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AN INSTRUMENT FOR MEASUREMENT OF THE DENSITY OF PLANT COVER OVER SNOW COURSE POINTS

by
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The role that vegetation plays in the disposition of snow was pointed out by George W. Craddock[2/] in his paper given at last year's meeting. In this paper Mr. Craddock indicated that the most obvious influence of plant cover was its capacity to intercept snow. Other influences discussed included its shading effect on melting and its hydrologic influence on water from melted snow. The development of a method of relating forest cover to snow accumulation has been investigated briefly at the former Northern Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service, Missoula, Montana, now a part of the Intermountain Forest and Range Experiment Station as a result of the recent consolidation of these two units.

Forest cover has been described and evaluated by many methods. Some depend on ground observation, others on aerial photographic interpretation. The method developed during this investigation was for the purpose of making observations from a specific spot, such as a snow course point. These observations were taken from the ground. The instrument developed and employed for taking these observations we have called a "ceptometer." It is this instrument that I wish to talk about today.

The basic concept back of the development of the ceptometer is that surrounding forest cover as well as that directly overhead has an influence on snow at a particular point. The ceptometer provides a

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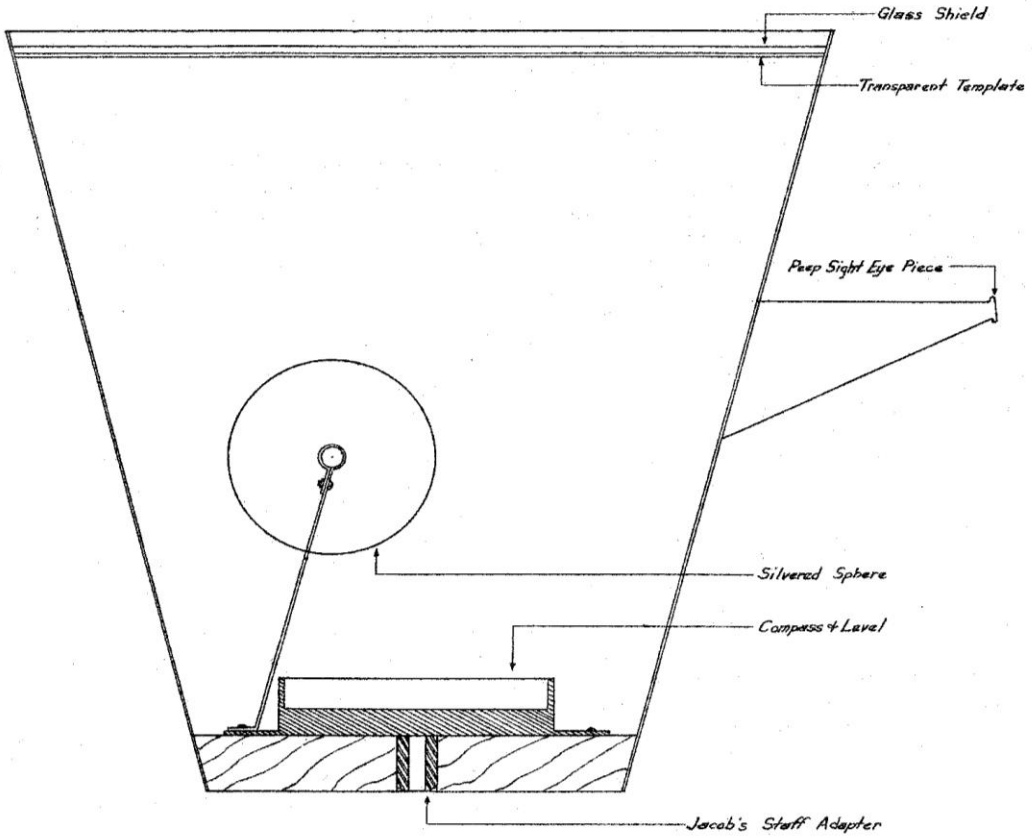

