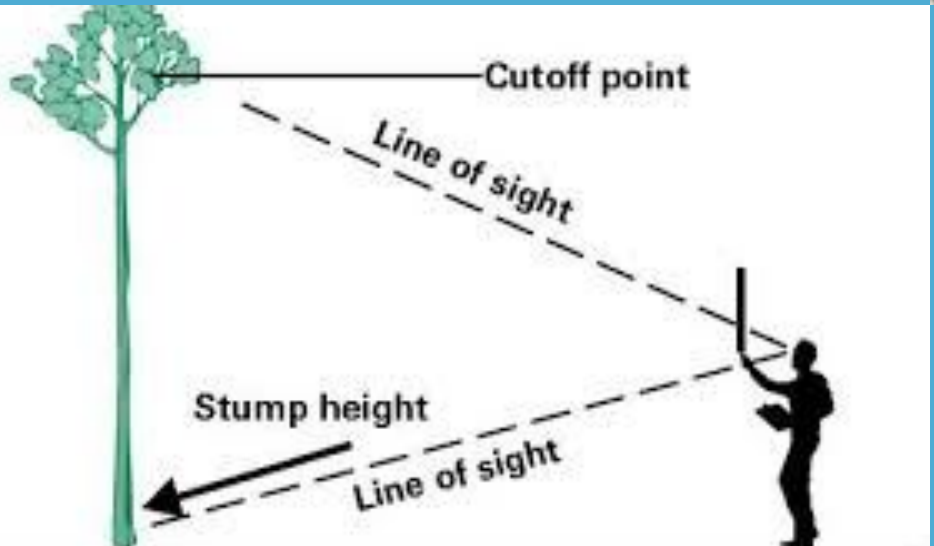
To Measure Diameter at Breast Height (DBH):

1. Hold stick 4.5 ft from the ground and 25 inches from your eye, with the back of the stick against the tree
2. Aline the stick so that the left '0' line is in line of sight with the left side of the tree
3. Without moving your head, read the measurement that aligns with the right side of the trunk

Scale Stick/Biltmore Stick - Measuring Merchantable Tree Height

- Merchantable tree height: the usable portion of a tree's trunk once it is cut down
    - It is measured from the stump (6-12 inches above the ground) to the point on the trunk where it becomes too small to be useful (usually 6 inches in diameter)

Example Video: https://www.youtube.com/watch?v=N4WvfA9lhbE



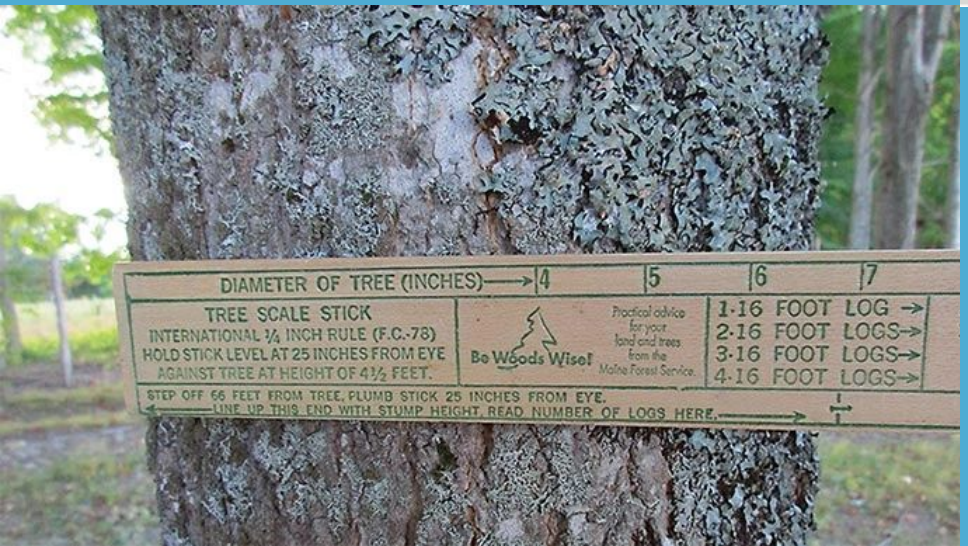
On the scale stick, height is measured in 16ft logs

