

Symposium on Forest Microclimate*

Kananaskis Forest Experiment Station, Alberta, Canada

22-26 September 1969

The Third Forest Microclimate Symposium, sponsored by the Canadian Forestry Service, Department of Fisheries and Forestry, was held 22-26 September 1969, at the Kananaskis Forest Experiment Station, and Environmental Sciences Centre (University of Calgary) near Seebe, Alberta. The 66 invited participants came from various Government Departments, Universities and industry in North America. The symposium comprised five sessions each with invited and contributed papers, a general session of contributed papers, a field trip, and several informal sessions.

The first day was devoted to WATER RELATIONS IN THE FOREST. The energy balance over various surfaces was described by Fritschen (Univ. Washington, Seattle) to illustrate the effect of soil drying, plant height, and wind speed upon the evaporation rate. Meteorological methods of estimation of evapotranspiration were then discussed and he concluded that a combination of the energy balance and eddy correlation technique may be the most suitable method for determining evapotranspiration from forests. Storr (Meteorol. Branch, Calgary) used the energy budget method to estimate the evapotranspiration above the forest canopy. The forest microclimate relations to storage and delivery of rainfall and snow-melt water were adequately covered by Anderson (Pacific Southwest Forest & Range Sta. Berkeley, Calif.). Clements and Cabart (Petawawa F.E.S., Chalk River) described the distribution of precipitation, soil and air moisture in young and old aspen stands, while Harlan and Golding (Canad. Forest. Service, Calgary) assessed the influence of topographic and vegetative variables on snow accumulation in a sub-alpine watershed, by point-sampling and computer mapping techniques. Relative turgidity was used by Lees (Canad. Forest. Service, Edmonton) to determine the role of short-period drought stress on natural seedlings of Sitka spruce in Scotland. Swanson (Canad. Forest. Service, Calgary) discussed the tree as a dynamic system in forest-water resource research, and drew attention to the fact that the tree response to the external environment cannot be predicted wholly from external measurements. He also described the value of heat pulse velocity as an indicator of transpiration. Lesko (Canad. Forest. Service, Calgary) described the need for the measurement of various climatic parameters to give a biologically meaningful description of the ecosystem moisture-regime, to be related to the water potential in plants.

*) Prepared by J. M. Powell, Symposium Co-ordinator, Canadian Forestry Service, Dept of Fisheries & Forestry, 132A Ninth Avenue S.W., Calgary 2, Alberta, Canada.

On the following morning the group took up the subject of **DATA ACQUISITION AND PROCESSING FOR MICROCLIMATE RESEARCH**. Rogalsky (Meteorol. Branch, Toronto) stressed the importance of communication with the programmer for all data acquisition systems to ensure that the equipment, procedures and formats used will be economically practical and give the desired results. Allen (US Department of Agriculture, Ithaca, N. Y.) then enlarged on an operational data logging system developed by their team for microclimate studies of agricultural crops, in which CO_2 , water vapor, shortwave, net and visible radiation, wind speed, temperature, and soil heat flux data are obtained. The use of power spectrum analysis for obtaining the energy contained in sunflecks of different duration was reported by Reifsnnyder and Furnival (Yale Univ., New Haven, Conn). Henshaw and Fritschen (Univ. Washington, Seattle, Wash.) reported their experience with diodes for temperature measurement.

The afternoon was devoted to a field trip, led by Golding, to view the work going on in the **MARMOT CREEK EXPERIMENTAL WATERSHED**, an area set aside for an evaluation of commercial timber harvesting methods, and for timber cover manipulation purposely designed to alter stream flow quantity, water quality or stream flow regime. No timber harvesting or manipulation has commenced yet, but the basin is now well documented for hydrologic purposes, including information on certain meteorological parameters such as amount, distribution and variability of precipitation, snow accumulation and ablation, estimates of evapotranspiration, and wind and turbulence studies. In the evening a short visit was made to the **COSMIC RAY STATION** (Univ. Calgary) situated on the top of Sulphur Mountain overlooking the town of Banff.

