INFLUENCE OF BIOLOGICAL LEGACIES ON SUCCESSION

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ABSTRACT: Survival of indicator plant species was addressed in a long-term study of succession after clearcutting and slash burning in Douglas-fir forests. Very dry or very mist habitats returned to classifiable states more rapidly than less harsh environments. Areas with sparse understory before logging were slowest to return to classifiable states.

Predisturbance ecosystems typically have major influences on the pathways and rates of succession after a catastrophic disturbance. Much of this influence is related to "biological legacies," organisms or organic structures and influences that persist through the disturbance. Indeed, a disturbance can be viewed as an editing process in which selected elements of the predisturbance ecosystem are carried into and influence the recovery process. The importance of biological legacies has been demonstrated in seres after natural large-scale catastrophic events (for example, the eruption of Mount St. Helens) and after typical forest clearcutting.

Important biological legacies include living organisms, structures, and spatial patterns. Living legacies include green plants, animals, seed banks, and fungi. Important animal and fungal components may include pests and pathogens, as well as mycorrhizal fungi. Numerous organisms survived the catastrophic eruption of Mount St. Helens as a result of many different strategies and circumstances (Franklin and others 1985). Dead organic legacies include fine organic matter, as well as structures such as standing dead trees, downed boles (coarse woody debris), and large soil aggregates. Coarse woody debris is critical as habitat for many heterotrophs and for many other ecological functions (Harmon and others 1986). Spatial patterns include soil patterns that are associated with individual trees and patterns in composition and density of understory vegetation associated with overstory canopy density (shading). Western hemlock and western redcedar provide an outstanding example of the contrasting effects of tree species on soil chemical, physical, and microbiological properties (Alban 1969; Turner and Franz 1985). Areas of greater sunlight (gaps) and of dense shading (antigaps) produce contrasting legacies. For example, at the H. J. Andrews Experimental Forest in the western Cascade Range of Oregon, heavily shaded areas belonging to the Tsuga heterophylla series (referred to as the Coptis laciniata, or Goldthread community, by Dyrness 1973) have depauperate urderstories; after clearcutting, tree regeneration is typically more successful on such sites because of the lack of competing herbs and shrubs.

A major issue in vegetation classification is identification of habitat types early in succession. Hence, a biological legacy of particular interest is persisting indicator species. Their survival was addressed in a long-term study of succession after clearcut logging and slash burning in Douglas-fir forests at the H. J. Andrews Experimental Forest (Dyrness 1973; Halpern 1987. A total of 192 permanent 2 x 2 m sample plots were established in undisturbed forest; changes in vegetation have been observed since the plots were logged and burned during 1962-66.

Analyses considered the period of time before plots returned to an identifiable state, with habitat type and disturbance intensity as major variables. Results showed that more extreme habitats (very dry or very mist) returned to a classifiable state more rapidly than modal sites, partially because modal environments depend mre heavily on relative coverage of widespread species for identification (i.e., lack high-fidelity species). Areas that had depauperate understories before logging (antigaps) were slowest to return to an identifiable state after disturbance. Generally, recovery period increased with increasing disturbance intensity.

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