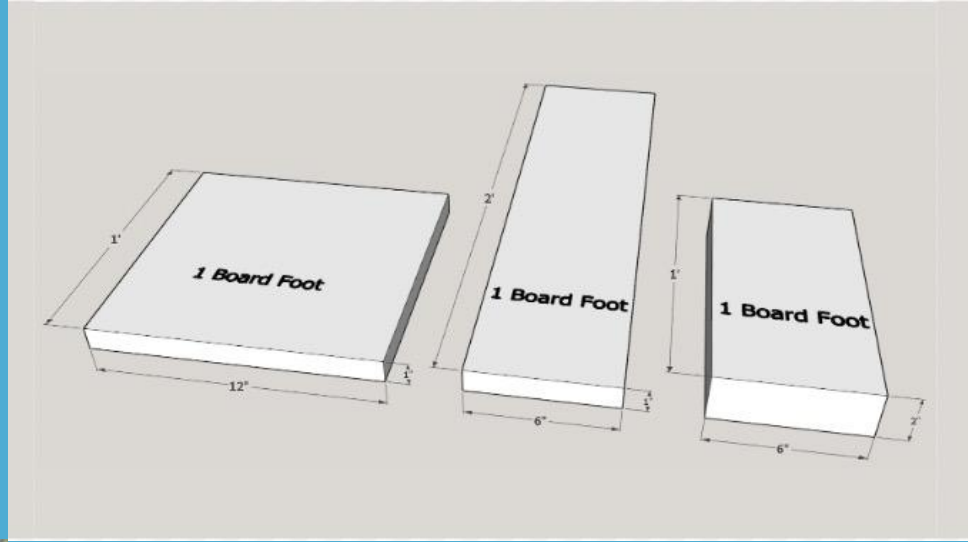
To Measure Tree Height:

1. Stand 66 ft from the tree
2. Hold stick vertical, 25 inches from your eye, with the height of tree side of the stick facing you
3. Line up the base of stick 6-12 inches from the bottom of the tree
4. Without moving your head, read the height where your line of sight and the point at which the tree trunk is less than 6 inches in diameter

Scale Stick/Biltmore Stick - Measuring Volume

Example Video:
https://www.youtube.com/watch?v=F9Tn74xWAZA

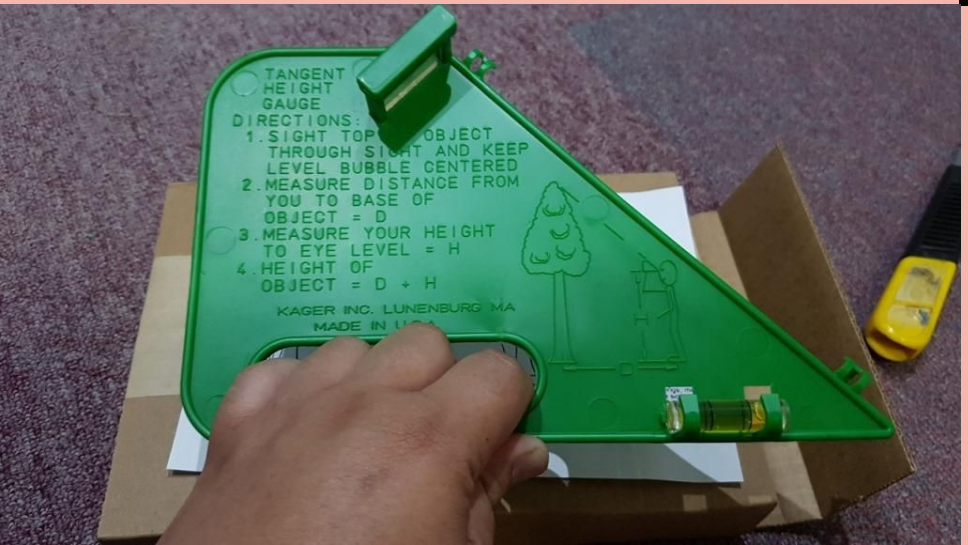




- Use the merchantable height and diameter measurements to find the board foot volume from the table on the side of the scale stick
- Board foot is a volume unit of measurement for lumber, it represents a piece of wood that is 1 inch thick, 12 inches wide, and 12 inches long

