Group Selection Cutting in Mature Douglas-fir Forests

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Summary

This publication is part of the Alternative Forest Management series. (https://extension.oregonstate.edu/collection/alternative-forest-management-series)It describes a case study on the group selection method, a management style that mimics the natural gap creation that takes place in old-growth forest stands as a result of wind throw, landslides, and root-rot pockets. The result of group selection harvest is a wide range of quality wildlife habitat types all in one stand.

Overview

Group selection is a way to partially emulate older forest structure while still allowing for significant timber production. Under this multiaged management approach, the forest is regenerated by cutting small patches within the matrix of the mature forest (Figure 1). This management style mimics the natural gap creation that takes place in old-growth stands as a result of windthrow, landslides, and root-rot pockets. As with natural gap creation, the result of group selection harvest is a wide range of habitat types, including early successional, edge, and mature forest, all in one stand.

Group selection harvests, however, can be much more complicated than traditional clearcut harvesting. Harvest areas must be carefully marked, with thought given to the patch size, volume removed, and equipment access now and in the future. Logging is complicated because leave trees in the matrix need to be protected from the trees that are felled and skidded to landings. Subsequent harvest must also provide access to other parts of the stand while not destroying regeneration that resulted from the previous harvest. Encouraging and maintaining regeneration is also trickier because herbicide application can be logistically difficult, and planted seedlings must compete with the much larger trees surrounding the opening for light, water, and nutrients.

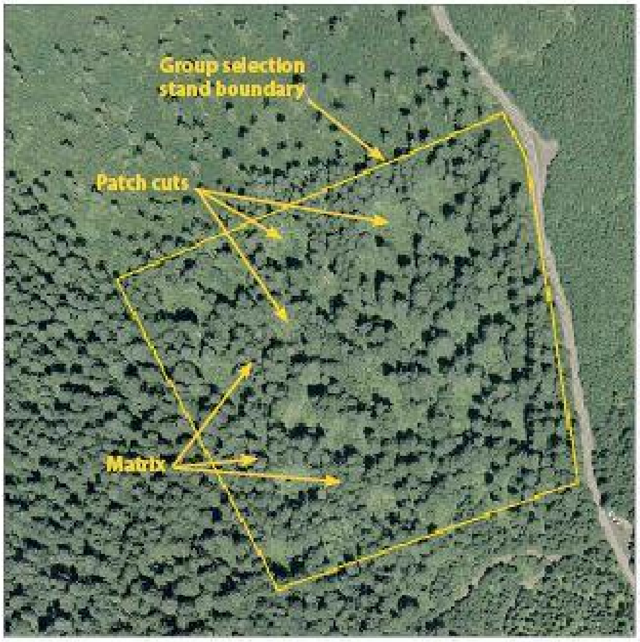

Figure 1. Aerial photo depicting group selection patch cuts and the mature, uncut matrix 20 years after harvest.

