INTERNAL REPORT 21

FOREST HYDROLOGIC MODELS

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A simulation model for the forest interception system has been constructed to describe aerial distribution of water in the Douglas-fir ecosystem at the Allen Thompson Research Center. The model has been simplified by integrating the many variables affecting processes in the system by considering only surface area of storage and evaporation of stored water to the atmosphere. Water not retained in storage by a tree becomes throughfall and stemflow.

The maximum quantity of water stored on a tree has been broken into two components, foliage and stem storage, which have been determined by empirical measurements of input and output in terms of a continuity equation.

Theoretical considerations incorporated into the model suggest foliage storage increases to a maximum by an exponential function, but stem storage follows a linear change with precipitation. Evaporation during and after a storm is approximated by a linear function. The general form of the interception equation is as follows:

Interception = foliage storage + stem storage + evaporation during storm

$$I = A(1-3^{-cp}) + gx + E$$

where
A = maximum foliage storage
P = precipitation
c = constant controlling rate of storage increase
g = constant depending upon channeling of water to the tree stem by branches
x = excess water not incorporated into foliage storage
gx = limited by maximum stem storage
E = evaporation

Figure 1 shows the results obtained from the computer simulation model that describes a sequence of wetting and drying. Maximum storage was maintained during the second storm. A test of the model at that time should show precipitation inflow equal to outflow by throughfall and stemflow.

Current research is being undertaken to evaluate the constants in the model and to test it on several storm sequences monitored during 1971.

CHANGE IN CANOPY STORAGE