



Field Measurements: USFS Fixed Radius Quarter-Acre Forest Plot

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Lesson 1: Setting up the Plot

Background

The following tutorial takes you through the process of delineating the boundaries of specified $\frac{1}{4}$ acre fixed radius plots and the different forestry measurements collected as part of a long-term monitoring program at the USFS Fraser Experimental Forest in Colorado. Each of these plots have been previously surveyed, so locations of the plots were provided as GPS waypoints and each plot had a marker (pictured right) which denotes the center point of the plot (rebar staked in the ground and covered with a piece of white pvc piping).

The purpose of this exercise is to use a three-person field crew to visually determine the boundaries of the forest plots for subsequent cataloguing and silvicultural assessment of stand composition and structure, such as tagging and cataloguing the trees, seedlings and saplings.



Required Materials

The following items are required for conducting a forest plot calibration:

- Topographic map of forest with GPS waypoints
- GPS unit (it's best to have the plot waypoints already entered into the unit)
- Hard hats
- Blank data sheets
- Clipboard

- 30-meter tape
- Pin flags
- Lumber crayons

*Note: Items that should always be on hand when conducting field research in forested areas: Extra GPS batteries (make sure to take a waypoint with your GPS at the car for your return trip), a bow saw (to remove trees that may fall and block the road), and fully charged two-way radios.

Creating the Fixed Radius Plot

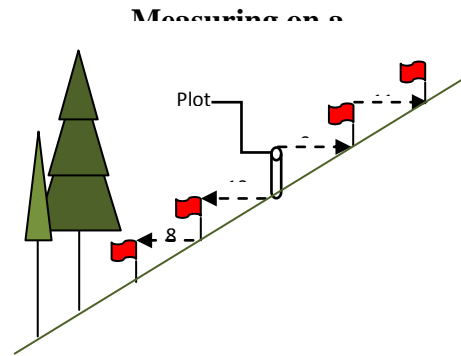
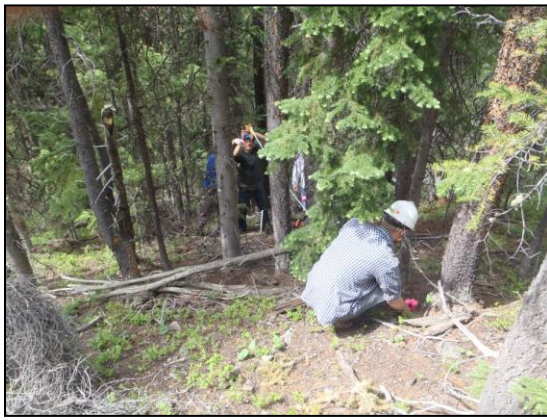
The forest plot will be measured from the plot's center point up slope, down slope and both directions across. When calibrating a forest plot perimeter it is most efficient to use three people. One person acting as anchor for the 30-meter tape from the central point of the plot, another, the roller, rolling out and measuring the tape across the transect and the third, the flagger, marking the measured boundaries with pin flags, marking the boundary trees with lumber crayon and making sure the tape is run in a straight line.

Start by measuring out the upslope boundary. Often, these plots are established on uneven topography. To correctly measure out a horizontal line on a slope, we must account for the change in height. This is done by breaking the line up into segments.

From the plot's central point, the anchor person will hold the end of the 30-meter tape above their head. *Note: It is best to determine a set height and stick with it for measurement consistency. The roller will walk out as far upslope as they can in a straight line, keeping the tape taught and horizontal.

When the tape starts to slacken, the roller should reel in the tape until taught and the flagger should mark that point. From there, the anchor will move up to the flagged point and start the process again until the roller reaches 17.94 meters *Note: You may not be able to measure the entire 17.94 meter quadrant transects in one measuring attempt. Depending on the terrain, slope, height of crew members, etc. it can take multiple measurements. One crew member should be designated to keep track of how far out each measuring attempt goes, adding the length of each segment to the last until the total reaches 17.94 meters. When the 17.94 meter boundary is reached and flagged, the flagger will mark the tree(s) at this farthest point within the plot boundary with a lumber crayon (this can be a mark of "IN" or a simple vertical line. Whichever is chosen, be consistent).

(Below): Keeping the tape taught and horizontal while measuring downslope.

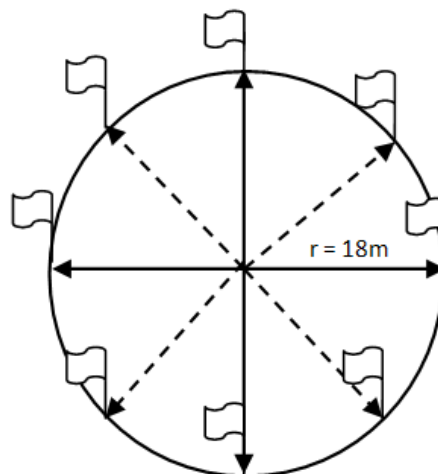


Next, measure the downslope boundary. The process is very similar to the aforementioned upslope transect measurement but one key distinction should be made. In this case, the anchor holds the end-point of the 30-meter tape low to the ground and the roller holds the tape above their head. The roller will walk out as far downslope as they can in a straight line, keeping the tape taught. When the tape starts to slacken, the roller should reel in the tape until taught and the flagger should mark that point. From there the anchor will move up to the flagged point and start the process again until the roller reaches 17.94 meters.