Credit: Tristan Huff, © Oregon State University

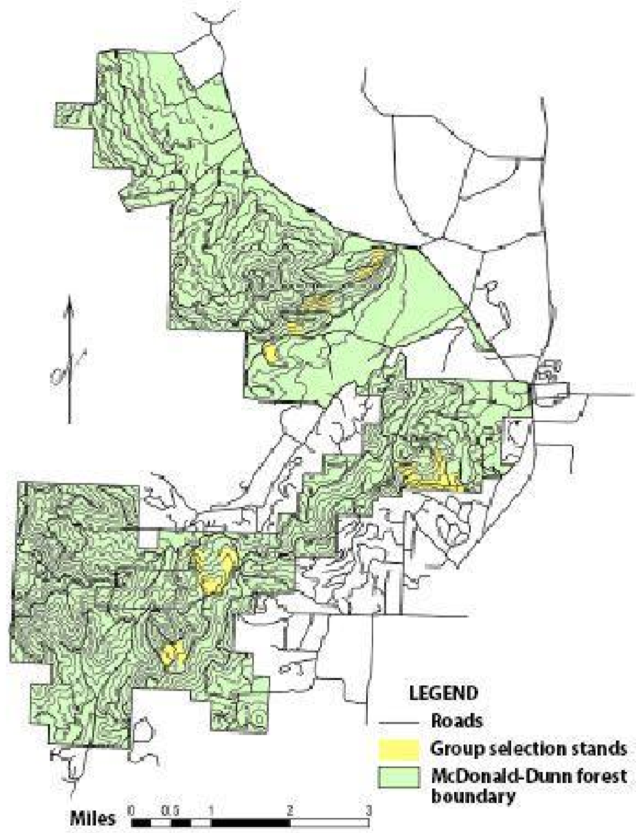

Figure 2. Location of group selection stands within the McDonald-Dunn Forest northwest of Corvallis, Oregon.

Credit: Tristan Huff, © Oregon State University

History of the McDonald-Dunn Forest

The McDonald-Dunn Forest has a long history of human influence. As far back as 10,000 years ago, the area was home to the Luckiamute and Kalapuya Indians. These tribes regularly burned to create a relatively open landscape (although riparian areas remained forested, as did scattered patches of Douglas-fir in the foothills of the Coast Range). As the area now called the McDonald-Dunn Forest was homesteaded, prairie and oak savannah were converted to grazing, wheat, and orchards.

As OSU's College of Forestry gradually acquired the properties that now comprise the McDonald-Dunn Forest, open areas were afforested through planting as well as through natural regeneration. More than three-quarters of the area we consider in this case study is old prairie and oak savannah that has been afforested.

In 1989, the OSU College of Forestry Integrated Research Project (CFIRP) was initiated to help researchers understand the trade-offs among timber production, wildlife habitat, and aesthetics associated with alternative silviculture methods. As part of this larger study, 14 stands were designated for management using the group selection method (Figure 2).

Stand and forest conditions

Stand composition and productivity

The 14 group selection stands considered in this case study range in size from 6 to 12 acres and represent a wide range of age classes and site characteristics. Species composition was fairly similar across the sites. In 1989, prior to harvest, these 14 stands ranged from 59 to 136 years of age. Soils are predominantly comprised of the Dixonville, Jory, Philomath, Price and Ritner series, which are generally deep, well-drained, silty clay loams derived from basalt parent material. Slopes varied among stands; 10 stands were suitable for ground-based logging, while four were steep enough to require cable logging equipment. Prior to harvest, Douglas-fir made up 83 percent of the basal area of these stands, with hardwoods (14 percent) and grand fir (3 percent) comprising the remainder.

Site productivity ranges from a site index of 101 to 121 feet (50-year base age).

Insects and disease

There are no significant insect or disease issues in these stands.

Desired stand structure

In the summers of 1989, 1990, and 1991, a third of each stand's volume was harvested from multiple, approximately half-acre patches. Following harvest, 2-year-old Douglas-fir seedlings were planted in order to establish a new cohort in the openings. A second entry is planned 20 to 30 years after the initial entry, in which another third of the stand will be harvested, again using half-acre group selection openings. After another 20 to 30 years, a third harvest will remove the remaining matrix forest. By this time, group selection patches cut in the first entry will be mature (Figure 3). Once all three entries have occurred, the result will be a three-aged stand with a 60- to 90-year-old cohort occupying the oldest-age class.