Tangent Gauge - Measuring Tree Height

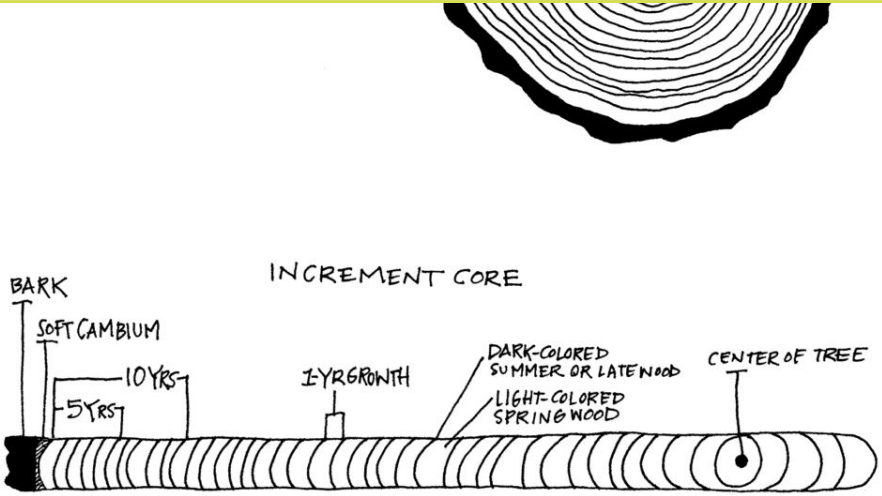
Example Video:
https://www.youtube.com/watch?v=sUNY1ga69XA



1. **Find a location to take height:** Find spot roughly one tree height away from the tree you are measuring with a clear view of the entire tree.
2. **Align the gauge and level:** Adjust your position until the top of the tree is aligned within the sight rings at the top of the gauge. While keeping it aligned, adjust your position or the gauge until the bubble in the level is centered.
3. **Measure the distance:** Measure the horizontal distance from your feet to the base of the tree.
4. **Add height:** Add the height of your eye level from the ground to your distance from the tree. This will give you the tree's height.

