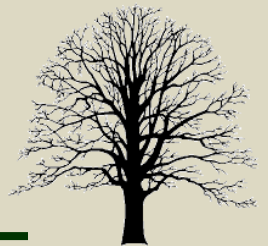




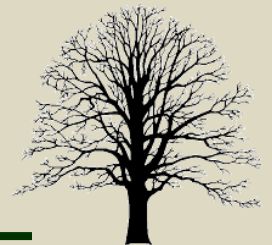
# Forestry Tools





**Foresters utilize a variety of specialized tools to accomplish the following tasks:**

- ❖ **Measure trees**
- ❖ **Conduct forest inventory**
- ❖ **Mark trees**
- ❖ **Measure logs**
- ❖ **Plant trees**
- ❖ **Navigation and orientation**
- ❖ **Lay-out timber sales**
- ❖ **Fight fires**



# Forest inventory and timber management

Foresters use a variety of tools to conduct a forest inventory.

Starting with aerial photos, topographic and soils maps, a forester will layout an invisible grid of sample plots over the parcel of forestland they are inventorying.

Using a compass or GPS unit, the forester will navigate to each plot on this invisible grid. Using a wedged prism or angle gauge, the forester will systematically measure the trees in the plot that are picked up for tally by the prism or angle gauge. This is called **variable plot cruising**.

The data collected from the inventory will help the forester determine the species composition of the forest, number of trees per acre, volume of sawtimber in board footage, amount of cordwood, pulp or biomass per acre, basal area, density or stocking levels of the forest and more.

This data will help the forester develop recommendations to manage the forest based on the landowner's objectives.



# Scale/Biltmore stick

**Used to measure tree diameter and merchantable height in 16 foot log increments.**

## **To measure tree diameter:**

Hold stick horizontal with diameter measurements on “Tree Scale Stick” side facing you.

Place stick against tree at breast height (4 ½ feet above ground on high side of tree). Distance from your eye to tree should be 25” (which you can determine using “Log Scale Stick” side of the scale stick).

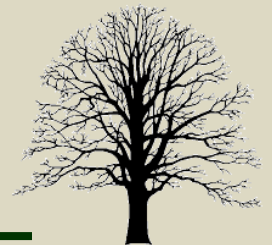
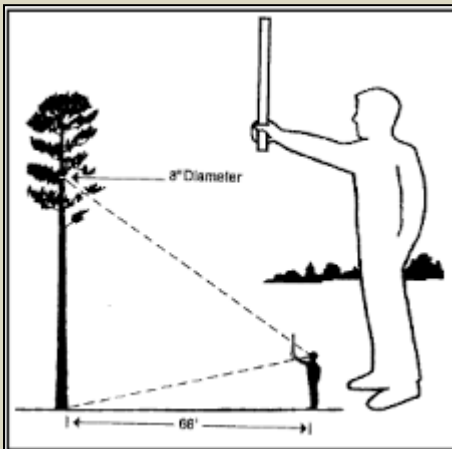
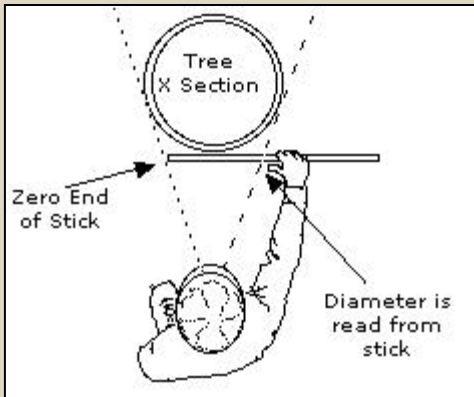
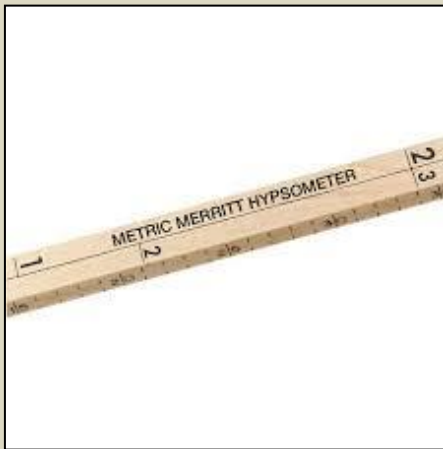
Place zero end of stick even with left edge of tree. Without moving your head read diameter figure from stick at right edge of tree.