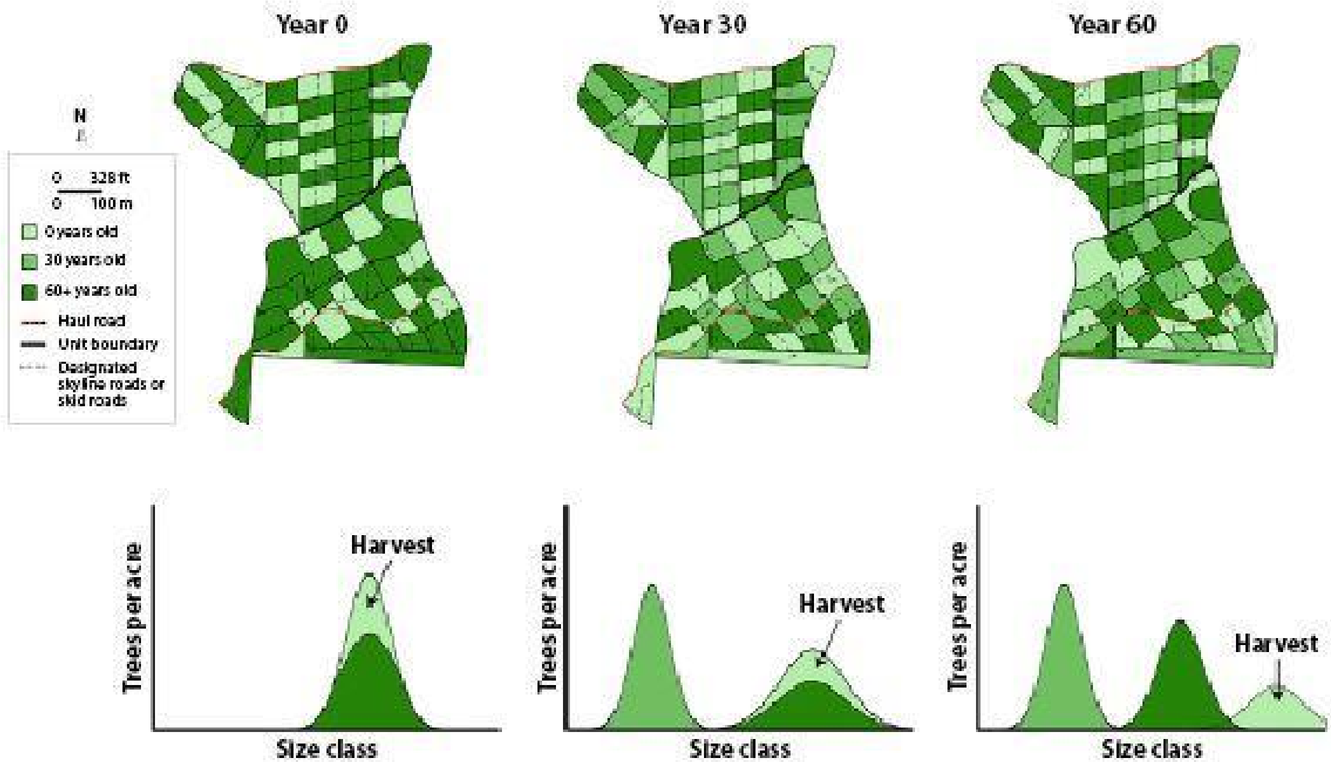

Figure 3. Group selection units progress through two example stands over time. Eventually, a three-aged stand results and is maintained over time. The north stand is cable-logged and the south stand is tractor-logged.

Credit: Tristan Huff, © Oregon State University

Logging and harvest costs

Considerable planning was necessary prior to harvesting the small patches in the group selection stands. Each patch had to be individually marked, and skid trails had to be designated, not only for the first entry but for the second and third entries as well. Skid trails were marked so that they were straddled by the group openings. Ten of the 14 harvested stands have slopes generally less than 30 percent and were logged using ground-based equipment. The remaining four stands have steeper slopes (generally over 30 percent) and were logged using uphill cable yarding. Six stands (four ground-logged and two cable-logged) were analyzed during logging to determine harvest costs.

For the ground-logged stands, a John Deere 648 grapple skidder was used for skidding logs that were felled directly onto designated skid trails. A FMC 210 tractor with winch line was used for pulling logs to the skid trails and skidding to the landing. Designated skid trails were spaced approximately 150 feet apart. Planning and harvest costs for this unit were found to be about $5/MBF more than a comparable clearcut harvest.

