Silviculture Can Manage More than Just Trees

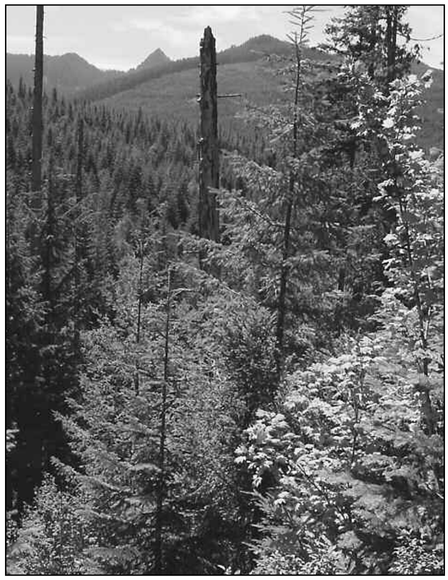
BY ROLF GERSONDE

The practice of silviculture is used to meet many different landowner objectives. Often, non-timber objectives are addressed in combination with timber management when aquatic or terrestrial wildlife objectives are pursued by modifying silvicultural systems or harvest designs. Silvicultural systems that are intentionally designed for non-timber objectives are rare in North America, but are found in other parts of the world, such as coppice systems for forage production, cork production, agro-forestry, and others. The two most common objectives that receive special attention in the Pacific Northwest are wildlife habitat and hydrology. Besides mere modifications to timber management through buffers or reserves, a number of silvicultural approaches have been suggested to meet these objectives and are part of our silvicultural tool box. Summarized below are several approaches from the literature, many of which I apply in my work to promote habitat development in second-growth conifer forests of the western Cascades.

Probably the most powerful tool silviculturists have is species selection during regeneration. The decision of which species to plant will not only influence density management and future regeneration, but also species diversity, habitat provision, and production of non-timber products. Wildlife habitat relationships are often bound to specific tree species, offering forest managers an easy way to increase habitat diversity by growing mixed-species forests.

While most of timber management in the PNW focuses on conifer species, maintaining 15-20% deciduous trees such as alder, maple, cottonwood, and cherry in the forest can increase songbird diversity and regulate forest insect populations. Other benefits of deciduous species are litter input and promoting the below-ground community for decomposition and nutrient supply—in other words, the basis for fertile soil. While forest managers and regulators seem to favor rapid regeneration with commercial tree species, maintaining early seral vegetation has been shown to benefit many wildlife species and pollinators. Some of these benefits can be achieved by establishing stands or patches with lower stocking density. We often find that flowering and fruit production benefit from direct sunlight in canopy openings that can maintain a diverse flora and fauna.

Silvicultural approaches to density management are also used to promote biodiversity and habitat values. The benefits of small- and medium-scale structural variability were shown by the work of A. Carey who tracked wildlife use in various levels of density. He concluded that a mix of structural types and densities benefit abundance and diversity of many native wildlife species, and coined the term "biodiversity pathways" for stand development with structural diversity. Stocking control is indeed our second most powerful tool, regulating growing space to promote growth and vigor of certain stand components (crown classes, species, age classes) or provide growing space for understory vegetation that maintain biodiversity during intermediate stages of stand development. In addition to thinned patches, it is suggested to retain a combination of dense canopy cover for thermal regulation and open canopies for understory development as most wildlife species move between different forest structures for their habitat requirements. Suggestions for size and density differ between forest types, but variability at the one- to ten-acre scale has been suggested for several forest types, and densities for thinning may range from 30-60 percent of full stocking, including small canopy gaps that promote early seral vegetation.



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This young mixed-conifer stand was thinned to increase deciduous shrub and herb cover for wildlife habitat. Snags and large trees are retained for nesting and foraging.