## **To measure tree height:**

Stand 66 ft. away from tree. Hold stick vertical with log measurements facing you (hypsometer).

Hold stick 25” from your eye with bottom of stick at stump height.

Read # of logs from stick at the top of the merchantable part of the tree. (10” inside bark for hardwoods and 8” inside bark for conifers).







# Diameter tape

Used to measure tree diameter. Tape is calibrated to go around the circumference of the tree and give you diameter of tree.

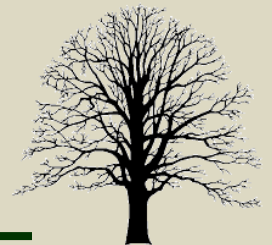


Tape is evenly wrapped around tree at 4 ½ feet above ground at high side of tree (a.k.a diameter at breast height or dbh). If tree is large diameter, the hook is used to grasp tree while you walk around the tree.

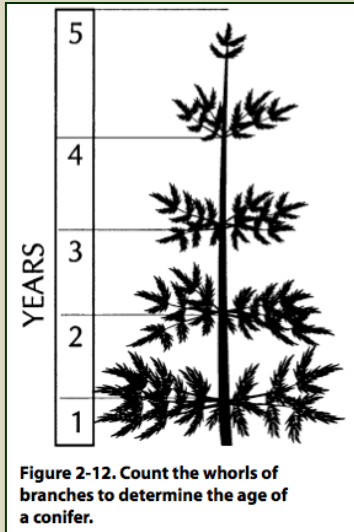


Diameter of tree is read where the zero mark intersects the tape.

**Example:** Tree at left is 25.3" in diameter.



# Note on Tree Diameter



On young conifer seedlings, you can sometimes determine the age of the tree by counting the number of whorls.

← The seedling on the left shows five years of growth.

***Beware!!!***

## The Largest Tree is Not Always the Oldest Tree!!!

Factors such as genetics, tree species, soil nutrients, water, sunlight, diseases, insects, deer browse, weather events, competition from surrounding trees and crown size can all influence how well a tree develops.

Tall dominant trees with full healthy crowns may be the same age or even younger than smaller suppressed trees.



# Calipers

Used to measure tree diameter.

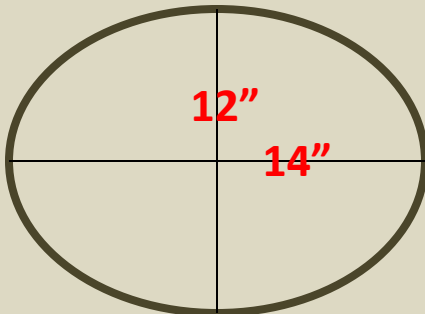
Hold calipers horizontally against the tree at breast height (4 ½ ft. above ground at high side of tree.

Close the caliper and read the diameter where the right caliber intersects the number on the scale. Always measure the tree in two directions, each measurement at 90° (perpendicular) to the other.

***Trees are not always perfectly round. !!***

If the tree is elliptical, measure the tree the widest way and then the narrowest way and average the difference of the two.

***Example:*** Tree at left is 12" the narrow way and 14" the wide way.  
Average tree diameter is 13"!!





# Clinometer

Used to measure tree height and the slope or gradient of an incline.

