Integrating science and experience into silvicultural prescriptions and forest research

Summary of June 14-15, 2007 workshop

Gifford Pinchot National Forest, Vancouver, WA

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Introduction

The Central Cascades Adaptive Management Partnership, which includes the Eugene BLM, Willamette National Forest, PNW Research Station, Oregon State University, and the H.J. Andrews Experimental Forest, has a history of bringing together researchers, communities, and resource managers to improve the development and transfer of forestry knowledge. This partnership between science and management concentrates on identifying knowledge gaps where science could help solve management problems; leading to our ultimate goal of creating science that is relevant to the needs of on-the-ground practitioners.

With this intention in mind, we convened a workshop in mid-June 2007 to explore current and emerging issues related to silviculture—the basic foundation of many types of forestry management activities. Today, devising silvicultural prescriptions in the larger context of multiple land uses and reduction of wildfire risk creates a difficult decision space for land managers; a situation made even more difficult when high-quality science is not available. Furthermore, finding ways to accomplish silvicultural goals that are financially viable as well as socially acceptable is crucial, because even the most scientifically advanced management plan is useless if we cannot implement it.

The purpose of our workshop then, was for managers to bring discussions of current issues in silviculture to the scientists who might be able to inform them through existing studies, models, and management tools, or through future research. The two-day workshop was deliberately structured to be practitioner-led, with scientists as the audience, so that the scientists could listen to the problems faced by those in the field. On day one, six silviculturists presented their prescriptions, highlighting the constraints they were under, the assumptions they used, the science that guided them, and any tools that helped them succeed. This allowed practitioners to share ideas with each other, and gave scientists a chance to consider how their work could meet the needs of those in the field. Each presentation was followed by a facilitated discussion with the audience of questions raised. Day two provided a chance to reflect on each project through more in-depth discussion. For each project, a researcher and a senior silviculturist were assigned to lead a conversation with the group about possible sources of information and tools, current knowledge gaps, and potential roles for practitioners and researchers in developing a base of knowledge and tools to meet local or regional needs. The goal of the second day was to produce a list of researchable questions that would help fill current information needs.

Summaries of the six presented prescriptions

1. Cat Creek Thinning (Gifford Pinchot National Forest, Cowlitz Ranger District), presented by Andrew Larson from University of Washington, and Derek Churchill of Conservation Northwest

This 45-acre prescription, originating from a local stewardship group called the Pinchot Partners, was designed as a demonstration stewardship project. The goal was to accelerate late-successional conditions (large trees with complex crowns, decadence, a diverse plant community, multiple canopy layers, and horizontal heterogeneity). The site was in the western hemlock/Oregon grape plant association with moderate site productivity. It had been clearcut in 1957 and then broadcast burned and planted. Pretreatment conditions were Douglas-fir dominated, with lots of big coarse wood, quite a few legacies, residual cedars, and root rot beginning to create gaps—overall, a pretty diverse stand. The design focused on increasing crown class differentiation, accelerating

growth and establishment of advanced regeneration and understory, and preventing loss of species and structural diversity.

The prescription was to thin proportionally from the middle, taking mostly Douglas-fir. They did not take anything larger than 15 inches dbh (diameter at breast height, 4.5 feet above the ground); up to 25% of the "small stuff" was left. They put in skips and gaps around biodiversity hotspots, and also included additional skips and gaps that were approved by the sale administrator. To retain existing heterogeneity, they removed 50% of the trees between 7 and 15 inches dbh in a proportional thinning. They used the following pairing method to select trees: within each pair, they chose the one that was not a wildlife tree, or they chose the smaller tree. Since modeling variable density thinning is difficult, they went with averages (and used good stand data).

This was an "unusual" and complex contract, which could not be done through the standard FS contracting process. The contract did not sell the first time they put it up for bid. After improving their cover letter to make it clearer, it sold.

2. Curran Junetta Thinning (Umpqua National Forest, Cottage Grove Ranger District), presented by Suzanne Schindler, District Silviculturist

This project included 21 units in a planning area of 7000 acres. All were 50-year-old managed stands that had been clearcut in the 1950s. The objective was to reduce tree density in second-growth timber (to reduce fire risk). The prescription was for commercial thinning of 1,236 acres using helicopter, ground-based, and skyline logging. Gaps were located based on the following criteria: ¼-acre gaps were dispersed in 11 of the units, and ½-acre gaps were dispersed in 4 of the units. These ½-acre gaps were also located at the limits of access where skyline yarding was prescribed. The silviculturist reviewed marking guides, and used designation by description (DxD) with the presale crew prior to marking.