In the steeper stands, skyline corridors were designated prior to harvest either in a fan design or a parallel design (Figure 4). Logging costs were significantly higher in skyline-logged group selection stands than in comparable clearcuts because corridor changes (moving the skyline) were much slower in the group selection stands. For the stand that utilized parallel skyline corridors, logging costs were 18 percent higher than in cable-logged clearcuts. Stands utilizing fan skyline corridors were 32 percent more expensive to log. While the fan layout allowed all yarding to take place from one landing (thus eliminating the need to move the yarder), skylines in the fan layout needed more moves compared to the stand in which parallel corridors were used.

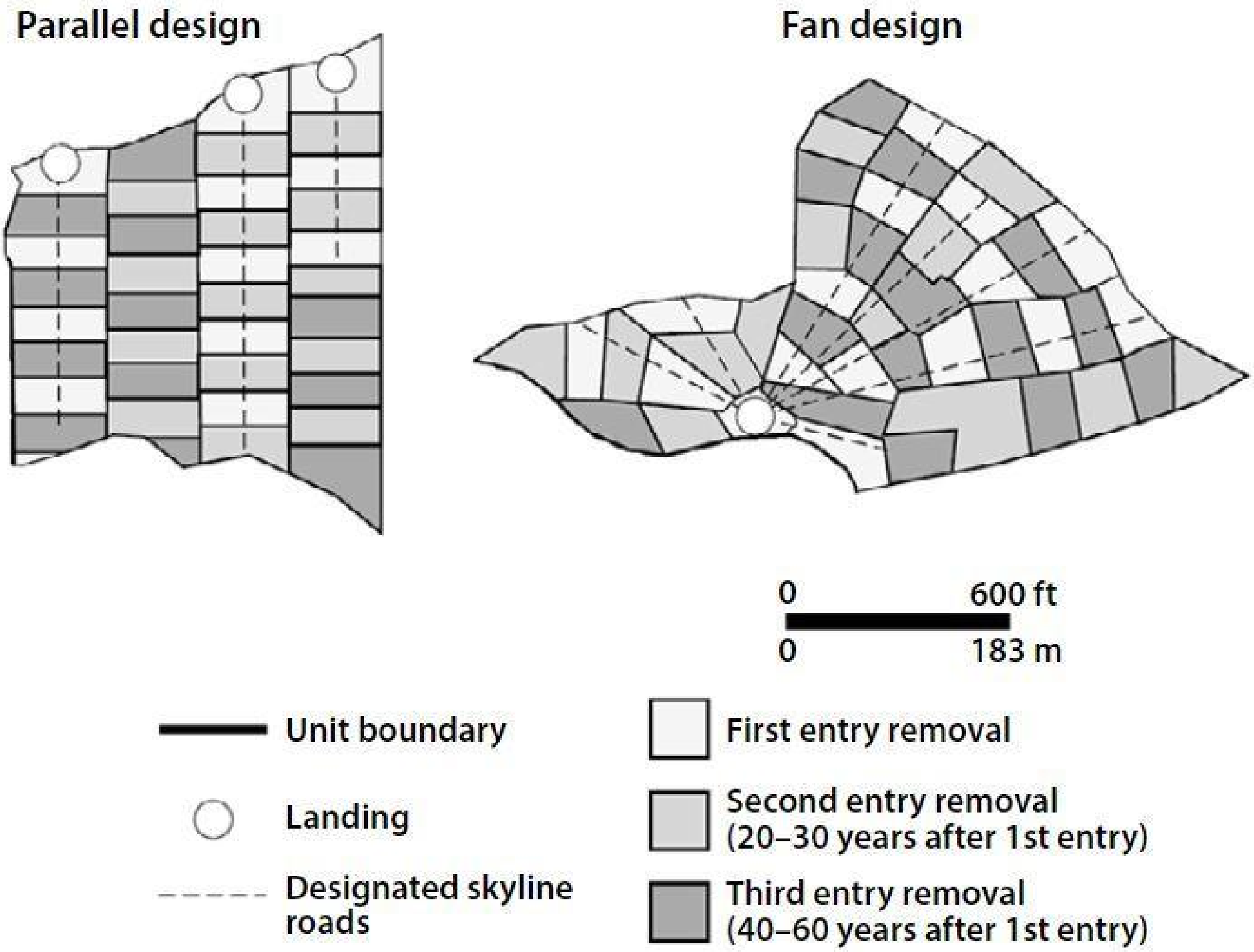

Figure 4. Examples of the two skyline corridor designs used in the CFIRP group selection stands. Adapted from Ecological and Socioeconomic Responses to Alternative Silvicultural Treatments, edited by Chris C. Maguire and Carol L. Chambers, 2005, Oregon State University College of Forestry