Next, measure across slope ensuring measurements are made in both directions, while the anchor and roller hold the tape at the same level (holding the tape lower is recommended). As with the other directions, the roller will walk out as far across slope as they can in a straight line, keeping the tape taught. When the tape starts to slacken, the roller should reel in the tape until taught and the flagger should mark that point. From there the anchor will move up to the flagged point and start the process again until the roller reaches 17.94 meters.

Once the four quadrant boundaries have been marked, it is recommended that four additional diagonal transects be measured and flagged at the 17.94 meter boundaries. This makes the forest plot boundaries more distinguishable, which will make subsequent plot assessments much easier. These diagonal transect measurements are conducted in the same fashion as the four boundary measurements previously noted. Upon marking the forest plot extent, remove the pin flags that are NOT denoting the 17.94 meter boundary.

*Note: It is highly recommended that you double-check a few boundary points and run the 30-meter tape to the central plot marker to validate.



(Left): Four quadrant boundaries with diagonal transects forming $\frac{1}{4}$ acre circular plot.

Flags mark the final perimeter.

Lesson 2: Forest Field Plot Sampling (Tree Measurement and Tagging)

Required Materials

The following items are required for conducting a forest plot calibration:

- Topographic map of forest with GPS waypoints
- GPS unit (it's best to have the plot waypoints already entered into the unit)
- Hard hats
- Data sheets
- Clipboard
- D-tape (diameter tape)
- Cruiser vests
- Hammer
- Aluminum nails
- Tree identification tags

*Note: Items that should always be on hand when conducting field research in forested areas: Extra GPS batteries (make sure to take a waypoint with your GPS at the car for your return trip), a bow saw (to remove trees that may fall and block the road), and fully charged two-way radios.

Tree Tagging

For this process, all trees within the quarter-acre plot with a DBH (diameter breast height) greater than 2 centimeters will be tagged and catalogued. The tree tagger should be the first member of the group to start work so that the other two who are cataloguing can easily identify the tagged trees and record those in numerical order (if the tagger is unsure if a tree's DBH is > 2 centimeters, they can do a quick measurement, explained later on in the tutorial).



To tag a tree, feed the nail through the whole in the tag and hammer it into the tree 30- 60 centimeters (approximately 1- 2 feet) above eye level. This makes sure the tag will be visible even with deep snow accumulation. Don't drive the nail all the way into the tree. Leaving some space allows the tree to grow and not envelope the tag but limits the chance of the nail falling off the tree.

(Below): Good height for tagging trees



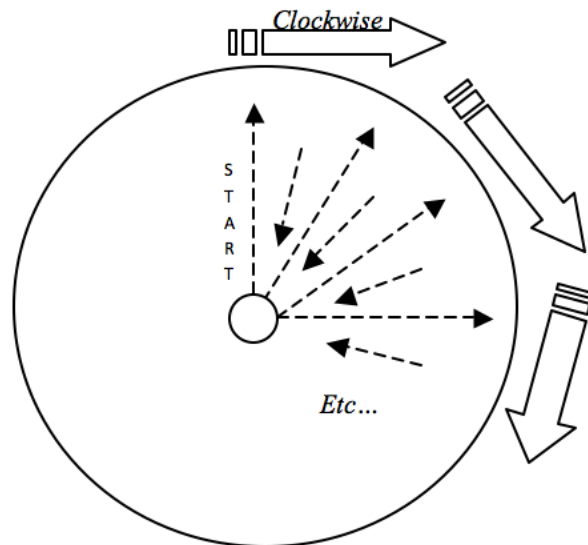
Choose a spot such that the tag is facing the center point of the plot (rebar staked in the ground and covered with a piece of white pvc piping). Hammer the nail at a slight downward angle so the tag slides down and dangles freely at the nail head. Make sure the nail is solidly lodged inside the tree; 2.5 - 5 centimeters (approximately 1.5 - 2.0

inches) is a good depth.

Movement

For each plot, always start the tagging and cataloguing process by moving upslope of the central plot marker and work out towards the edge of the plot, then back in to the center--always move clockwise. (See diagram to the right):

For the first tree noted, you need to take a measurement of the distance from the tree to the central plot marker and take an azimuth compass reading.



distinguishing the canopy characteristics of trees (listed above the Crown Class column), very few trees in the plots will likely be “dominant”. More often than not the most common classifications will be “co-dominant”, “understory” and “dead”.

Measuring DBH

In addition to noting the species of each tree and characteristics found in the adjoining data sheet, you will be measuring the DBH (diameter breast height) and tagging each tree with a unique identification number. It is suggested that you continue to work in a crew of three, with one person tagging the trees, one person measuring DBH, and one person following behind filling in the data sheet. Regular communication between all three team members helps keep the work accurate and efficient. *Note: All crew members should take part in identifying tree species and characteristics.

When measuring DBH, the d-tape should be used with the white side, which has diameter measurements (the yellow side has a normal metric ruler). The person measuring should stand upslope of the tree and measure around the base of the tree 1.4 meters high (approximately 4.5 feet). The “0” on the tape should be visible to the person measuring and the starting point of the measurement. The tape should then be wrapped around the base of the tree until the tape overlaps with the “0”. This intersection is the tree’s DBH measurement.

(Below): Measuring DBH



*Note: Make sure the tape is not being obstructed by a branch on the blind side of the tree which would make the measurement greater than the actual diameter.

Final Check and Completion

*IMPORTANT! Once all the trees in the plot have

been catalogued, the team should walk within and around the entire plot to ensure they did not miss any trees. If any were missed, tag and record them just as you did the others.

Once all trees are tagged, finish the plot by removing the marker flags around the perimeter, pack all gear up, and move on to the next location.

Congratulations! You have successfully calibrated a USFS fixed radius quarter-acre forest plot!