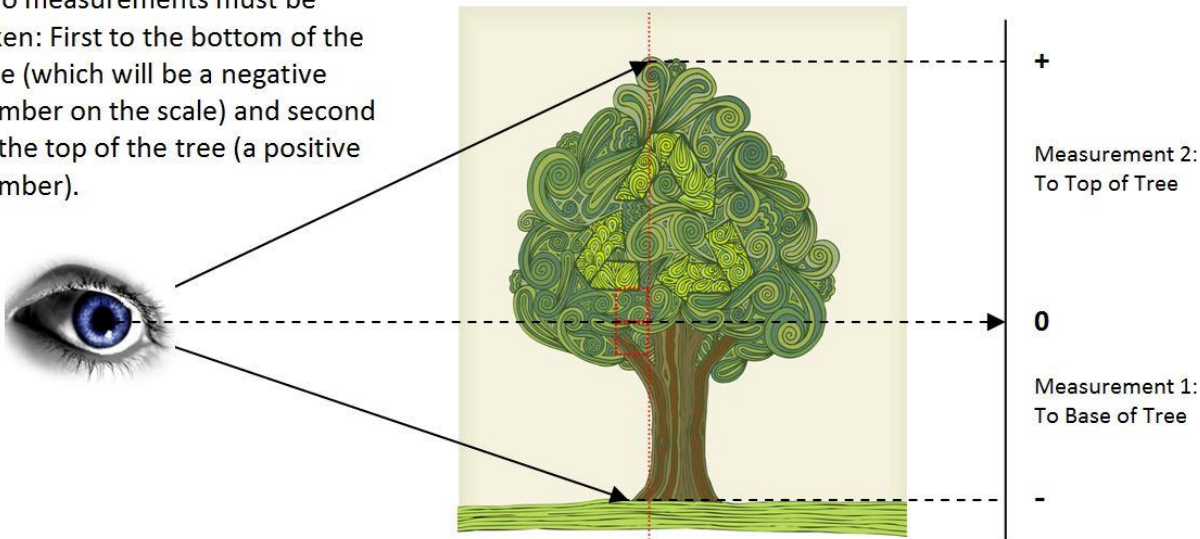
Stand 66 ft. away from tree on ground that is higher than base of tree. Try to find a path with a clear view of the bottom and top of the tree.

When you look through clinometer you will see two scales.

For tree height, read the scale on the right.

## Using a Clinometer to Measure the Height of a Tree

Two measurements must be taken: First to the bottom of the tree (which will be a negative number on the scale) and second to the top of the tree (a positive number).



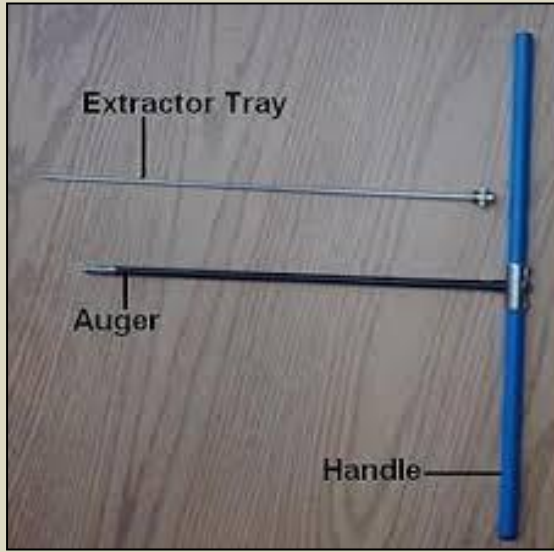
The overall height of the tree will be: measurement 1 (eye level to the base) + measurement 2 (eye level to the top).

**Note:** The negative number resulting from measurement 1 is not “mathematically” negative — it is simply below the zero reference point. (Which is the height of the viewer’s eye!)





# Increment Borer



Used to extract a core sample from a tree to view growth rings.

