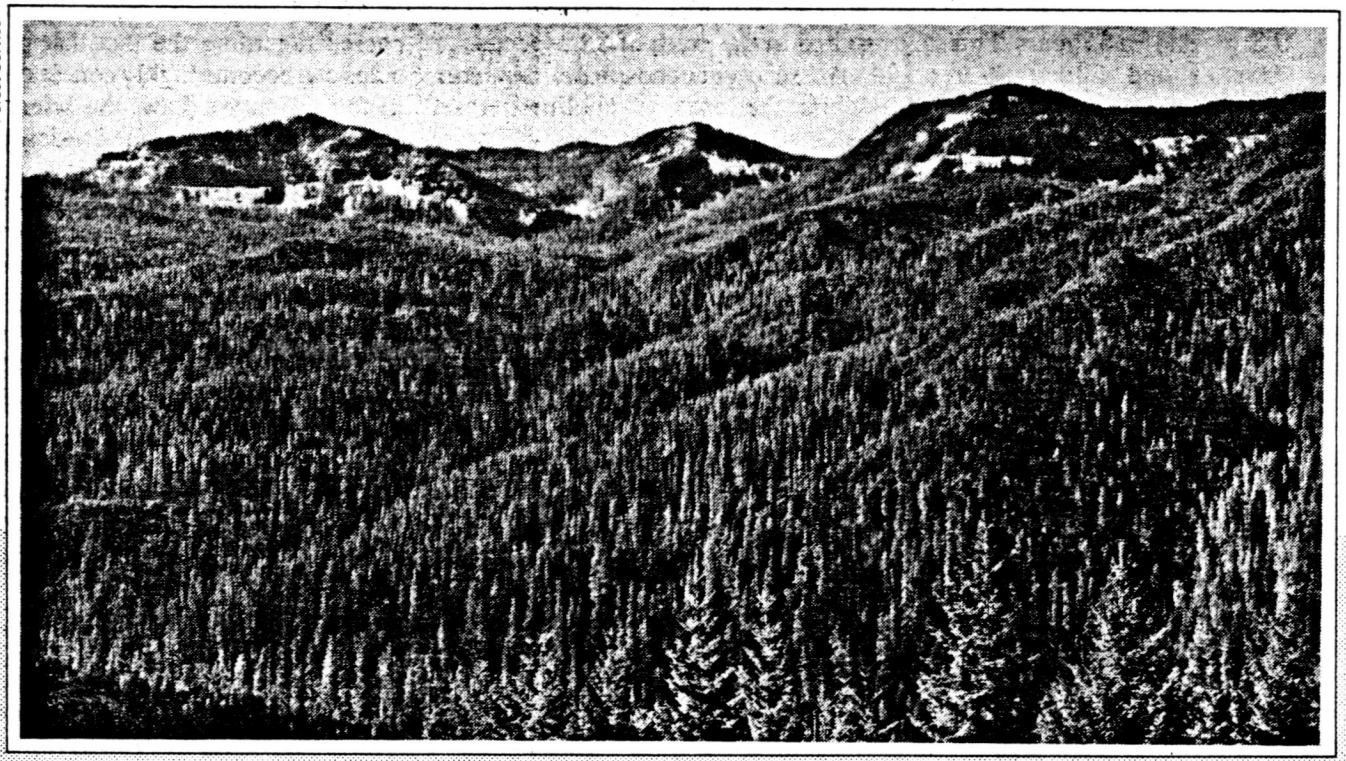
ECOSYSTEM MANAGEMENT

A NEW FORESTRY



Forest Service

by Dieter Mahlein
and Miles Hemstrom

National forest timber management programs are largely designed to harvest and regrow timber the most cost-efficient way. Although logging techniques are sometimes modified to reduce effects on soil, streams, and wildlife, ecological processes remain unaddressed. Recently, a group of land managers and researchers have begun to develop strategies for *ecosystem management* which will consider these processes for lands under timber management.

Ecosystem management (ESM) incorporates into management decisions current knowledge of ecological functions and interactions within and among areas with the goal of maintaining ecological diversity and integrity. Foresters practicing ESM will attempt to recognize multifunctional, interconnected systems instead of focusing on only one resource or the interaction of a few resources.

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The ESM philosophy derives from our current understanding of natural processes and the influence management activities have on them. But our understanding is incomplete; although ESM is aimed at reducing the effects of management activities on the ecosystem, it cannot, of course, perfectly mimic natural processes. However, it will allow us to learn more about the ecology of managed lands and incorporate that knowledge into our management programs.