Fig. 1. Sectional view and parts of Ceptometer

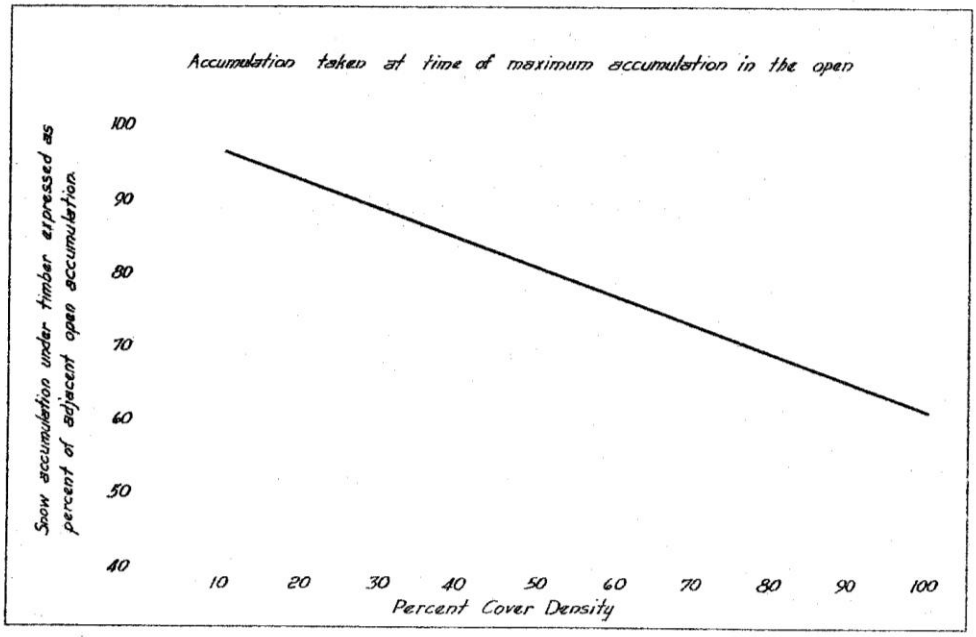

Fig. 2. Relation of snow accumulation under cover to open accumulation as measured with the ceptometer within an angle of 45 degrees from vertical.

measurement of that cover from the vertical down to a 45-degree angle from the horizontal. The measurement is made by sampling the cover with a dot grid. The number of dots falling within cover is an index of cover density. These dots on the grid and the cover above are radially reflected from a sphere within the instrument which is located over a specific measuring point. The density is expressed as percent, ranging from zero to one hundred.

The ceptometer, in its present state of development, consists of a silvered sphere rigidly mounted above a base, a protective case extending from the base to the horizontal transparent dot template held in place above the sphere, and an eye-piece for observing the reflected images on the sphere(see fig. 1). The transparent dot template is constructed with a grid of evenly spaced dots covering the 45-degree field of view from vertical. Lines were engraved on the template to delineate four quadrants and to further subdivide the quadrants into segments subtended by angles of 15, 30, and 45 degrees from the vertical. A compass and level built into the base permits leveling and orientation of the ceptometer for each operation.

The procedure for any single observation at a fixed point is as follows:

1. The ceptometer is attached to a standard Jacob's staff by means of the adaptor and the instrument erected in a vertical position over the observation point.

2. The upper surface (template) is adjusted to a true level position and oriented to the due north and south position through use of the level and compass in the base.

3. The number of dots whose centers are covered by the overstory are now counted and recorded. In making this count, such overstory as would not be present during the snow season was ignored.

We found it easiest to make the counts by the smallest areas delineated on the template. There are twelve of these--three in each quadrant. The three are made up of (1) the segments between vertical and the limits of the 15-degree angle, (2) the segments between the 15-degree angle and the 30-degree angle, and (3) the segments between the 30-degree angle and the 45-degree angle. In the denser cover it was found convenient to count "open" dots, or dots not falling on plant cover, subtracting them from the known number of dots in the particular segment to arrive at the recorded count. These counts were then converted to percent of the observed overhead area occupied by plant cover.

The ceptometer was used where comparative measurements were being made of snow conditions in the open and at adjacent points which were under the influence of various intensities of forest cover. Figure 2 indicates some of the preliminary relationships obtained at time of maximum accumulation in the open.

About 750 observations of conditions under cover were used in preparing figure 2. In all cases the cover density was measured out to 45 degrees from the vertical. Further testing might indicate whether cover outside those limits has a significant influence on the storage of snow.

The collection of density data by quadrants and their segments primarily was for the purpose of studying the influence of various portions of the canopy. The data have not as yet been analyzed with respect to these influences. Neither has the influence of slope steepness and aspect, both of which were measured at the sample points.

It is recognized that the ceptomter is still in a rather crude stage of development and that the data obtained with it are fraught with some shortcomings. Notwithstanding, it is believed that this instrument affords the possibilities of developing a more realistic approach to the relationships between forest cover and the storage of snow at sampling stations.

DISCUSSION

Dr. Paul E. Lemmon (Soil Conservation Service, Portland, Oregon). --The undersigned has developed and constructed a number of instruments called "spherical densiometers" with which to estimate percentage of overstory density in forests. These instruments have been in use for about six months at various locations in the Pacific Northwest to accumulate information on overstory density in connection with routine correlations of soils with forest sites and with forested range sites that are being carried on by the Soil Conservation Service. The instruments were developed after experience with one described by Mark W. Robinson (An instrument to measure forest crown cover. Forestry Chronicle 23: 222-225. 1947).

The spherical densiometer comprises essentially a curved mirror on which the percentage forest overstory cover is estimated from a point. Either convex or concave mirrors may be used. The latter merely inverts the image. There are other minor differences that may be important in choosing between them. Instruments now in use contain highly polished chrome mirrors 2-1/2 inches in diameter cut from 6-inch spheres. They are mounted in small wooden recessed boxes with hinged lids similar to compass boxes. The overall dimensions are about 3-1/2 x 3-1/2 x 1-1/8 inches. A circular spirit level is mounted (recessed) beside the mirror.