3. Late-Successional Reserve (LSR) Thinning (Eugene Bureau of Land Management), presented by Rich Kelly, Silviculturist

This prescription was developed for a planning area of 24,400 acres consisting of 20-30 year old stands that were not commercial, but in need of thinning. The objectives were to reduce density and develop snags and coarse woody debris. Since this project was concerned with young stands, it did not rely on traditional silvicultural practices. The idea was to increase variability of tree spacing in 75% of stands, so tree densities would range from 40 to 110 trees per acre within 10 years. The actions taken were: to thin approximately 1/3 of the stands to an average residual density of 40-60 Douglas-fir trees per acre, to thin approximately 1/3 of the stands to an average of 60-80 Douglas-fir trees per acre, and to thin approximately 1/3 of the stands to an average of 80-110 Douglas-fir trees per acre. This was implemented using tree girdling to achieve a variable-width spacing for the Douglas-fir. They did not take larger trees (over 16 inches dbh), or trees less than 6 inches dbh. They did not girdle species other than Douglas-fir, trees with green limbs to the ground, trees that were leaning, or trees with broken tops. In 1-2 years, the girdled trees will die and will break and fall in 5-10 years. This type of non-traditional approach can be controversial, and did raise some questions, such as "What differentiates commercial from non-commercial? Are single entries better than multiple entries? How can we create coarse woody debris, and what type of longevity will it have?"

4. Ellsworth Creek Project (Ellsworth Forest Preserve and Willapa Bay National Wildlife Refuge, Washington), presented by Bill Lecture, The Nature Conservancy (TNC)

This project involves large-scale forest restoration in the coastal Sitka spruce forest zone. The 7400-acre Ellsworth Creek drainage was managed primarily as an industrial forest prior to being purchased by the TNC. The goal is to put the Ellsworth Creek Preserve on a developmental pathway toward late-successional forest. One major concern is to help the forest develop wind resistance. Other desired conditions include ecosystem resilience, spatial and temporal variability, functional landscape linkages, and habitat for late-successional forest species. With wind being the dominant disturbance factor, the recommendation was to thin lightly and frequently. 6000 acres of the Ellsworth Creek Preserve are available for active management after setting aside ecological reserves, limited-entry buffers, marbled murrelet habitat, and riparian buffers. Current challenges

include: cost effectiveness, differing objectives among landowners, considerations of climate change, and finding a way to incorporate natural processes into restoration. To improve resiliency, they are encouraging Douglas-fir. They have found there is nothing they can do to keep hemlock out.

5. Railsiding Thinning (Sol Duc Valley, Olympia National Forest), presented by Verne Farrell, Silviculturist

In this project, the goals were to develop terrestrial habitat, to demonstrate management of hemlock "carpets," to allow retention of full crowns and encourage diameter, to open up the understory and reintroduce herbs and shrubs, and to develop a stand with three canopy layers. The pretreatment stand condition was a variable understory, with 5-20,000 trees per acre. The prescription was to thin to an average spacing of 16 feet, from below. The assumptions were that once hemlock is established it can be thinned mechanically, that two canopy layers plus an understory would be able to prevent a second pulse of hemlock, that thinned understory hemlock would be able to thrive without lots of "wet noodling", and that herbs and shrubs would be able to flourish in thins. The area was thinned in two stages, first in 2001, then in 2004. Potential problems included the contractors no understanding the prescription (inadvertently cutting shrubs, etc.), slash, and wet noodling. Overall results of the treatment were the elimination of the hemlock carpet, a few mid-story hemlocks and vine maples, a few wet noodles, no pulse of hemlock regeneration, and much more ground vegetation.

6. 700 Road Thinning (Cedar River Municipal Watershed, Washington), presented by Rolf Gersonde, Seattle Public Utilities

The Cedar River watershed is part of the water supply for the city of Seattle, and also includes habitat for threatened salmon. Important objectives for this prescription therefore included safe and secure drinking water, and conservation of important fish habitat. Pretreatment forest was a 65-year-old cohort of western hemlock, with densities of 200-400 square feet of basal area per acre. The project was designed with stakeholder involvement, including local tribes, conservation groups, oversight committees for the watershed, and local citizens. After a public involvement workshop, the project took a

year to design. Public comments pushed for yarding fewer trees, creating more gaps, thinning conservatively, and not cutting big trees. In the end, 230 acres were thinned. Yarding corridors created gaps, and smaller skips and gaps were located by the operators. Operator certification was done beforehand to ensure that operators could "read the fine print," and fully understood the prescription. Only one successful bidder could implement downhill yarding. The project designers used a light model to create variability, and the Topex model to calculate topographic exposure and effect of tree position relative to gap edges on diameter growth and average crown width. They found that creating gaps had a greater effect on creating large trees than thinning.