Ecosystem management will not supplant natural ecosystems in reserved lands, nor will it resolve questions regarding whether or not to enter these and other roadless areas.

For example, recent research has shown that belowground and microbial portions of the ecosystem are much more dynamic than foresters once assumed. Forests in stressful environments, such as high-elevation locations and dry sites, spend over one-half of their energy on root maintenance. Some effects of management are obvious—we know that hot slash fires often lead to increased soil erosion. Their effect on the interaction between roots and beneficial fungi in the soil are more subtle, yet may greatly affect growth and survival of future stands. ESM will eliminate or at least greatly reduce slash burning to better maintain microbial activity and other soil functions.

High diversity and complexity characterize most natural ecosystems. Complexity allows an ecosystem to respond to disturbances with resilience. Human management simplifies nature, reducing resilience: we plant certain tree species to a certain density, space harvest units certain distances apart, follow prescribed rotation lengths, reduce the abundance of snags and logs, and suppress the shrub and herb-dominated early stages of succession.

Ecosystem management minimizes this management-caused reduction of natural diversity, complexity, and stability so that basic forest-ecosystem functions can continue despite human interference. For example, soil productivity will be better retained by limiting the use of heavy equipment in sensitive areas and also by timing activities so that they coincide with periods of minimal soil sensitivity. Leaving large woody debris on the ground will slow erosion, release nutrients through decomposition, and increase moisture retention. Retaining nitrogen fixing species, such as ceanothus and alder, during early successional stages will allow important nutrient cycling to continue on managed land.

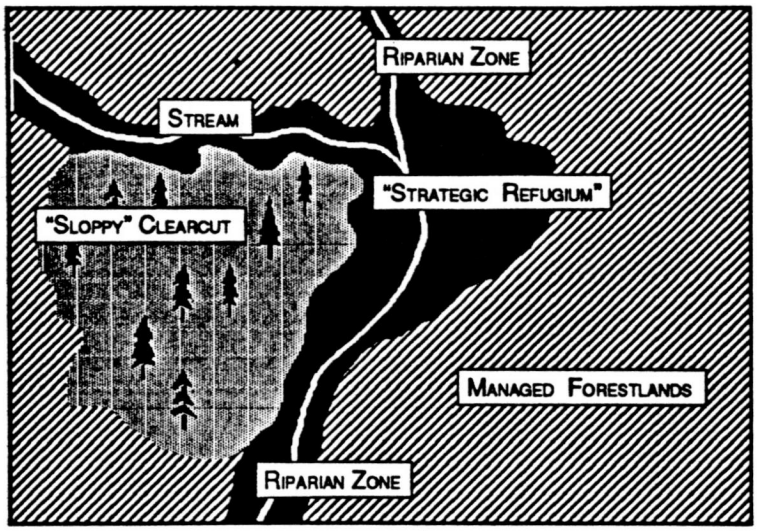
Forest Service

Unlike recent management, clearcuts under an ecosystem management scheme would have irregular edges and abundant down wood and snags.

Maintaining ecological diversity goes beyond basic concern for vegetative diversity. Genetic diversity is an integral part of ecosystem resilience. As much as possible, ESM will preserve the natural, genetic base. This means that native seed plants of all indigenous species will be retained on harvest sites, and planting and thinning operations will be modified to discourage monocultures.

Further, no successional stage will be suppressed to the extent that it loses its natural function. For example, conversion from the shrub and herb-dominated seral stage by reforestation will be slower

than under current management. Although the amount of managed land in a particular seral stage will still vary from natural conditions, all seral stages—including old-growth—will be retained in functional patch sizes.



Travel corridors along streams will link habitat islands. Clearcuts will be "messier" in order to reduce forest fragmentation.

ESM is not limited to the immediate harvest site. The size, shape and dispersion of harvest units across the landscape have a major bearing on the availability of wildlife habitat, the susceptibility of watersheds to floods, and the potential for catastrophic fire or insect damage, among other things. Harvest must be planned to maintain a network of functional fragments.

ESM will reduce fragmentation, better maintaining spatial diversity. For example, clearcut edges will be frayed rather than straight to maintain more natural appearances and functions. Abundant down wood, snags, and occasional live trees will connect irregular patches of trees with one-another and with the clearcut edges, allowing a more natural distribution of plant communities. Individual harvest units will likely increase in size so that blocks of unentered stands will be larger. This will reduce fragmentation of interior forest habitat.