Core samples and growth rings help determine many things about a tree and the forest:

- ❖ Age of trees
- ❖ Rate of growth of trees
- ❖ Weather patterns such as drought years or wet years
- ❖ History of fire
- ❖ When trees in the forest become too crowded and need more room to grow

## ***Timber Management Tip:***

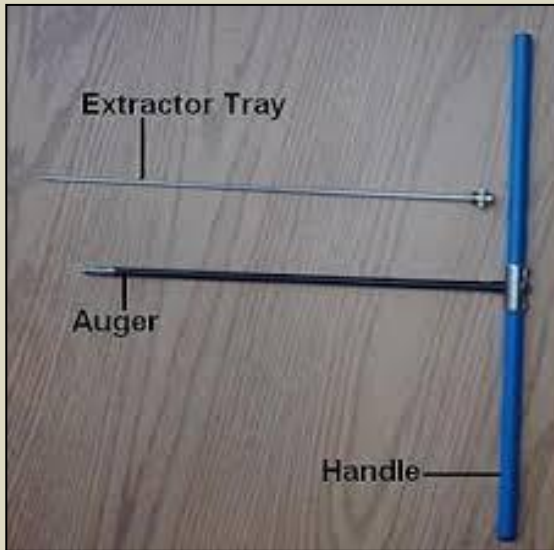
Examining the growth rings will help determine how well the tree is growing. The fastest growing trees, that are well formed, with full crowns and dominant in the over story are generally those trees that should be left as “crop” trees for future timber production. These trees also provide seed for natural regeneration.

Trees with a slower rate of growth, that are poorly formed with thinning crowns are generally candidates to remove to make room for the more vigorous trees.



# Increment Borer cont'd

- 1) Firmly push the auger against the tree at dbh making sure the auger is parallel to the ground.
- 2) Firmly grasp the handles and rotate the auger clockwise "drilling" into the tree.
- 3) Continue turning the auger until you are into the center of the tree (on smaller trees) or until your hands are near the tree.
- 4) Gently but firmly push the extractor all the way into the auger.
- 5) Leave the extractor in the auger and rotate the auger counter-clockwise to break off the core.
- 6) Pull out the extractor and the core sample should come out with the extractor.
- 7) Count the growth rings to determine the age of the tree and/or the rate of growth. If this was done at dbh, add approximately 5 years to more closely determine actual tree age.



# Tree & Log scale stick

Used to determine approximate number of board feet in a tree or the amount of board feet in a cut log.



## Use of Tree Scale Stick:

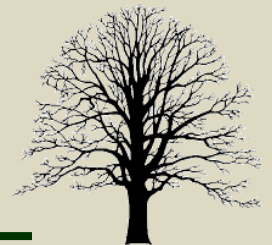
Once you have measured the diameter of the tree and the height to determine the number of logs, read across the scale on the stick to determine the board footage in the tree.

## Use of Log Scale Stick:

Measure the small end of the log across the diameter of the log inside the bark.

