



Research Note

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A SYSTEM FOR AUTOMATICALLY RECORDING WEIGHT CHANGES IN SAPLING TREES

by

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ABSTRACT

Describes an accurate and simple system for taking continuous weight records of sapling-size trees. Measurements obtained using this system have helped in describing the mechanism of interception storage in tree crowns during snowfall.

Knowledge of the hydrologic process of snow interception is limited, particularly in respect to quantities of snow caught by coniferous tree crowns. In past studies, snow interception has been calculated as the difference between the water equivalent of the snowpack in a forest opening and that of the snowpack beneath the tree canopy some distance away. This difference, even on a theoretical basis, is of questionable value because it assumes that the same quantity of snow falls in the opening as upon the forest canopy.

In 1965, we developed a direct system for measuring snow interception by conifer crowns. After 2 years of testing--carried out in cooperation with the Department of Forestry and Range Management at Washington State University--the success of the system has been proven, both in terms of simplicity of operation and accuracy of data.

We already have published one report from data collected using this system.² It describes the mechanism of interception storage during a snowfall. This paper deals only with the design and mechanics of duplicating this system in which cut sapling-size trees are suspended from a cable in such fashion that a continuous weight record can be taken for each tree.

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²Satterlund, Donald R., and Harold F. Haupt. Snow catch by conifer crowns. Water Resources Res. 3(4): 1035-1039, illus. 1967.

METHOD OF SUSPENSION

We have three 25-foot cedar poles set upright in a triangular layout within a small clearing on our test site at Priest River Experimental Forest in northern Idaho. Strung between these poles is $\frac{1}{2}$ -inch cable, from which six small boat pulleys are hung (two along each run of cable). This permits six trees to be weighed at a time.

A single-tree setup is shown in figure 1. The cable used to suspend the tree from the pulley is of steel $\frac{1}{8}$ inch in diameter. On one end of this cable is bolted a C-hook, which is attached to a wire loop affixed to the top of the tree. The other end of the cable is connected by a ball-bearing swivel to a short length of standard steel (float) tape, which is perforated. The perforations engage the drive sprocket on the recorder. The other end of the steel tape is fastened to a spring-tension scales (see figure 2), which is hooked onto one of the cedar poles. The swivel prevents the steel tape from twisting free of the drive sprocket during windy periods.

AUTOMATIC RECORDING APPARATUS

Although almost any model of water-level recorder, drum, or roll chart should operate satisfactorily, we used a surplus Friez FW-2 recorder³ with a 192-hour drive. In order to convert it into a weight recorder, we replaced the float wheel with a small, custom-built drive sprocket.

This drive sprocket, which was machined from 17/32-inch O.D. brass rod, has 10 inserted "teeth" made of 16-gage brads. The center of the rod is drilled to fit onto the float wheel shaft. Once on the shaft the original float wheel clamp prevents the sprocket from slipping (figure 2).

The modified recorder is actuated by placing it next to the steel tape until the sprocket teeth engage the perforations. As the spring in the scales is stretched or contracted with changes in weight, a record of movement is made by the recorder. The recorder need not be bolted to the shelter base.

The smallest vertical unit on the FW-2 chart corresponds approximately to a 2-1/4-pound change on a 300-pound spring-tension scales.⁴ Because the arm assembly traverses, the apparatus will record any amount of snow that does not exceed the capacity of the scales used.

RESULTS

The sensitivity of the system is excellent. We can detect deposition of snow, rain, dew, frost, or loss of tissue moisture from the severed tree in small quantities. Weight change can be measured to at least one-half pound. This represents only 0.00122 inch (water equivalent) of catch over a projected crown diameter of 10 feet.

Pen traces or interceptographs on the FW-2 chart resemble those illustrated in figure 3. The interceptographs shown characterize one type of sequence in which snow builds up on needle clusters and limbs only to unload rapidly from tree to ground with a change from falling snow to rain.

³ Use of trade names herein is solely for identification and does not imply endorsement by the U.S. Forest Service.

⁴ Hanson "The Viking," Model 8930, or equivalent.

