



Continuous Cover Forestry as part of Sustainable Forest Management in the Pacific Northwest, USA

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Continuous Cover forestry (CCF) is not a commonly recognized term in the USA, but the concept and objectives of CCF to “manage forests to provide structurally, visually and biologically diverse ecosystems and deliver multiple benefits to people” is an idea that resonates with both forest managers and the public in the USA. The concept of CCF (often referred to as adaptive management, forest restoration or sustainable forestry) is often applied on public lands in the USA in response to new regulations, for the restoration of forests degraded by insects or disease, to reduce the risk of wildfires, or to improve wildlife habitat and biodiversity while maintaining forest cover. In the Pacific Northwest region of the USA (PNW), strategies to increase stand diversity and enhance biodiversity are a common management objective but the incentives for implementing these management practices vary among landowners and between different ecoregions. For this article, I will summarize how forest management practices have shifted over the past 20 years in response to changing regulations and outline some of the important forestry issues and opportunities that I see in the next several years for forest management in the PNW.

During the 1990s, there were unprecedented changes in the forest management of federal forests of the Pacific Northwest largely in response to the federal listing of the northern spotted owl as a threatened species under the Endangered Species Act (USDA and USDI 1994). The focus of forest management shifted from sustainable timber with a focus on Douglas-fir (*Pseudotsuga menziesii*) wood production (Haynes 2007) with minor harvests of western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*), to an emphasis on endangered species (Spies et al. 2007). For federal forestlands west of the Cascade Mountains (westside) this management change was implemented in 1994 with the Northwest Forest Plan (NWFP). A main goal of the NWFP, along with conserving biodiversity and owl habitat, was the need for a sustainable supply of timber to maintain the stability of local and regional economies (USDA and USDI 1994). However, harvest levels have never reached the sustainable level proposed in the plan, and most of the harvest has occurred using partial harvesting (i.e. thinning of plantations) with clearcutting almost completely abandoned in federal forests (e.g. Forest Service-USFS and Bureau of Land Management-BLM). Forest management practices on private lands in the PNW have become more intensive with shorter rotations, even-aged management using clearcutting, herbicides to reduce competing vegetation and forest plantations of predominantly Douglas-fir (Haynes 2007). On westside federal forests, management has shifted to thinning of conifer plantations with the development of multi-storied, uneven-aged forests (Fig 1-3), or multi-species forest including hardwoods such as red alder (*Alnus rubra*, Fig 4). These forests have greater stand structural and species diversity than even-aged conifer plantations but both long-term management and the sustainability of commercial thinning in these forests are uncertain beyond the next few decades without establishing new Douglas-fir stands using clearcutting and planting.



Figure 1. Heavy selection cutting of a mature Douglas-fir (*Pseudotsuga menziesii*) stand in SW Washington with about 10 trees per acre of remaining overstory. Ten to 15 years after cutting the understory trees are regenerating to Douglas-fir, western Hemlock (*Tsuga heterophylla*) and some red alder (*Alnus rubra*).



Figure 2. Commercial thinning of 50 year-old even-aged Douglas-fir (*Pseudotsuga menziesii*) stand in western Oregon. Understory trees are mostly regenerating to shade tolerant western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*) and some Douglas-fir.



Figure 3. Thinning of an eighty-year old Douglas-fir (*Pseudotsuga menziesii*) stand in an experimental research area of western Oregon Cascades mountains. Thinning experiment has variable thinning treatments, this treatment removed about 25% of overstory stand across tree diameter classes.



Figure 4. Mixed 80 year-old Douglas-fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*) and red alder (*Alnus rubra*) stand on Oregon coast. Stand was thinned about 20-30 years ago and currently has an abundant understory of ferns, herbs and shrubs.