Increment Borer - Tree Age

Example Video: :https://www.youtube.com/watch?v=vuDlaxWN2lk

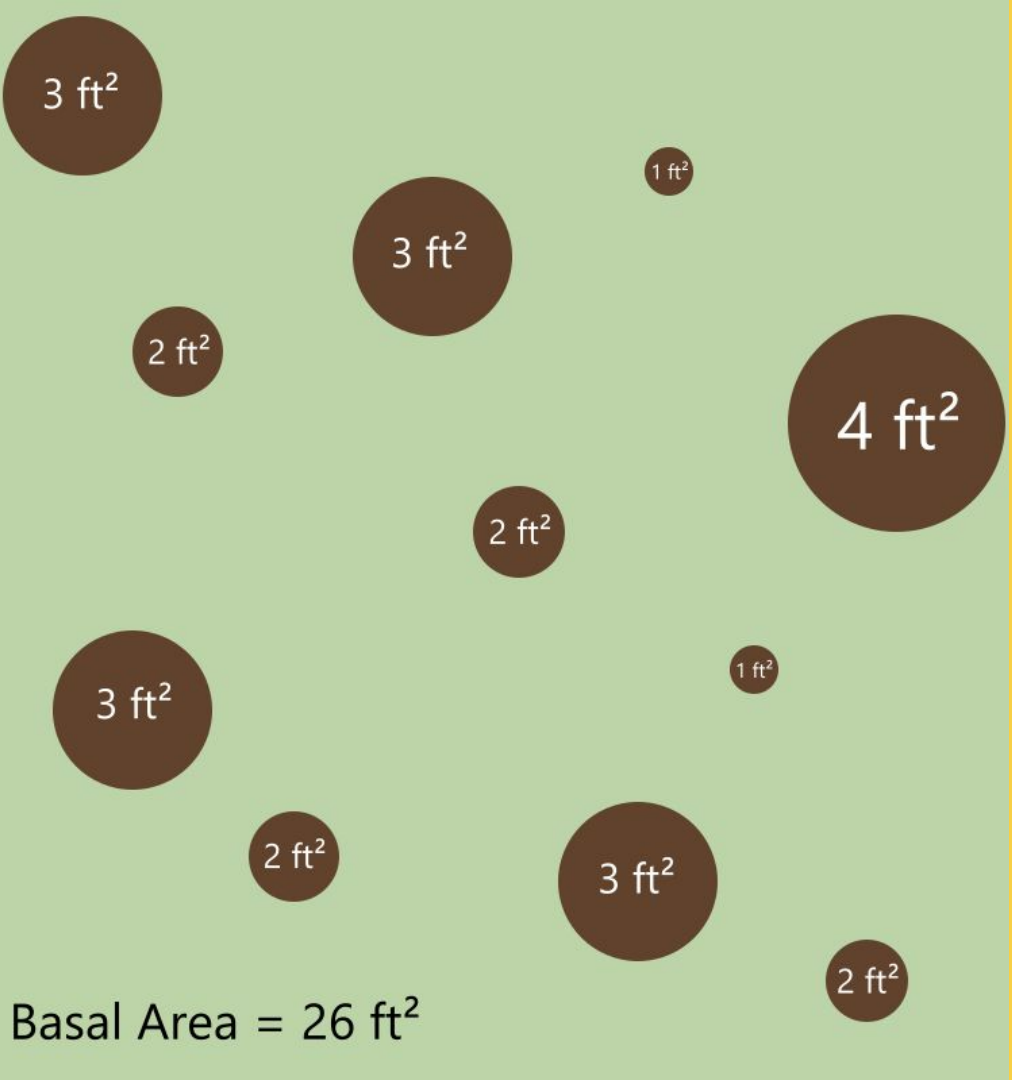


Counting tree age from tree core:

1. The space between each 'ring' of growth represents one year
2. Count rings from outermost ring to the tree center to determine approximate tree age

Measuring a Forest Stand

- Trees Per Acre (TPA): most basic measurement of stand density
- Basal Area: average amount of an area occupied by tree stems



Basal Area

- **A measurement used to describe a single tree or a stand of trees:** the cross sectional area of tree trunk(s) measured 4.5 feet above the ground
- Measurement describes forest density, timber stand volume, and growth

Formula for a single tree:

$BA = 0.005454 \times DBH^2$

BA: Basal Area in Square Feet

DBH: Diameter at breast height (4.5 ft from the ground) in inches

0.005454 = "forester's constant" which accounts for pi, converting inches to feet, and the circular area calculation

For Multiple Trees:

Add basal area of individual trees together

Example Video:
https://study.com/academy/lesson/video/basal-area-definition-formula.html