Regeneration and growth

Following harvest, logging slash was either piled and burned or scattered. Two-year-old Douglas-fir seedlings were planted in the openings at a spacing of 13½ feet (239 trees/acre). Herbicide applications consisted of one ground-based broadcast spray using a hose and reel. Follow-up spot treatments using a backpack sprayer were done around seedlings, as needed, 1, 2, and 3 years following planting. Also, some hardwood clumps were controlled (as needed) using basal spray or hack-and-squirt methods 4 years after planting.

Figure 5. Ineffective vegetation control resulted in Himalayan blackberry dominating this patch.

Credit: Tristan Huff, © Oregon State University

Growth of seedlings planted in the group selection openings was slower relative to seedling growth under comparable clearcut conditions. While seedling height growth was similar between group openings and typical clearcut conditions, diameter growth was significantly reduced under the group selection regime. Seedling growth in the group openings was reduced by competition from mature trees in the surrounding stand. Seedlings planted in half-acre openings are shaded by the surrounding stand, and roots from the mature trees extend and continue to expand into the opening after harvest takes place. Thus, seedlings in the group openings are experiencing competition both above ground for light and below ground for water and nutrients. As future openings are created in these group selection stands, some of this competitive pressure will be removed, which could result in a period of increased growth for this cohort.

Impacts of competing understory vegetation on the growth and survival of seedlings were highly variable, likely due to differences in pre-harvest plant communities and effectiveness of vegetation control methods in different group openings. In some openings, the above-described herbicide applications were not sufficient to adequately control competing vegetation. In these situations, grasses, sprouting hardwoods, and, especially, Himalayan blackberry overtopped seedlings, resulting in poor survival and greatly reduced growth (Figure 5). However, in some openings, the chemical treatments effectively controlled competing vegetation, and seedling growth and survival was adequate to establish a healthy group of young trees (Figure 6).

It is likely that differences in vegetation communities and in operational difficulties associated with herbicide applications both contributed to differences in the effectiveness of vegetation control. Furthermore, because seedlings planted in small patches grow more slowly than those growing in very large openings (e.g., clearcuts), it will take longer for these seedlings to reach a “free to grow” state. Consequently, establishing a healthy stand in these patches will likely require more seasons of vegetation control than are normally required in a clearcut setting.

Douglas-fir natural regeneration was spotty and generally not abundant within the group selection openings. Even though a great deal of seed fell from the surrounding mature trees, the soil within openings was not disturbed enough to create a good seedbed of bare mineral soil for germination and seedling establishment.

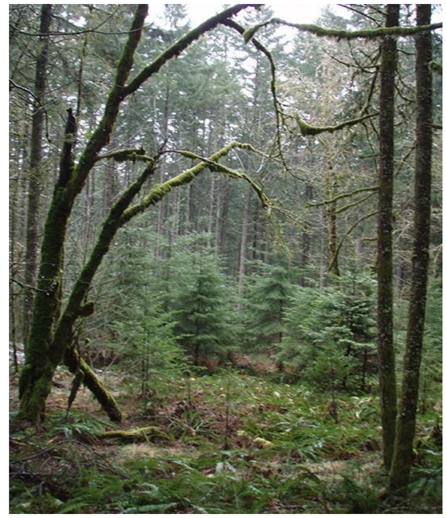

Figure 6. Effective vegetation control resulted in slower-growing but successful regeneration.

