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Forest Ecosystems: Old Pines and Young Salmon

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Ecosystem management, as a process aimed at sustainable forestry, and *ecosystem science,* as the developing knowledge base for managing forest ecosystems, are gradually gaining acceptance as terms that describe current goals and methods in Pacific Northwestern forestry. Some of this acceptance results from the notion that we have been practicing forestry this way all along - and some comes from changes in attitude and practices due to new insights and techniques. New technologies including GIS (geographic information systems), and high-tech, small scale logging equipment have enabled some long-held management objectives to become practical.

One of the more dramatic consequences of ecosystem science and management has been the substantial increase in interdisciplinary thinking and cooperation in understanding forest ecosystem functions and developing management strategies. Sometimes this collaboration brings together information that was well-known all along *within* disciplines - the foresters knew it or the wildlife biologists knew it, but it wasn't shared *across* disciplines. Other times, one discipline uses its training and experience to consider a problem faced by another discipline. Occasionally, the result is new thinking about forest ecosystem functions and important changes in management techniques. Two recent, local examples come to mind.

Ponderosa State Park in central Idaho is named for its large, old-growth ponderosa pine trees scattered across the developed and natural areas of the park. Primarily because of fire exclusion, the vegetation and wildlife of the park have changed to a plant and animal community that is detrimental to the survival of pine trees. The most obvious ecosystem change is the dense growth of shade-tolerant fir trees that were eliminated in the pre-fire suppression forest by periodic wildfires. As firs grow, they shade out the intolerant crowns of pines, gradually shifting the balance of competition for moisture, nutrients, and growing space, until finally the weakened pines succumb to insects and decay. . Pine regeneration is rare because of the shade and the concentration of rodents in the few unshaded areas.

The park managers and the public decided that the veteran pines should be preserved and that replacement trees are essential to a long-term solution. However, interdisciplinary teams identified several problems with an immediate return to a fire-maintained ecosystem. First, the massive fuel buildup from decades of fire exclusion puts the normally fire-resistant pines at risk. Second, the rooting structure of the pines has changed. Before fire exclusion, there was little duff (needles and other organic litter) on the forest floor so pine roots stayed deep in the mineral soil. Today, pine needles are over a foot deep around each big tree, and below this is a deep organic layer full of shallow pine roots. Growth potential is greater, were it not for the competing firs, but fire now would smolder at the base of the trees, destroy these shallow roots and further weaken or kill the pines. Raking the needles back would reduce the chance of lethal temperatures at the tree trunk, but would still kill these shallow roots. The management team, assisted by Dr. Leon Neuenschwander, UI Professor of Fire Ecology, decided that logging to remove fir trees would reduce competition, restore the historical forest structure, recycle forest nutrients, and make prescribed burning less risky. Prior to burning across larger forest areas, the buildup of needles around the old pines were

CONTINUED ON PAGE 2

burned-off gradually during several winters, by burning the top layers next to the trunks off when snow covers the ground except for the "wells" under the tree crowns. While this gradual vegetation management scheme is implemented, discussion continues about the changes and management of the animal community that has paralleled changing plant community in the park.

Dr. James Moore, UI Forestry Professor and Director of the Tree Nutrition Cooperative, provides another example of thinking about forest ecosystems with dramatic implications. Dr. Moore viewed the incredible biomass of dying salmon in an Alaska stream, and translated this phenomena to conditions affecting the threatened salmon populations in Idaho forest streams. Jim knows through his forest nutrition work that many of our northwestern soils and streams are nutrient poor. Salmon gain most of their growth in the ocean. In the process of spawning and dying in fresh water, salmon transfer large volumes of nutrients from the ocean into otherwise nearly sterile, inland streams. Jim believes that the loss of nutrients to the fresh water ecosystem, from declining spawning runs, must have a great impact on the entire aquatic ecosystem, possibly accelerating salmon endangerment. It is true that it doesn't take that many successfully spawning salmon to provide the numbers of fish to mathematically sustain the population, when other conditions remain constant. However, the loss of nutrients to the ecosystem could impact the size and health of salmon smolts, reducing their ability to withstand downstream migration and other important linkages in their anadromous life cycle. Jim's observations, and his suggestion to artificially fertilize spawning streams, seem to represent new thinking to the fisheries biologists he and I have talked to, and may have far-reaching implications for addressing the critical issue of salmon biology.

These are just a few examples that show there are still a few frontiers to be challenged, and that thinking about the forest as an ecosystem, combined with a greater ability and willingness to communicate, can help move the concept of sustainable forestry into effective practice.

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