Raynor (Brookhaven National Lab., Upton, Long Island, N. Y.) introduced the session **DIFFUSION AND DISPERSION IN AND NEAR FOREST STANDS**, and discussed results they had obtained from the measurements of wind speed, temperature and turbulence in, over and outside a pine forest. Continuous point source dispersion tests into and within forests were made with a variety of tracers, including stained pollens and spores. Fritschen and Driver (Univ. Washington, Seattle, Wash.) then reported on studies of the dispersion of **FOMES ANNOSUS** spores and fluorescent particles into and within a Douglas-fir stand in relation to meteorological parameters. Chapman (Canad. Forest Service, Victoria) introduced the term odor meteorology, and went on to discuss air movements in the forest in relation to odor responses of bark and ambrosia beetles which are dependent on their sense of smell for finding suitable trees or logs to attack. If these odor attractants could be isolated and knowledge of very small scale air movements obtained, these attractants may be used as an effective control for destructive insects. In a study associated to that reported by Chapman, Turner (Canad. Forest Service, Victoria) referred to two simple techniques to obtain quantitative values for the lateral gustiness and dispersion of smoke puffs involving direct observation. MacHattie (Canad. Forest Service, Ottawa) reported on experiences with zero-lift balloons as visible indicators of air trajectory. To conclude this session three short papers were presented which involved the measurement of aspects of **PHOTOSYNTHESIS**. Woodman (Weyhaeuser Co., Centralia, Wash.) correlated net photosynthesis rates with environment factors within the crown of a Douglas-fir tree. Schwarz (Environmental Sciences Centre, Univ. Calgary) discussed differences in frost and heat resistance and CO_2 uptake between a mature and young pine tree. Allen reported their experiences of obtaining the CO_2 flux in a Costa Rican Tropical Rain Forest.

The afternoon session was devoted to **CLIMATIC CLASSIFICATION AND ITS POSSIBILITIES FOR FORESTRY**. Longley (Univ. Alberta, Edmonton) outlined some of the values of, and problems associated with, classification of climate, and drew examples from Alberta. Baier and Sly (Canad. Department of Agriculture, Ottawa) then discussed various methods used to calculate agroclimatic parameters, and bio-mathematical models that express quantitatively the effect of

weather and climate on agricultural plant growth, and indicated their potential value in forestry. Reifsnnyder described a refinement for a solar-energy calculator. Holmes (Canad. Department of Energy, Mines & Resources, Calgary) reported the results of airborne measurements of the mesoclimatic effect of the Cypress Hills on the air passing over them. MacIver (Univ. Alberta, Edmonton) used the technique of mobile thermo dew-point recording at selected periods in the day to establish topographic microclimate differences in forested terrain. The session concluded with a discussion, by the Canadian participants, of the scope and feasibility of a forest climate classification for Canada.

In the final general session, MacHattie described the distribution of summer temperatures in the Kananaskis valley where inversions occurred almost every night. Benoit (Univ. Calgary, Calgary) referred to microclimate studies underway in the Drummond Glacier Valley. Hocking (Canad. Forest. Service, Edmonton) reviewed winter desiccation in conifers and stressed the internal and external factors that might be responsible for causing or preventing desiccation. Murphy (Univ. Washington, Seattle, Wash.) reported studies in California to relate overstory thinning to ground-fuel moistures in fire fuel-breaks as a feasible forest fire control method. Marshall (B.C. Department of Agriculture, Victoria) briefly outlined the system used in British Columbia to obtain a topoclimatology as an aid in land capability classification. The meeting closed with a few pertinent comments by MacHattie.

The informal sessions included a visit to an automatic weather station, displays of instruments, viewing of topical films, and a tour of the work underway at the Environmental Sciences Centre. A report was given by Reifsnnyder on Forestry and Forestry Meteorology in Bavaria, especially the work of Baumgartner, Munich. Slides or films of phenomena, such as insect plumes connected with convection, spread of forest fires, recording of dispersion of continuous and instantaneous smoke puffs, and "red-belt" winter-damage to conifers were shown and discussed. Microclimatic research on the top of a mountain in the Alps was reported, and a pilot study to measure the effects of forest irrigation on stem growth rates, internal water stress, and several environmental parameters was discussed.

The Proceedings of the Symposium are to be published in 1970 by the Alberta-Territories Region of the Canadian Forestry Service.