Basal Area Gauge - Measuring Stand Basal Area

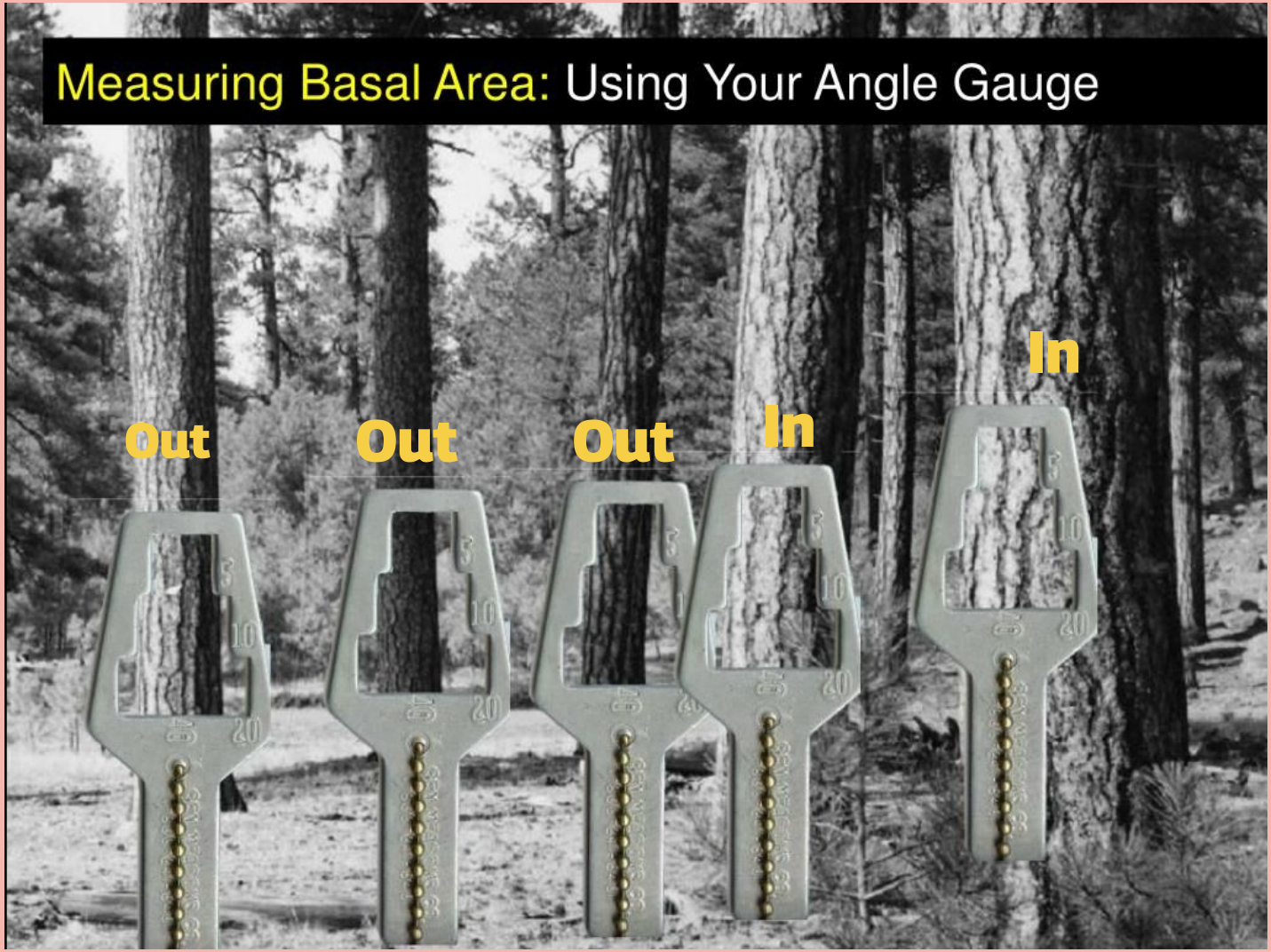
1. **Plot Center**: Pick a point on the ground (helpful to mark with a stick or flag) and stand above it so your eye is over plot center
2. **Hold the gauge**: Hold the gauge in one hand at set distance from your eye
3. **Scan for trees**: Rotate around plot center, looking at the center of each tree trunk at a consistent point (roughly 4.5ft from the ground) through the 10 baf area of the gauge
4. **Identify "in" and "out" trees**:
    a. **In**: Trunk fills entire viewing window, edges are not visible in window
    b. **Out**: Trunk is smaller than viewing window, can see space on one or both sides
    c. **Borderline**: Trunk barely fills window, edges are visible. Count every other borderline tree in plot as "in"
5. **Calculate Basal Area**: Add up "in" trees and multiply the sum by the prism's basal area factor (BAF) which is typically marked on the prism

