Instructions

⚠ Keep this sheet for your records.

Using Forest Densiometers

Originally developed and published by Dr. Paul E. Lemmon, the Spherical Densiometer is designed for rugged field use while remaining compact and lightweight for ease of transport. This instrument has been extensively tested by numerous foresters and forestry technicians on stands of ponderosa pine, lodgepole pine and Douglas fir.

History

The pioneering work was done mainly in the Pacific Northwest; however, subsequently the instrument has been used for measuring overstory density throughout the U.S. and internationally. The original methodology was developed to characterize and quantify canopy density for representative forest sites where numerous parameters such as tree size (height, girth, age and growth rates), tree spacing, soil type, slope and slope orientation, elevation and others were determined.

Reading Canopy Areas

The spherical densiometer consists of either a concave or a convex mirror with twenty-four ¼" squares engraved on the surface. The design is such that the operator views the same degree of arc overhead regardless if the user is in a low lying canopy area or a mature stand of high canopy timber.

Each square of the grid is then equally subdivided mentally into 4 smaller squares (⅛" x ⅛") and represented by an imaginary dot in the center of each of the smaller squares. Thus a total of 96 dots representing smaller square areas can then be counted within the grid. Once the representative forest site has been selected for measurement, the user holds the instrument level and far enough away from his/her body such that the operator's head is just outside the grid. The operator can then count the number of dots, representing the smaller (⅛" x ⅛") square areas of canopy openings, up to a total of 96. The number determined is then multiplied by 1.04 to obtain the percent of overhead area ***not*** occupied by canopy. The difference between this percentage and 100% is the estimated overstory density in percent.

Four readings are taken about a reference tree in each site area and averaged. The operator should be positioned with his/her back toward the reference tree, and moving about the reference tree facing North, East, South and West.

"The reference tree in each site represents a typical dominant or co-dominant species in the stand. The points selected around each reference tree should be far enough away (from the reference tree) so that the crown of the reference tree is just outside the overstory area being estimated" (Lemmon, 1956).

The statistical accuracy and repeatability of the instrument is based on taking four readings, using up to 96 dots representing the smaller (⅛" x ⅛") squares for up to a total of 384 smaller squares per site (96 x 4), and then averaging all four readings at the different orientations about the reference tree. Obviously, in a forest environment, you will be counting considerably less than 9 dots representing the smaller squares, so the exercise is a lot less laborious than it might first appear. The denser the overstory canopy, the fewer dots you will have to count since you are counting the ⅛" x ⅛" areas in which you can see sky in the major portion of each of the smaller squares. With a little practice, you will find that the data can be gathered quickly and with repeatability using the same or different operators.

In open forest where more than half of the canopy area is open to the sky, you can reverse the process and count just the smaller square areas (⅛" x ⅛") that are covered by the canopy and multiply by 1.04 to obtain the estimated overstory density percentage.

Reference: Lemmon, Paul E., 1956, A Spherical Densiometer for Estimating Forest Overstory Density; Forest Science 2(4)314-320.
Lemmon, Paul E., 1957, A New Instrument for Measuring Forest Overstory Density; Journal of Forestry 55(9)667-668. 236501.LET