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Microclimatic Pattern and Basic Biological Responses at the Clearcut Edges of Old-Growth Douglas-fir Stands

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During the last several decades, the forest landscape in the Pacific Northwest has been highly fragmented with progressive and consistent clearcuttings. One of the most obvious and important features of this landscape is forest edges formed between land of different ecosystems. There are unique ecosystem composition, structure, and function at these edges, the so-called *edge effects*. Expanded knowledge of edge effects is needed to predict impacts of forest fragmentation on ecosystems and landscapes, and to develop guidelines for management of biological diversity. Microclimatic patterns and associated biological features have been under study along edges of mature and old-growth Douglas-fir (*Pseudotsuga menziesii*) forests in the Pacific Northwest since 1988. Preliminary results are presented here.

This study has focused on forest edges adjacent to recent clearcuts. Edge exposure (orientation) is a primary variable. At each edge, portable weather stations and sampling plots are established at seven points along a transect extending from a clearcut to the interior (240 m) of the forest during summer and early fall. Temperature and moisture content of air and soil, wind speed, and short-wave radiation are monitored. Tree growth, regeneration, mortality, and stem distribution are measured on the sample plots. Twenty different

edges were studied during 1988 and 1989, in and around the H. J. Andrews (OR) and Wind River (WA) Experimental Forests.

Air temperature, relative humidity, and wind speed appear to be very sensitive to distance from cutting boundary, edge exposure, and daily macroclimate. Temperature and humidity generally return to interior forest level within 120 to 180 m of the boundary. However, edge width may extend for more than 240 m in the extreme case of a hot, windy day in a south-exposed edge or only a few meters on cool, cloudy days. Soil temperature and moisture exhibit a relatively narrow edge width of 60 to 120 m. Seasonal and daily oscillations in soil conditions are also much smaller than those of air temperature and moisture. Radiation pattern is more strongly influenced by forest structure and edge exposure than distance from the cutting boundary. There is a larger affected edge area on west- and east-facing edges (120 m) than on south- and north-facing edges (30 to 60 m).

Biological variables measured at forest edges are generally less sensitive to distance than microclimatic conditions. Some differences are obvious within 30 to 60 m of a forest edge, such as higher tree-growth rates and abundant regeneration of Douglas-fir and western hemlock (*Tsuga heterophylla*), higher tree mortality rates, and reduced regeneration of Pacific silver fir (*Abies amabilis*).

Data collection is continuing with the ultimate objective of developing computer models to show the importance of edge effects in an ecosystem and landscape. The project is expected to be completed in 1991.