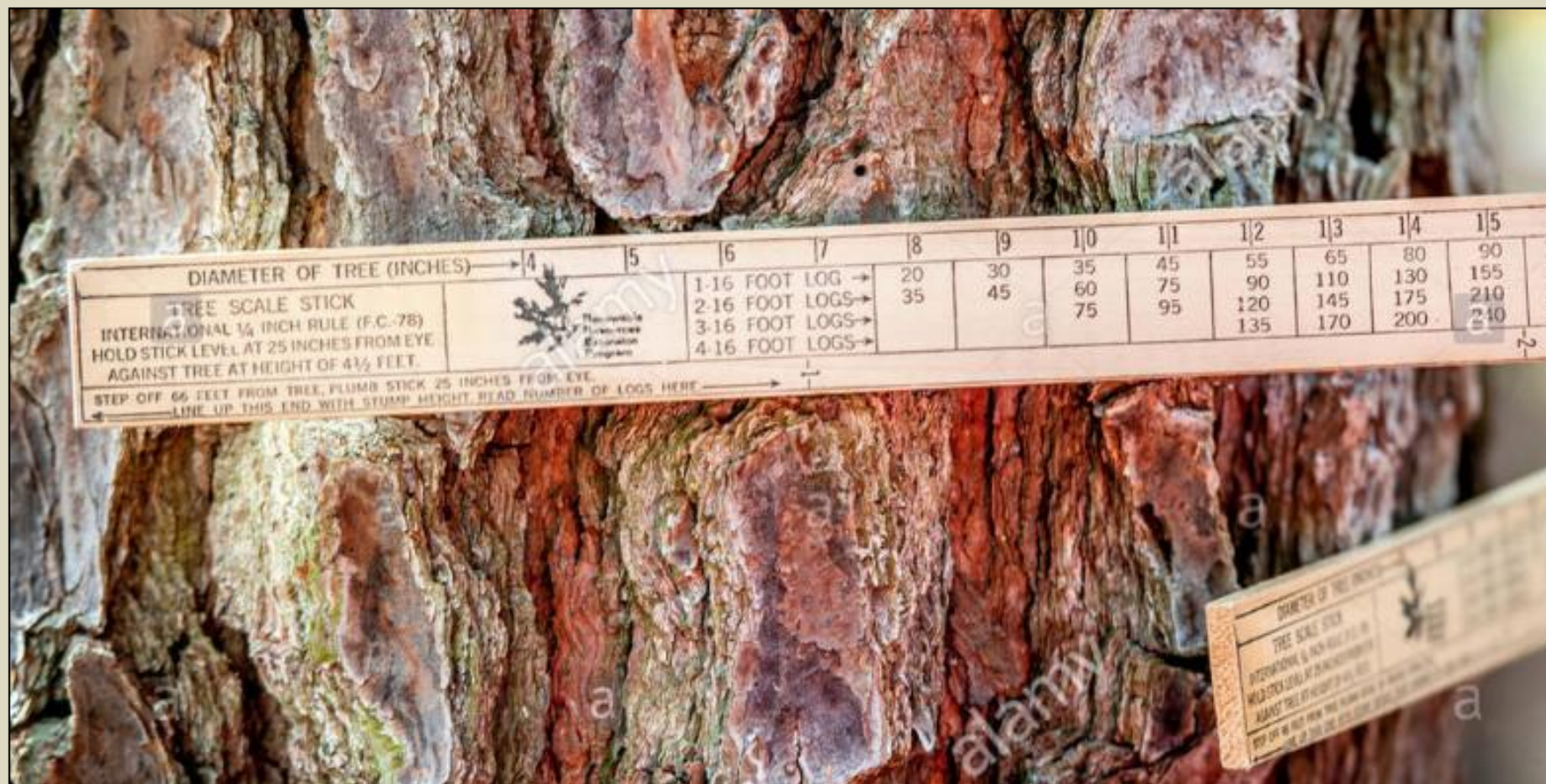
Measure the length of the log in feet.

Read the amount of board feet in the log from the stick based on the diameter and length of log.





# Tree scale stick *example*





# Log scale stick *example*



LOG AT SMALL END (INCHES)		6	7	8
LENGTH OF LOG (FEET)	8 FOOT LOGS	10	10	15
	10 FOOT LOGS	10	15	20
	12 FOOT LOGS	15	20	25
	14 FOOT LOGS	15	25	35
	16 FOOT LOGS	20	30	40

**Example:** Looking at the scale stick in the above...

If the log measures 7" diameter on the small end and is 10' in length, it would have 15 board feet in it.

If the log measures 8" diameter on the small end and is 14' in length, it would have 35 board feet in it.



# Peavey and Cant Hook

Used to roll or move logs on the ground or turn squared off logs (cants) on a sawmill.



Peavey



Cant hook





# Tree marking paint gun

Used to mark which trees to cut or which trees to leave prior to the start of a timber sale.

Trees are marked at eye level on at least two sides of tree so loggers can more easily see which trees are marked from any direction.