Video Example: https://www.youtube.com/watch?v=qc0GBFkLyQk

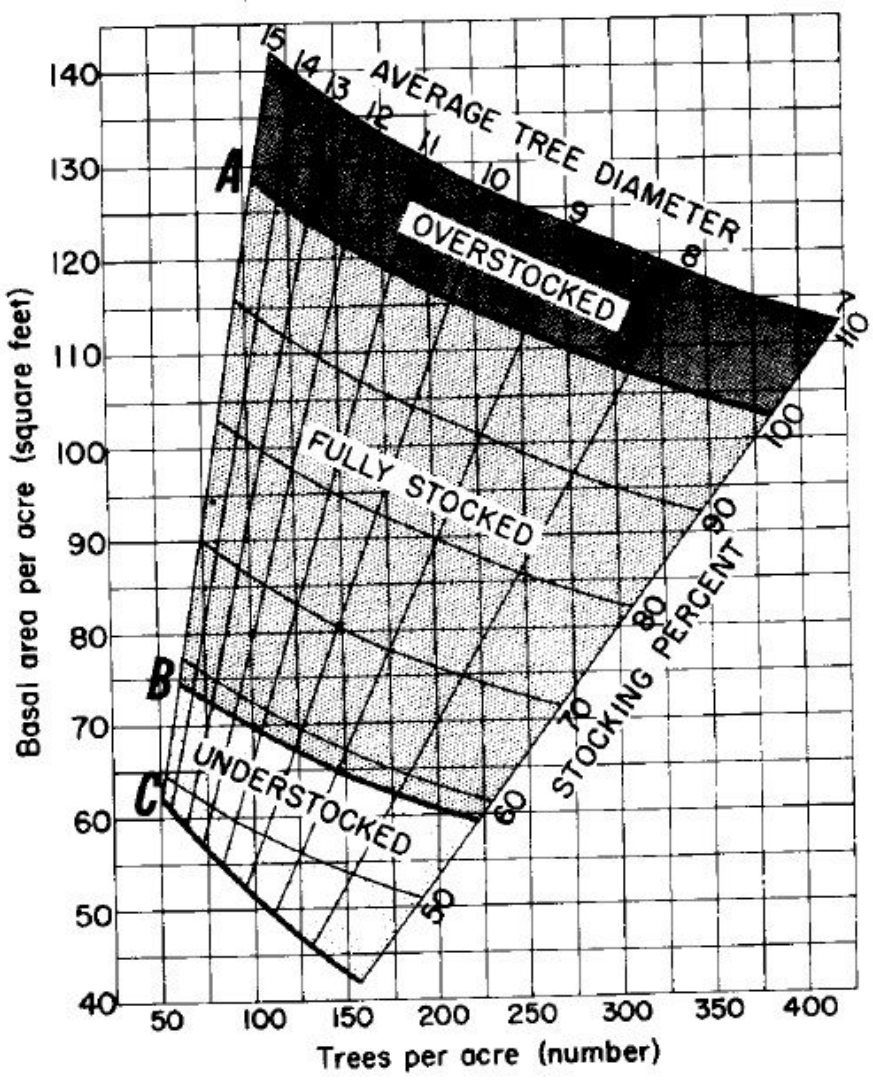
In

Borderline

Out



Looking at the 10 Basal Area opening, label these trees as ‘in’, ‘out’, or ‘borderline’.



Stocking

Measure of the relative density of trees in a forest stand compared to an optimum or desired level for that site

- **Understocked**: stand has plenty of growing space and needs more trees to reach full site potential.
- **Fully stocked**: stand is fully utilizing a site's potential without being overcrowded
- **Overstocked**: stand has too many trees, which can lead to competition and mortality. Thinning is often recommended.

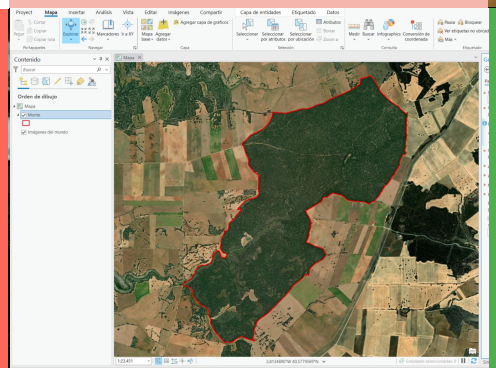
Other Forestry Tools

Prism:
Used to measure basal area

Clinometer:
Used to measure slope and tree height

GPS:
Used for navigating and documenting location

Tree Height Laser:
Used to measure tree height



GIS:
Computer-based tool used to create, manage, analyze, and map spatial data

www.VACD.org/Envirothon