Mount St. Helens 1980

Botanical Consequences of the Explosive Eruptions

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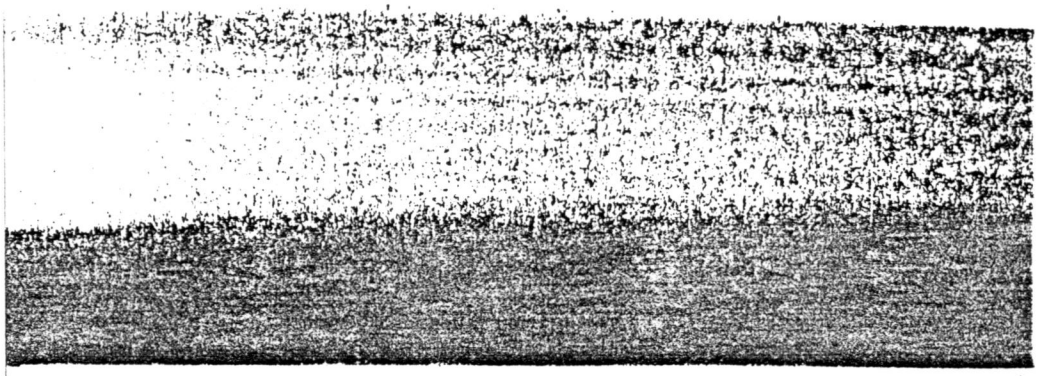

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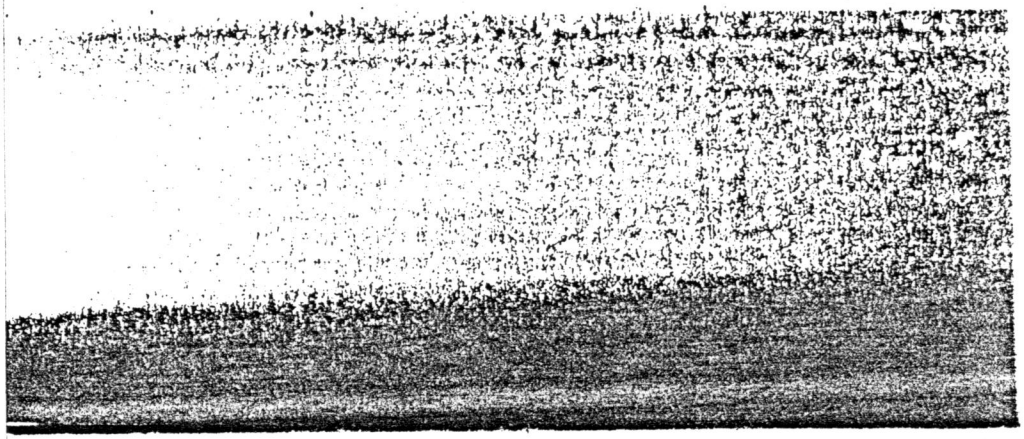
Ecological Effects of the Eruption of Mount St. Helens: An Overview

Frederick J. Swanson

The diverse effects of volcanic activity on ecosystems described in this volume reflect the complexity of the volcanic events associated with the May 18, 1980, eruption of Mount St. Helens. During the eruption, a huge avalanche of rock and snow, a directed lateral blast of rock and superheated steam and gases, repeated pyroclastic flows, ashfall, and mudflows dramatically transformed the mountain and the surrounding landscape. Farther from the mountain, airborne tephra was deposited on the various ecosystems of eastern Washington, northern Idaho, and western Montana. Each volcanic and hydrologic event would be expected to have distinctive impacts on ecosystems and influence subsequent ecosystem recovery in various ways. For this reason, analysis of the ecological responses to the eruption must be based on a detailed understanding of the volcanic and hydrologic processes that initially perturbed the ecosystems. Furthermore, recovering ecosystems undergo rapid physical and biological changes, and interactions among plants, animals, and geomorphic processes are particularly dynamic. Consequently, the response of any one component of a system can be best understood in terms of the overall behavior of the ecosystem and the landscape.

The debris avalanche area presents especially complex problems in sampling recovering vegetation. The surface materials of these deposits exhibit great heterogeneity in terms of the topography, the lithology, and the abundance of residual organic matter. The surface has subsequently been altered by fluvial erosion and deposition and by mudflows. Revegetation has begun at the margins of the deposit where transported soil blocks containing propagules of plants, mycorrhizal fungi, and nutrients are concentrated. Plant recovery has been slow where fluvial processes have repeatedly altered ecosystems on the avalanche surface. Consequently, plant communities are forming a complex mosaic determined mainly by the landforms and geomorphic processes occurring at each microsite.

In the blast zone, complex interactions occur among hillslope erosion processes, living plants, and dead woody debris. Timber felled



by the lateral blast retards sheet and rill erosion of tephra deposits by slowing the flow of water and sediment downslope. Initial recovery, however, has been dominated in many areas by sprouting of belowground parts of residual plants where erosion of the tephra deposits has exposed the old soil surface. Elsewhere in the blast zone, ecosystem reestablishment has been sparse, consisting of a few colonizing organisms or a few residual plants and animals emerging from below ground or from snowbanks present on the day of the eruption. These small oases of organisms, however, are facilitating establishment of small animals and other plant species from seed or spores by providing shade, food, seed-trapping sites, and litter.

Farther from the volcano, airborne tephra deposited on forest and steppe communities has had complex effects on ecosystem interactions among plants, animals, and the altered physical environment. Of particular interest is the long-term effect that the ash layer will have on seed germination dynamics and the buried, delicate cryptogamic crusts of the arid lands of eastern Washington.

A comprehensive investigation of the ecological recovery occurring at Mount St. Helens will provide a unique opportunity to gain a greater understanding of the evolution of ecosystems around other stratovolcanoes of the Cascade mountain range of the Pacific Northwest and elsewhere in the world. In turn, observations of the stages and patterns of recovery of volcanically disturbed ecosystems elsewhere in the Cascade range may be of important value in predicting the course and rate of future ecosystem recovery around Mount St. Helens.