Tree is also marked at the base of the tree below where the tree will be cut. This is to assure that only the marked trees are cut.

**Timber Management Tip:** Foresters will mark and tally the trees to be harvested prior to the implementation of a timber sale. This helps the landowner visualize which trees will be harvested and which will be left standing based on their objective. The timber tally (total amount of board feet of timber marked) is utilized by sawmills, loggers and timber buyers to determine how much they will pay the landowner for the marked trees.



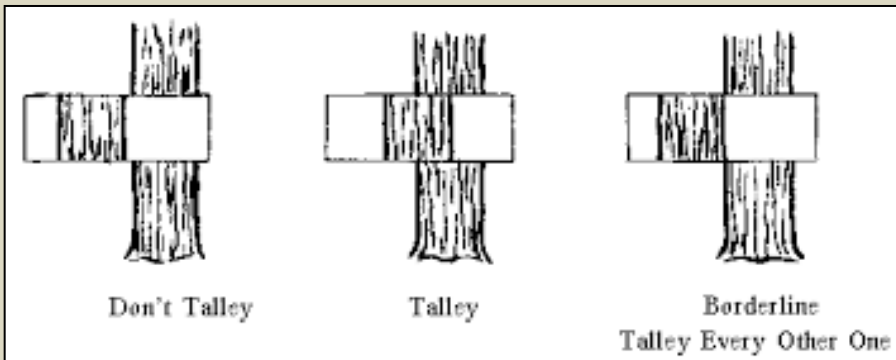
Tree  
marked at  
eye level  
and stump  
mark.



# Wedge Prism

Used for forest inventory to statistically sample the forest to determine the number of trees per acre, the **basal area** and/or the amount of sawtimber per acre without having to measure every tree.

Locate plot center. Hold prism arms length over plot center with the bottom parallel to the ground and the face of the prism parallel to the tree viewing the tree through the prism at 4 ½' above the ground. Rotating clockwise while extending the prism over plot center, record the diameter and/or diameter and height of the trees that are "in". Continue to rotate until you get back to the first tree you started at.



Viewing the trees through the prism – Tally or don't tally

Using the data collected, a series of calculations derives the # of trees/acre and/or the volume of board feet/acre. **Basal area**: Cross-sectional area of a tree at 4 ½' above the ground. Total Basal area is the amount of area trees take up in the forest.