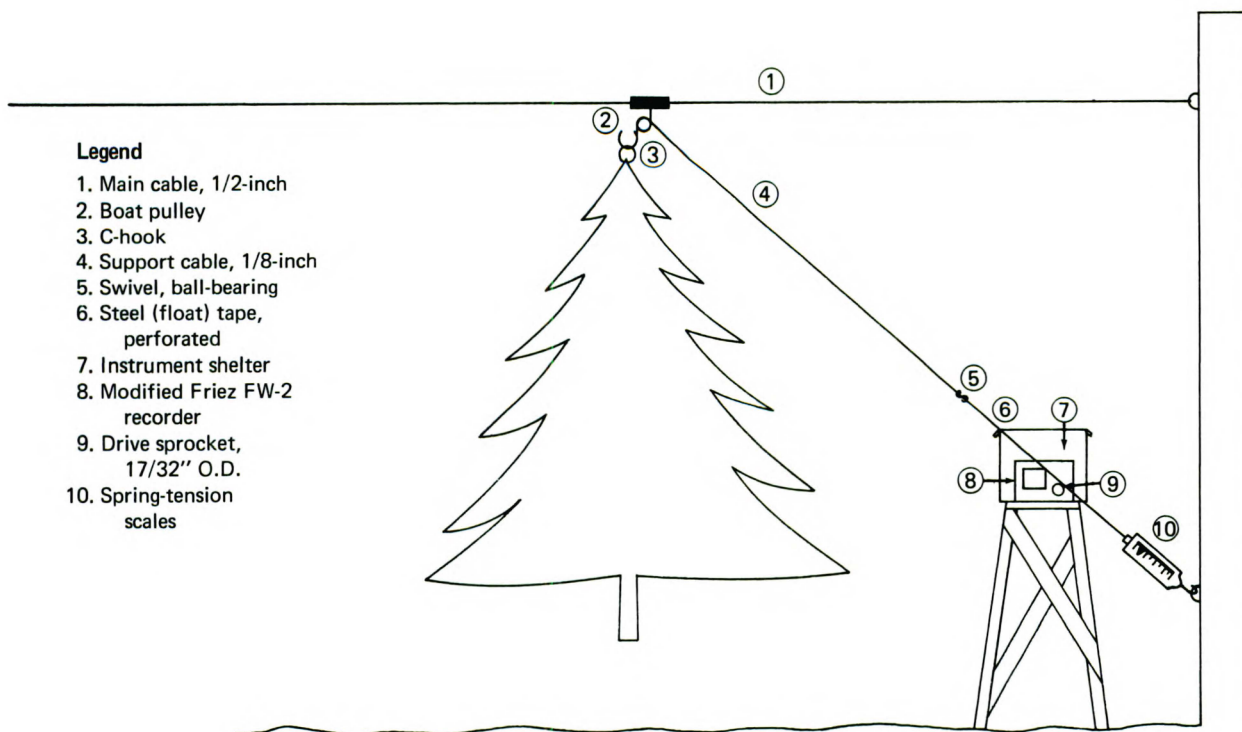


Figure 1.--A schematic view of the suspension system-automatic recording device for weighing sapling trees.

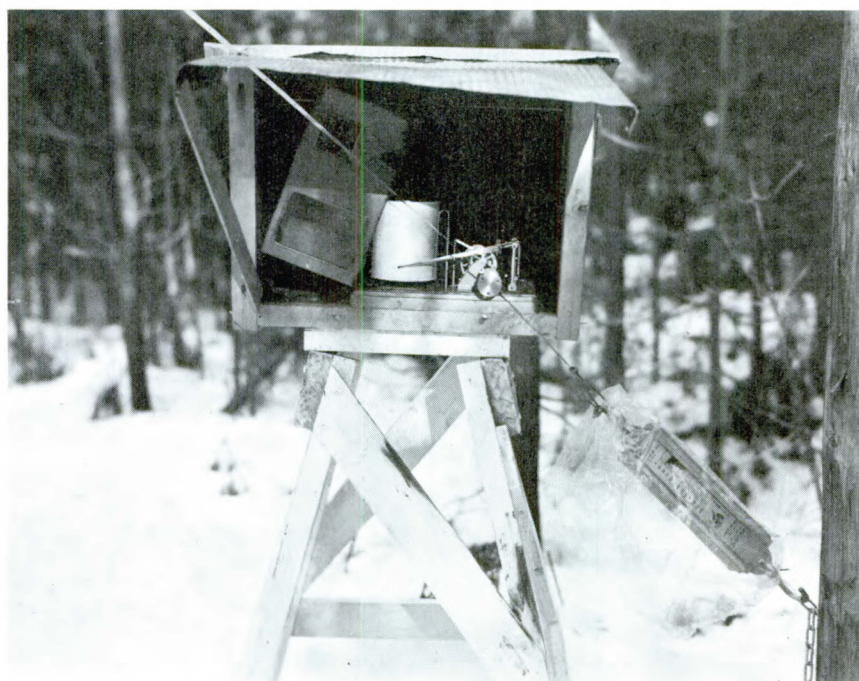


Figure 2.--Closeup of the recording apparatus and spring-tension scales.

