AN ABSTRACT OF THE THESIS OF

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in Forest Engineering presented on December 10, 1984

Title: Comparative Snow Accumulation and Melt During Rainfall in Forest and Clearcut Plots in Western Oregon

Abstract approved: R. Dennis Harr

A study was conducted to compare snow accumulation and melt during rainfall in adjacent forest and clearcut plots in the transient snow zone of the western Cascade Range in Oregon. Snow accumulation differences were determined by comparing the water equivalents of forest and clearcut snowpacks. During rain-on-snow periods, energy balances were analyzed to evaluate the differences in energy transfers acting to melt snow in the two plots. In this way, snowmelt differences can be linked to the microclimatic alterations related to clearcut logging. Snowmelt estimated by energy balace analyses was compared with snowmelt determined by snowmelt lysimeter data and snow survey information.

The forest canopy played a strong role in controlling snow accumulation. Snow trapped in the forest canopy melted faster than snow that accumulated on the ground in the clearcut plot. Snow survey information indicated that the water equivalents of clearcut snowpacks averaged 29 mm, but were up to 74 mm greater than forest snowpacks.

For five rain-on-snow events during the winter of 1983-1984, four of which rainfall amounts were smaller than that called for in the study design, a comparison of snowmelt estimated by the three methods had variable results. Only during the last two rain-on-snow events, of which one was the annual rainfall event, did results from the three methods all show greater snowmelt in the clearcut plot. Snowmelt determined by lysimeter information was more reliable during these events than the previous three events because of improved rainfall sampling.

Snowmelt estimated by energy balance analyses was consistently greater in the clearcut plot. Longwave radiation was the greatest source of snowmelt for all events, contributing 38-88 percent of the total computed snowmelt of each event. Snowmelt attributed to net longwave radiation was 22-56 percent greater in the clearcut plot. However, the combined fluxes of latent and sensible heats accounted for a large portion of the snowmelt differential between the plots. Although the combined fluxes ranked second in importance as a source of heat for snowmelt (6-36 percent of the total snowmelt for each event), in the clearcut plot they were 226-300 percent of the combined fluxes in the forest plot.

During the largest rain-on-snow event (February 11-13, 1984), total snowmelt was 55-111 percent greater in the clearcut plot depending on the method of measurement. The increased snowmelt of the clearcut plot is attributed to (1) greater snow accumulation prior to the event and (2) greater energy inputs during the event.

COMPARITIVE SNOW ACCUMULATION AND MELT DURING RAINFALL IN FOREST AND CLEARCUT PLOTS IN WESTERN OREGON

by

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A THESIS

Submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of
Masters of Science

Completed December 10, 1984

Commencement June, 1985