# Angle gauge

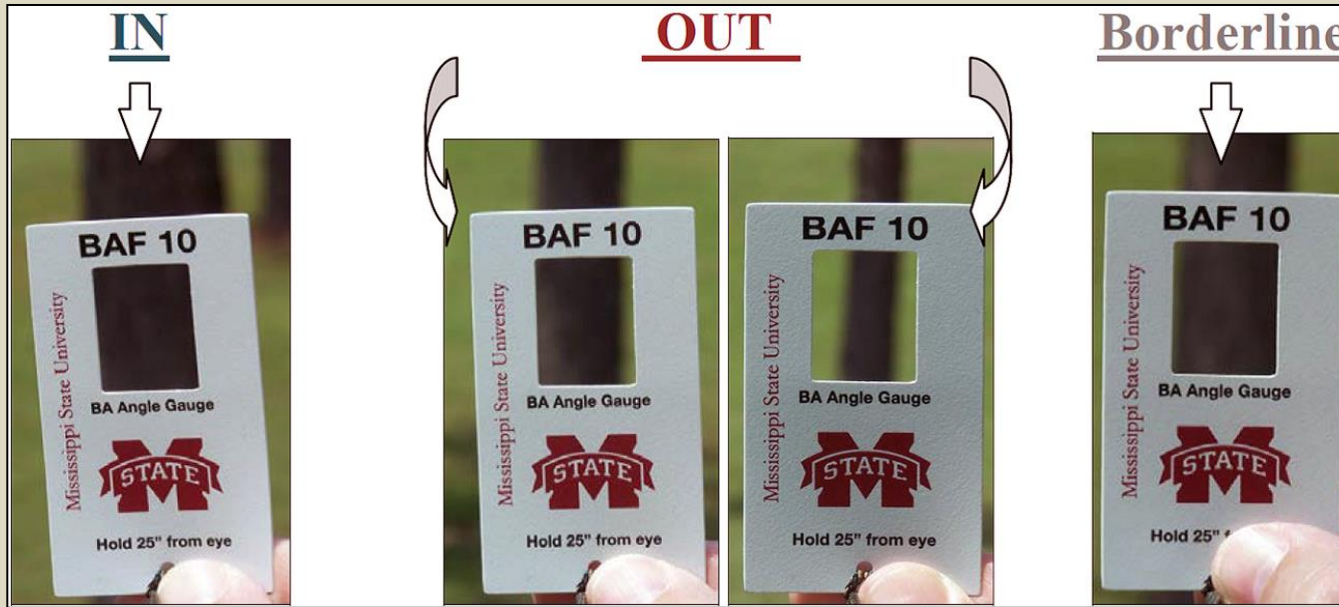


Used similarly to a prism for forest inventory. An angle gauge is a tool used to determine which trees to measure when using a variable radius plot design in forest inventory. Using this tool a forester can quickly measure the trees that are in or out of the plot. An angle gauge is similar to a wedge prism though it must be held a fixed distance from the eye to work properly. Unlike the wedge prism, which is held over the plot center, the surveyor's eye is kept over plot-center when using an angle gauge.

When using an angle gauge the user must count trees that are larger than the width of the angle gauge, as viewed from the center of the plot. The angle gauge is held a set distance from the eye of the surveyor. Most angle gauges have a string or chain that lets the user know the set distance. Each angle gauge is set at a certain basal area factor (BAF).



# Angle gauge



Each angle gauge is set at a certain basal area factor (BAF). Each tree that is in the plot represents this number, the BAF, of square footage. It is multiplied by the number of trees on the plot to give basal area per acre. In the United States BAF is measured in units of square feet.

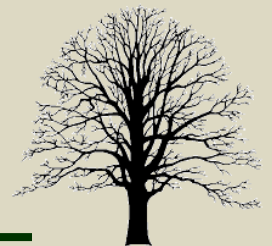
**Example:** Using a BAF 10 angle gauge a forester measures 12 trees that are *in* trees. Therefore, this plot represents 120 sq ft/acre of basal area.



# Compass



Used for navigation over long distances



# Flagging



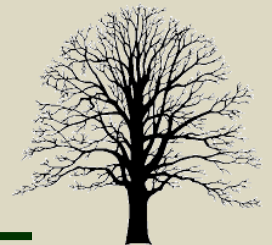
Used to identify property boundaries, iron pins or other physical evidence, wetland areas, logging roads, hazardous areas.

Boundary flags should be easily visible from one flag to the next.

The color of the flagging should be easily visible at any time of the year.

**Example:** In the Northeast, bright pink flagging is better than orange for flagging boundaries as the orange flagging may be difficult to see in the autumn when the leaves change.

A single flag is hung along the straight lines of a boundary. Double or triple flags are hung at a corner or angle in the boundary.