Survival and growth of retained matrix trees

Mortality of retained trees in the matrix did not differ from the natural mortality observed in uncut mature stands. There was very little blowdown, although some was observed in two group selection stands that were adjacent to open fields, probably due to these stands being less sheltered from the wind. Mortality unrelated to windthrow (competition, root disease, etc.) was also quite low in the matrix of the group selection stands. Low levels of logging damage helped contribute to this high level of survival. Since harvest operations were concentrated in the small group openings, damage to retained trees from equipment and falling timber was kept low.

By 15 years after harvest, retained trees in the matrix of group selection stands have not shown a significant increase in growth. This lack of a thinning response can possibly be attributed to two factors. First, many other studies have shown that an increase in growth in older Douglas-fir stands may not show up until as late as 25 years following a thinning. Second, trees can experience thinning shock when their shade-adapted needles and bark are suddenly exposed to sunlight following a reduction in overstory. Further study is needed here. While the larger trees did not significantly increase their growth rates following harvest, those immediately adjacent to patch cuts did sprout an abundance of epicormic branches that help create fuller crowns and, consequently, better wildlife habitat.

Wildlife response

Researchers looked at small bird and small mammal communities before and after harvest. Surveys indicated that the species mix in group selection stands was similar to the species found in uncut stands, especially when compared to clearcuts. There was a larger variety of bird species in group selection stands than in clearcuts, and the total number of birds was also greater in group selection stands. The variety of small mammal species was also greater in group selection stands compared to clearcuts, but the total number of small mammals was higher in clearcuts. This is probably because two common species, deer mice and Oregon voles, thrive in the dense grass and shrub layer present after a clearcut. More research is needed to explore the long-term wildlife response to group selection harvests.

Lessons learned

- These group selection stands show that regeneration growth is significantly impeded when small patch cuts are utilized. However, growth and survival can still be adequate to regenerate the stand. Growth rates would be greater if group opening size were increased to 1 to 2 acres.
- Group selection silviculture provides quality habitat for many wildlife species, especially songbirds, and may improve the aesthetics of a site compared to even-aged management methods.
- Harvesting costs are slightly higher than clearcutting under a group-selection regime (and higher still when the ground is steep and cable logging is necessary). Extensive pre-harvest planning by a skilled forester is necessary in order to mark harvest openings, skid trails, and/or skyline corridors.
- Herbicide applications were limited to ground-based applications (hose and reel, backpack sprayer, or hack-and-squirt/basal spray). Achieving good coverage and effective vegetation control using these methods requires skill and attention to detail. In small group openings, vegetation will likely need to be controlled for longer periods of time due to planted seedlings' slower growth rates.
- Under a group selection regime, harvests are smaller but occur more frequently, depending on the number of age classes desired and the period of time between harvests. This could be beneficial if one desires a more steady income over time from a single stand of timber.

Glossary

Afforestation — The act of converting from non-forested vegetation cover to forest.

Cohort — A group of trees of similar age that have developed after a disturbance such as fire or timber harvesting.

Epicormic branch — A branch that sprouts from a dormant bud on the stem or branch of a tree, often following increased exposure to light.

"Free to grow" — A seedling or small tree that is free from direct competition from other trees, shrubs, grasses, or herbaceous plants.

Matrix — In a group selection harvest system, the mature, retained portions of a stand.

MBF — Thousand board feet. A board foot is used to measure or express the amount of wood in a tree. The dimensions of a board foot are 12 inches by 12 inches by 1 inch.

Piling and burning — Thinning slash by making small piles and burning them, either during the operation (swamper burning) or later when conditions are right.

Regeneration — Young trees (seedlings) that start by planting, natural seeding or sprouting.

Seedbed — A forest floor that is conducive to the germination and growth of tree seedlings.

Site index — A measure of how tall dominant trees grow over a specified period (50 or 100 years). Site index reflects the combined effects of climate and soil quality on tree height growth. Trees growing on good sites (high site index) grow faster in height than trees on poor sites (low site index) over a 50- or 100-year period. The result is higher volume growth in board feet on the better site.

Skyline corridor — In cable logging, the area of the harvest unit accessible by a single setting of the skyline.

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