pattern in the distribution of litter fall. The results suggest that as stands pass through canopy closure, the site becomes more homogeneous.

We found distinctively different patterns of understory vegetation and litter fall rates under a 12- and a 25-year-old stand of Douglas-fir. When the alternative management of Douglas-fir is intended to encourage the maintenance of biological diversity, we need to consider the dramatic changes in ecosystem processes that occur during canopy closure. Establishing stands with widely spaced clumps of trees is one alternative that may help maintain the important understory component of the forests through a rotation.

Disturbance Succession and Species Interactions around Canopy Gaps in Old-growth Douglas-fir Forests

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When discussing issues of biodiversity in old-growth forests, one of the major contributors to diversity in these forests can be examined: canopy disturbances. The death of one to many trees in a specific area in the forest results in canopy gaps—the dominant disturbance force in old-growth forests. Several studies have addressed the current structure and many processes important in old-growth forests, but few have examined the changes over time in any particular area. The great ages attained by trees in the Pacific Northwest make the relatively short-term research studies difficult to interpret; long-term patterns are missed and the significance of infrequent events may be given more importance than deserved.

Canopy gaps initiate changes in forest composition and structure and are the primary source of forest change between major catastrophic disturbances (Spies and Franklin 1989). Disturbance regimes characterized by small gaps should be described by (1) the size and age distributions of gaps, (2) the birth and death rates of gaps, and (3) the responses of species to the regeneration opportunities existing in gaps of different sizes and ages. Furthermore, the formation of a gap alters the forest around itself, thus changing the future disturbance regime for that area.

Here, the hypothesis is that once a gap is created, disturbance is

centered around it, enlarging and/or lengthening it in one dimension or another. As parts of the original gap begin to fill in from the understory, other parts expand due to mortality in the main canopy. The result is that the forest becomes a shifting mosaic of small disturbance patches representing a wide variety of ages and canopy characteristics.

This research is part of a larger study looking at diversity and the environment that surrounds natural and experimental disturbance in forests of the Pacific Northwest (Spies et al. 1990). By combining detailed spatial analysis of a stand with age and growth information it is possible to reconstruct historic disturbance patterns of a forest. The use of Geographical Information Systems, a computer program, in ecological research makes analysis such as this possible on many different spatial scales. The results of this research will expand our knowledge of disturbance and provide valuable information relating to the biological and environmental responses of species to small-scale disturbance. In these times of forest alteration and the need to assess concerns for biodiversity and commodity production, studies such as this can provide much needed information on possible impacts from small-scale canopy disturbance. As we enter an age of alternative forestry practices, information on environmental and biological responses to small-scale disturbance will help our understanding of reforestation and management needs.

References

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Management Prescriptions for Restoring Biodiversity in Inland Northwest Ponderosa Pine-Fir Forests

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Prior to European-American settlement, surface fires burned dry, lower-elevation forests in the Inland Northwest (present-day United