Restoring Fire to Mixed Conifer Forests in the Northern Cascades

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Many of the ponderosa pine (*Pinus ponderosa*) mixed conifer stands in the Methow Valley of north-central Washington have developed understories of Douglas-fir (*Pseudotsuga menziesii*) as a result of fire exclusion. Most of the forest floor has not yet become cluttered with dead woody fuel. Instead, the live biomass has increased and created more ladder fuels (branches near enough to the ground to carry a surface into the crowns). Consequently, crown fires can be initiated by fires of lower intensity. There is an increase in dwarf mistletoe (*Arceuthobium* spp.), root rot, and other associated pathogens. Our challenge as land managers on the Okanogan National Forest is to reduce the tree biomass and stems per acre and adjust species composition to more historic levels while restoring fire to these stands.

Clearcutting and other regeneration harvest methods have been selected in some stands. The fire history for these areas was determined to provide both guidelines for fuels treatment alternatives and indicators of what Coarse Woody Debris (CWD) levels are appropriate. Past practices called for felling of small unmerchantable trees called whips. We now leave whips standing and kill them when we burn. This makes them available for wildlife use, and will contribute to desired CWD loadings in the future.

A similar procedure is followed in areas where partial cutting has been selected. First, fire history is determined. Then desired conditions are developed based on the fire history and ecotype (site type). These desired conditions become objectives for the stand, specifically stand density, species composition, and CWD levels. These objectives are then used to develop the burn prescription.

The development of the burn prescription considers the time of year that wildfire typically occurred in the stand. This helps determine the appropriate intensity of fire to prescribe. Duration of flaming and smoldering stages of burning are important considerations for fire effects. In some cases, burns have been ignited under damp conditions, with subsequent ignition of unburned fuel concentrations during a dryer period. These have been very successful in achieving more random fire effects. Other considerations are risk of fire escaping or smoke intrusions. How good are containment lines? Is mop-up necessary to reduce risk of escape or smoke problems?

On one 200 acre unit, the logging method used was overstory removal. In addition, it was planned for pre-commercial thinning. The concern from a fuels standpoint was the slash created by thinning. The thinned trees were 30-40 feet tall and 3-6 inches in diameter. Following the harvest, a field review produced a new plan. The saplings and poles were determined to be undesirable for future crop trees due to stagnated condition and presence of dwarf mistletoe. We decided to use prescribed fire to kill the present stand, leave the mature overstory trees for seed source, create a good seedbed with fire, and begin to restore fire to the ecosystem.

Fire was ignited on June 24, 1993, by aerial ignition. First a helitorch (a device suspended from a helicopter which dispenses a burning petroleum solution onto the treatment area) was used to establish a good, burned-out control line below the road, and fire lines were ignited by hand. A sphere dispenser (a helicopter-burn device that drops small incendiary devices) was then used to ignite the remainder of the unit. All weather and fire conditions were well within the burning prescription. Humidities during ignition ranged from 46 to 60 percent. The humidities dropped to a minimum of 25 percent after ignition was completed. Temperatures ranged from 50 to 70 °F., and wind speeds ranged from 0 to 8 mph. Fine fuel moisture ranged from 6-9 percent, with flame lengths averaging 5 feet. Fire behavior was primarily a creeping ground fire with 4-8 foot flame lengths in heavier fuel concentrations. More torching occurred throughout the day as the relative humidity dropped. There were only a few short-range spots, and these were contained immediately by holding crews.

As a result of this burn, the desired mortality of saplings and pole-size trees was accomplished. Some additional felling of surviving small trees will be needed. Site preparation for natural regeneration was accomplished. There was good retention of the seed trees. Not all existing snags were consumed, and more snags were created by the fire. A few openings were created, and other existing ones were enlarged. While five acres were planted, natural regeneration is becoming established over most of the area.

The conclusions reached as a result of this project are that prescribed fire was successful in killing the majority of the undesirable understory trees. Additional thinning may be required. The large diameter ponderosa pine and Douglas-fir seed trees had adequate survival, and natural regeneration appears to be adequate. This application of several ignition methods, combined with mechanical treatments such as felling of some understory trees, was a highly successful project. We restored the desired conditions, creating opportunities for subsequent maintenance using low intensity, non-lethal fires.

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