Common themes among 6 presented prescriptions

Research needs:

- **Natural processes vs. management.** What key natural processes are delaying desired future condition? How do processes interact as you begin active management? Can management accelerate late-successional conditions? How do you set a stand up to progress toward desired future condition on its own? What is the "normal" disturbance regime? What is the relationship between stand structure and susceptibility to natural disturbance?
- **Variability.** How to retain existing heterogeneity? How do you quantify heterogeneity? It could be really useful to take a crack at quantifying variability (histograms? Coefficient of variation?). When and where do you try to introduce it? Given natural disturbance processes, does it even make a difference what we do?
- **Gaps and skips.** A lot of studies include gaps. There could be some meta-analysis or composite analysis. Could do new work on composition of species. Does spatial arrangement of gaps matter? Where do we assess response? To aggregate or disaggregate? How does wildlife respond to gap patterns? Why do we make all gaps the same size? There's no natural disturbance analog to a naked hole in the woods. What do gaps have the potential to do? What are some different ways to introduce gaps? (marking, having contractor do it, ID dominant

tree). Also, what can we leave in them (i.e., what are the effects of within-gap diversity on use?)

- **Snags and coarse woody debris.** How to create cwd? Do we grow and pulse? Or create next time? What are appropriate levels of snags? Cwd? What are their longevity and function? What is cwd impact on understory response?
- **Modeling.** Test existing ones, develop new (e.g., growth rates). ORGANON and FVS don't look at crown complexity or epicormic development. Some need validation. FVS tends to underestimate regeneration in spruce. How can SEAPROG be improved with new data to predict regen better?
- **Single vs. multiple entries. C**ould look at biological, also social and economic impacts. In managing hemlock carpets, how can repeat entries be minimized? Can we quantify the balance between keeping shrubs/herbs in the midstory and not hemlock? Could use an evaluation of harvesting systems for second entry. What is the role in 2nd entry of harvesting corridors: reuse or shift?
- **Girdling.** What effect does girdling have on tree species by diameter classes? (mortality rates, effect of girdling on fuel pool, packing ratio – follow up with fire). This could be an interesting modeling question: how does girdling affect fuel load, understory response?
- **Climate change.** The LTER site at Bonanza Creek in interior AK was brought up. Also a USGS national phenology network, various modeling studies, and the Wind River NEON site.

****These questions were brought up, but got mentioned less frequently**

- How do thinning regimes change snow retention patterns?
- Info is limited on spruce development in OR/WA. Someone could look at epicormic branching on spruce.
- How to measure impact of thinning on water quality? At what scale? How to monitor?
- Develop a biodiversity index for thinning? Could give decisionmakers a way to compare elements.
- Need better estimates of operating costs. (Research Note is coming out)

Tools currently being used:

Models (FVS, light model, Topex)

Experience

Aerial photos

Journal articles

Stand exams, stand assessments

GIS maps

Reforestation records dbase

Tools that could be used, or tools under development:

- There are studies in progress quantifying stand conditions, stem map plots, overstory/understory relationships
- LIDAR will be able to give us specific types of stand information (crown metrics, spacing, veg work)
- There is work being done in modeling (including updates to FVS)
- BLM density management study
- Spies and Gray's gap study

Barriers encountered:

- Difficulty in modeling variable density thinning
- Could use good stand data, but don't always have the $$ for stand exams, and trouble arises when extrapolating bits of data across stands
- Same with marking trees – need ways to implement Rx without high cost
- Differing objectives between landowners
- Unclear how to incorporate natural processes into a prescription
- Challenges in contract compliance with FS – need flexibility to try new things

Current issues and/or new ideas:

- Stakeholder involvement – including implementers as stakeholders is an innovative step. Important and unusual. Helped us question our assumptions.

- Cut vs. girdle. Cutting creates habitat: girdling is cheaper to do. Girdling makes for a slower release of fuel load and leaves partial shade.
- DxD – spacing guide, works well when don't have $ for marking, based on stump height. Biggest tree is left. Required by NFMA.
- DxP – straight DxD gets you a uniform understory light environment, not variable, although you can make some trees "invisible," and then you can mix it up. Puts responsibility on purchaser. Authorized only in stewardship contracts.
- Single vs. multiple entries – what is best approach? There's a reluctance to plan for repeated entries, but on the other hand, maybe the likelihood that we will allow natural disturbance processes to happen unhindered is slim. Maybe we need to admit we have to accept multiple entries.
- Logic path is our legacy. Document your intentions when you write the Rx. Where were you trying to go? Estimate targets, uncertainties, go back and revisit conceptual model. Keep these records as part of your project reporting.
- Thinning is an anthropogenic disturbance. We have to act in a deterministic, efficient, systematic way. We aren't stochastic. How can we be messier without costing too much?
- Sometimes we disregard place-based knowledge (networking, retired people, operators, fuel specialists).

Summary

The intent of this workshop was to reap a better understanding of research needs and opportunities related to silviculture. But we also want to create a partnership between research and management communities and encourage a continuing dialogue. Not only does this give researchers a better sense of the pressing concerns of practitioners, but the practitioners themselves get a chance to hear from each other to solve common problems, share lessons learned, and—hopefully—devise new ways to approach silviculture. For this ongoing effort to succeed, we need to keep the conversation going. **Please contact us with your feedback, comments, questions, or suggestions:**

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