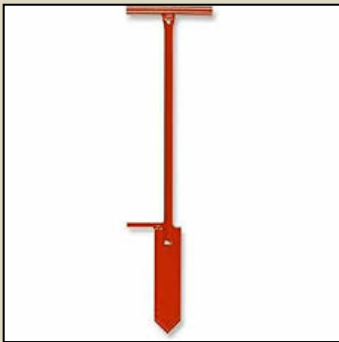




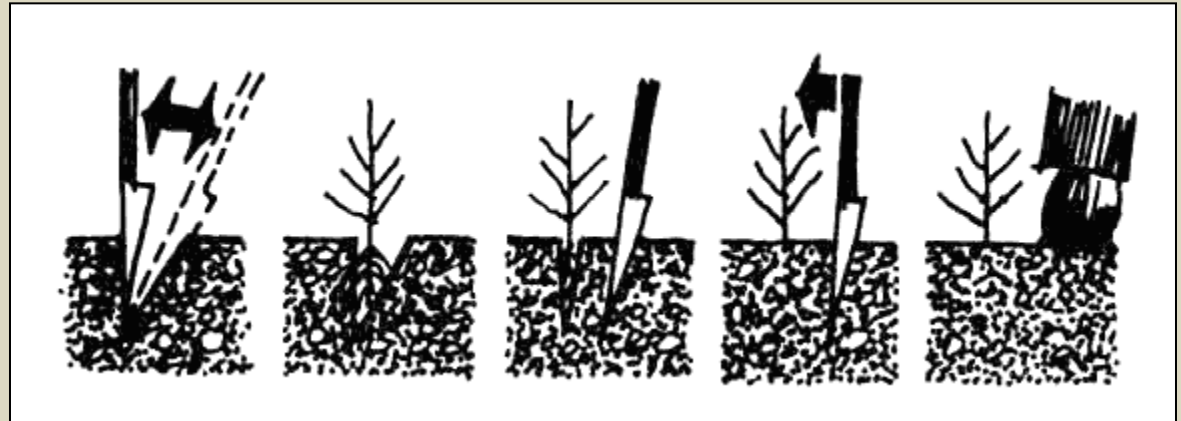
# Planting bar and Hoedad

Used for planting tree seedlings.

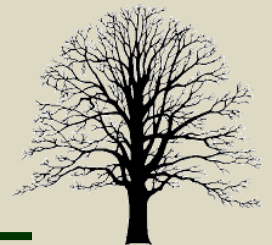
Used to break through sod or leaf lay, create a deep hole and loosen the soil all in one action



Planting bar



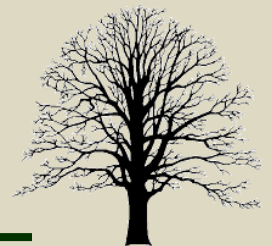
Hoedad



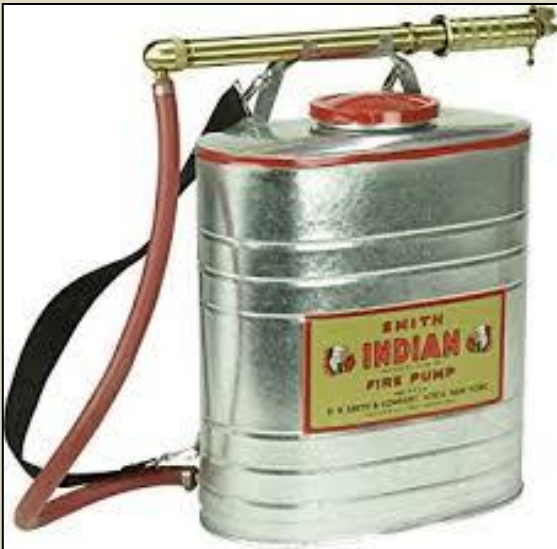
# Pulaski

Used in forest fire fighting.

Flat blade is used to “dig line” meaning to scrape back all the vegetation down to the soil to eliminate fuel and create a break to stop a ground fire from spreading.  
Axe is used on woody vegetation.

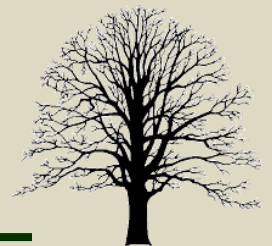


# Indian or backpack pump



Used in firefighting to put out spot fires or in “mop-up” meaning to put out small smoldering fires.

Holds 5 gallons of water





# Drip torch



Used in firefighting to start a fire.

Used in prescribed burns or to start a “back fire” to burn off fuel loads to stop an existing ground fire from advancing.

“Drips” ignited fuel on to the vegetation in a controlled manner.