Habitat elements such as large trees, dead or alive, are often integrated in silvicultural practices and referred to as retention. Individual large trees provide habitat for primary cavity excavators, such as woodpeckers, who create habitat for many other wildlife species, birds, and rodents. Retention can include large dead and damaged trees that provide additional habitat and foraging sites. Actively topping or damaging trees to create nesting platforms or cavities can mitigate the lack of large dead trees, but is more expensive than retention. However, where large tree habitat is lacking, these approaches can be used to improve second-growth forest habitat. In the same way, we may thin or release individual trees where logging is impractical and leave the fallen trees for down wood. In many places our second-growth forest lacks the down wood that is beneficial for amphibian migration and in-stream wood, which can be augmented by such cut-and-leave prescriptions.

One of our silvicultural systems that creates structural variability and a

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In the western Cascades, more snow accumulates and lasts longer in canopy gaps than under forest canopy. Later, snow melt will increase summer stream flows, fuel moisture, and amphibian habitat in montane wetlands.

range of habitat conditions is the group selection system where regeneration and intermediate treatments occur in an organized patch arrangement of various age classes. Patch size and arrangement may depend on shade tolerance of the regenerating species, and the frequency of regeneration and thinning depends on desired harvest age and productivity. This system can grow a range of tree species including deciduous trees in a clustered distribution which is desirable for wildlife habitat. Creating a patchwork of canopy layers increases habitat niches for small mammals and bird species, and the flora and fauna they depend on.

Silviculture can also affect watershed hydrology. Forests play an important role in the hydrologic cycle by intercepting precipitation and transpiring soil water. Probably the most important effect of forest cover is modification of the hydrograph, or the annual pattern of streamflow. Compared to other landcover types such as urban or agricultural lands, forests moderate the hydrograph by reducing peak flows and increasing below-ground base flows. The effects are modified by precipitation regime and vegetation type. Studies on forest hydrology in the Cascade Range show that forest cover affects catchment runoff and the effects are relatively short lived due to rapid revegetation. Overall, water yield increases after regeneration harvest, but fast-growing tree species transpire water at a higher rate than mature forest, causing reduced runoff for a longer period. Recovery of pre-harvest runoff levels is thought to occur only after 60-80 years or more. Very little data is available on the effects of intermediate forest density on runoff. But observations suggest that low density overstory cover and moderate growth combine the effects of moderating peak flows and lowering transpiration loss, benefitting runoff patterns and summer streamflow.

A special case of hydrologic effects of forest cover is snow accumulation and melt. Snow studies in the western Cascades have confirmed our observations that more snow accumulates in small forest openings and melts later as compared to under forest cover. Our dense conifer canopy can intercept half of the snow during winter storms in the canopy, where it melts or evaporates. The effect is different on the eastern side of the Cascade Range where topography and forest cover play a greater role in snow melt. These effects are important where forest managers want to maintain snow water storage for summer streamflow, fish habitat, fuel moisture, or amphibian habitat in montane wetlands. Forest cover of less than 50% appears necessary to have a positive effect on snow accumulation. Whereas, in larger forest openings, solar radiation drives spring snowmelt, and also exposes snow to winter rain events that can cause rapid melt and flooding. On the other hand, small canopy openings and low canopy density will promote both snow water storage by reducing interception and shading from solar radiation. The challenge in applying these structural objectives in a silvicultural system is that our rapid forest growth on the western side of the Cascades makes these effects short lived. However, an organized group-selection system or a low density two-aged system are alternatives to even-aged systems that promote snow water storage and forest hydrology.

Perhaps the most important hurdle to implementing silviculture for non-timber objectives is that it can come at a cost to timber production. Reducing stocking or retaining large trees for wildlife habitat may reduce timber production, but on the other hand, it can increase other important ecological services. Even though we have made progress with measuring the value of ecosystem services, wildlife and hydrology seem to have less compelling economic measures and recovering their value may be difficult. For public entities, however, incorporating a bundle of goods and services creates benefits for a broad range of stakeholders and will thus find greater public acceptance. In summary, silviculture has many tools available to meet landowner objectives of which wildlife habitat and hydrology are often key alternatives to timber production. ◆

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