East of the Cascade Mountain (eastside) drier forests with Ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), and mixed conifers including dry-site Douglas-fir, western hemlock and true firs have an equivalent set of regulations to the NWFP, but with a different set of management guidelines developed for the eastside forests of Oregon and Washington. The USFS and BLM were tasked to “develop a scientifically sound and ecosystem-based strategy for management of Eastside Forests” and this effort came to be known as the “eastside screens.” These eastside screens were implemented in August 1993 and include the following major provisions: 1) prohibit timber sales within late and old structural forest stands below an historic range of variability; 2) require that there be no net loss of late and old structural forest stands; 3) prohibit logging of live trees over 21” (i.e. 51 cm) dbh. These forests historically had fires occurring every 10-20 years and several decades of fire suppression, lack of management and high grading of older stands had left many forests with high levels of insects and disease and overstocked stands with a high risk of catastrophic fire that was unacceptable to the public. These eastside forests have had several large and intense wildfires that have killed all trees in large landscapes and have resulted in badly degraded soils (Fig 5).



Figure 5. Untreated dead stand (no thinning before wildfire) of mature conifers including Douglas fir (*Pseudotsuga menziesii*), true firs (*Abies* spp.) in the Cascade Mountains of eastern Oregon after wildfire. Intense wildfire in overstocked stand has killed all trees and the scorched soil will be difficult to regenerate.

Management in these eastside forests includes thinning smaller and mid-sized trees and saving the largest overstorey canopy trees, followed by prescribed fire to reduce shrubs and vegetation to keep fire on the ground below tree canopy levels (Fig 6-7). Stewardship contracting includes management practices designed to improve forest restoration and includes road and trail maintenance to restore water quality, thinning of stands to promote old-growth characteristics and habitat for wildlife or fisheries, using prescribed fire to improve stand structure, and reducing fire hazard. Forest management has largely been implemented using stewardship contracting with multiple objectives including improving forest health by removing dead or diseased trees, forest restoration to reduce risk of catastrophic wildfires, some timber production and improved recreation, wildlife and aquatic resources. Prescribed fire and reintroducing fire back into the ecosystem has been an important part of management to more closely mimic natural disturbance regimes. In many stands, this regular practice of thinning followed by prescribed fire has been successful in restoring healthy forests that are safer from destructive and intense wildfires.



Figure 6. Stand thinned 10 years before wildfire in predominantly Ponderosa pine (*Pinus ponderosa*) and some smaller Douglas-fir (*Pseudotsuga menziesii*), and grand-fir (*Abies grandis*) in eastern Oregon. Thinning reduced stocking and wildfire stayed on ground without fire reaching tree canopy and most overstorey Ponderosa pine survived. Some smaller dead trees were later thinned after wildfire.



Figure 7. Ponderosa pine (*Pinus ponderosa*) stand in eastern Oregon using prescribed fire to maintain natural fire regime and health of forest and reduce risk of wildfire. Stand was thinned first removing smaller trees and prescribed fire will burn lower bark but not kill larger Ponderosa pine trees.

In recent years in the PNW region, some new factors such as stewardship contracting, the formation of forest collaboratives and application of the concept of ecosystem services appear to be effective for implementing more projects and creating more complex forests (analogous to CCF). Forest collaborative groups involve conservation groups, economic development agencies, watershed councils, private landowners, and different federal and state agencies. These collaborative groups use a broad-scale approach to get consensus from stakeholders for active forest management practices such as thinning, prescribed burning, and other management at landscape scales. The concept of ecosystem services (Daily, 1997) has emerged as a way of framing and describing the comprehensive set of benefits that people receive from forests and landscapes. The US Forest Service has been exploring use of the ecosystem services framework as a way to describe forest values provided by federal lands and attract and build partnerships with stakeholders to implement desirable projects. Overall, in the PNW region of the USA, I foresee over the next several years an incremental increase in harvesting on federal lands and movement toward a consensus based approach that includes more forest restoration. I also see encouraging signs in the development of an integrated approach to managing forestlands with many federal, state, and private landowners working together to improve forest management across broad landscapes. In addition, an ecosystem service approach can help agencies identify why particular management actions are needed and the quantity or quality of services these management activities provide. In summary, the management of federal lands appears to be moving more toward a consensus-based approach that will provide a broad suite of values that may resonate more effectively with the public than even-aged silviculture that uses clearcutting and focuses on only timber.

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