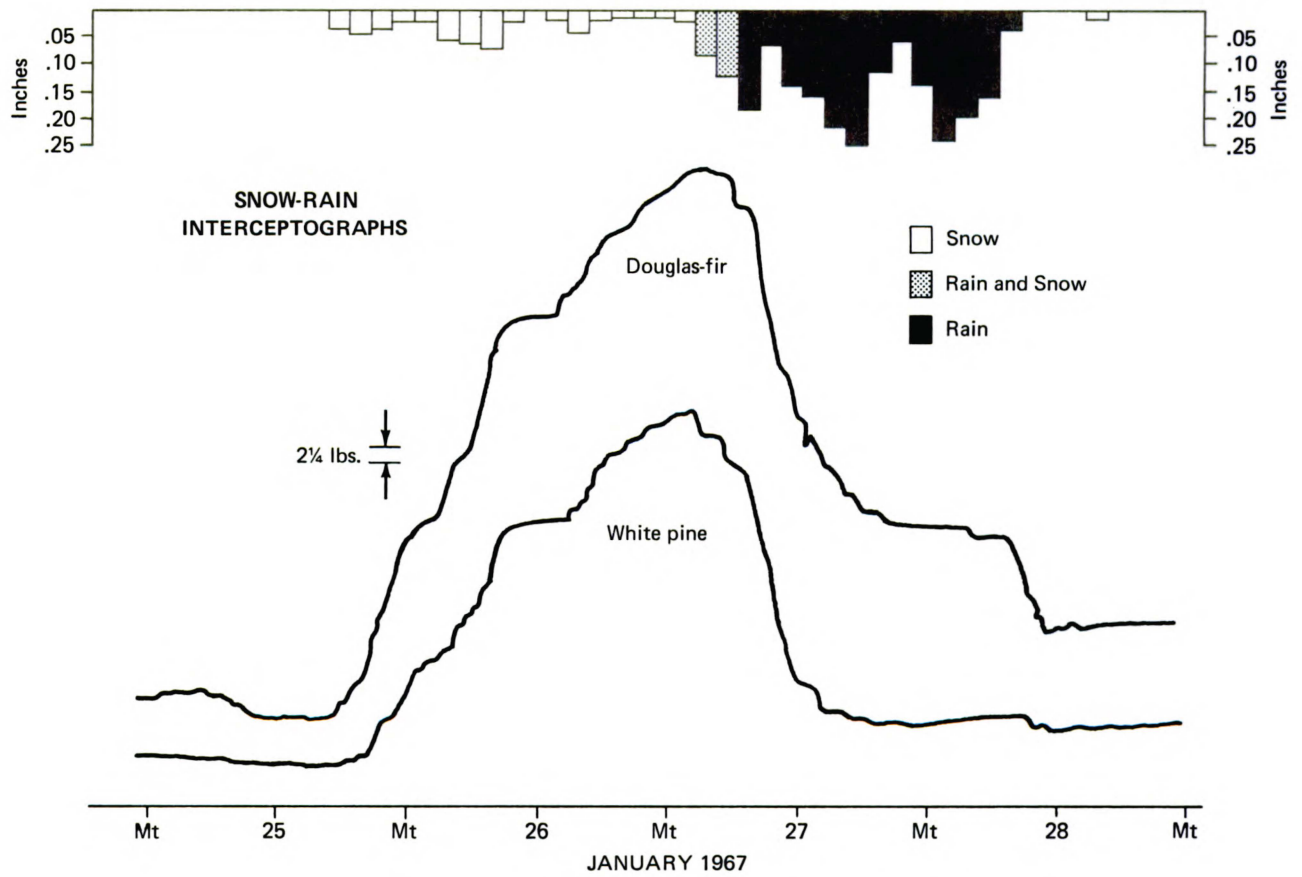


Figure 3. --Pen traces or interceptographs for two coniferous species.