Successional, genetic, and spatial diversity also influence the effects of pathogens on managed forests. Forest ecosystems will be less susceptible to disease-causing agents if diversity is retained at a higher levels. Simplification of ecosystems (such as through establishment of monocultures and fire suppression) reduces a forest stand's resistance to pathogens. Simplification will still occur under ESM, but its severity will be reduced.

Ecosystem management minimizes management-caused reduction of natural diversity so that basic forest-ecosystem functions can continue despite human interference.

Travel corridors, especially in riparian areas along streams, will be designed to allow wildlife migration across the landscape. This means that logging will not be allowed in riparian strips and that the strips must be wider than just the immediate banks, including level ground for easier wildlife travel. The corridor edges should be irregular to reduce susceptibility to blow-down.

Riparian strips will serve as major connections between existing and planned special management areas, such as habitat for old-growth-dependent species, research natural areas, and wilderness. These special areas, in turn, will be part of a system of "strategic refugia," essentially forming "knots" in the network, allowing preservation of plant and animal species dependent on less-disturbed habitat.

In the streams themselves, ecosystem management will retain sufficient quantities of large woody debris necessary for maintaining channel morphology, nutrient balance, and fish habitat. Replacement of large woody debris requires that its sources—large trees in riparian zones—are perpetually available. This will be accomplished through long-term planning and no logging in riparian corridors.

Riparian areas bordering the streams will be the true "catch-all" areas, the arteries of the network system, performing many important ecological tasks simultaneously. Beyond the travel corridor and buffer functions, riparian strips act as effective filters. Research in agricultural areas has shown that riparian vegetation can significantly inhibit travel of nutrients released into streams by agricultural fertilizers.

Riparian strips must be wide enough to block or at least reduce the effects of landslides caused by road-building and logging. They must also prevent stream sluice-outs. Clearly, riparian areas capable of fulfilling these functions will be substantially larger than the current strips. But no other leave areas can fulfill as many tasks.

The reduction in timber harvest necessitated by generous retention of riparian areas is smaller than commonly

Forest Service

Large woody debris left after cutting can slow erosion, release nutrients through decomposition and increase moisture retention.

assumed. Riparian areas are often considered to be the most productive timber growing sites, but scientific proof for this assertion is nonexistent. Instead, empirical evidence suggests that riparian areas have a far lower potential for growing commercial timber species than high-site lands. In other words, riparian areas produce a diverse riparian community which consists mostly of plants other than commercial timber species. It is this diversity and their unique natural distribution that makes them ideal leave areas in managed landscapes.

The first steps toward ecosystem management are being tested in several places in the Forest Service's Pacific Northwest Region. The Blue River Ranger District (Willamette National Forest) has developed new standards for the retention of old-growth components: an average of five to six live trees, 18 inches or more in diameter, are to be left per acre harvested. Most of these must be distributed over the entire unit and cannot be clumped in one place.

At least one soft (partially decayed) snag 25 inches or more in diameter will be left per acre. One sound snag at least 18 inches in diameter will be retained for every five acres, with large, broken-topped snags preferred. To assure a continued snag supply and maintain snags at a level of at least 40 percent of natural density, the time span for snag retention will exceed normal rotation length.

Unless over-riding concerns, such as high fuel loads, predominate, all rotten logs will remain in place. If existing logs number less than 5-15 pieces (depending on piece size), freshly felled logs will be substituted. Again, the goal is to maintain at least 40 percent of the potential natural wood accumulation.

These trial approaches cannot be considered full ecosystem management. The change-over to ecosystem management will be slow, if only because ESM inevitably will reduce sustainable harvest levels. This will occur because clearcuts, although they may be larger, will retain clusters of live trees, snags and down woody debris. In addition, riparian and other leave areas will be expanded and minimally managed.

Ecosystem management similar to the concepts outlined here may be the only way to assure long-term productivity of forest lands. This management approach will not supplant natural ecosystems in reserved lands, nor will it resolve questions regarding whether to enter these and other remaining roadless areas. It is a new forestry strictly for landscapes committed to timber management. It mediates between human demands and nature's complexity to ensure that these demands will not impair the long-term survival of natural diversity and, consequently, ourselves. PW