Regeneration

1. Bailey, J.D. and J.C. Tappeiner. 1998. Effects of thinning on structural development in 40- to 100-year-old Douglas-fir stands in western Oregon. Forest-Ecology-and-Management 108(1/2): 99-113.

Keywords: thinning
commercial thinning
regeneration
tree morphology

Abstract: The composition and structure of the understorey was studied in thinned and unthinned Douglas fir/western hemlock (Pseudotsuga menziesii/Tsuga heterophylla) stands on 32 sites in western Oregon. These stands had regenerated naturally after timber was harvested between 1880 and 1940; they were thinned between 1969 and 1984. Commercially thinned stands had 8-60% of their volume removed 10-24 yr before the study (in 1993-95). Undisturbed old-growth Douglas fir stands were present for comparison on 20 of these paired sites. Conifer regeneration density and frequency were consistently greater in thinned than unthinned stands. For example, average seedling density in thinned stands (1433/ha) was significantly greater than in unthinned stands (233/ha), but very similar to that in old-growth stands (1010/ha). Seedling density and frequency were strongly related to the volume removed and to stand density index (and other measures of overstorey density) just after thinning. In thinned stands, the density of small trees (intermediate crown classoverstorey trees and advanced regeneration) was 159/ha, significantly greater than in unthinned stands (90/ha), but not significantly different from that of old-growth (204/ha). The live crown ratio of these trees in thinned stands (66%) was greater than in unthinned (44%) and old-growth (48%) stands. Cover and stem density of shrubs was variable in all 3 stand types. There was significantly less tall shrub cover in unthinned stands than in either thinned or old-growth stands, which did not differ. Thinned stands had the most low shrub cover. Salal(Gaultheria shallon) and bracken fern (Pteridium aquilinum) cover was greater in thinned stands than in the other stand types, but there was no difference in sword fern (Polystichum munitum) and Oregongrape [Berberis nervosa] cover. Leaf area index in thinned stands (6.6) was not significantly different from that in unthinned (6.8) and old-growth stands (7.1); however, there was more leaf area in shrubs in the thinned stands. Thinning young Douglas-fir stands will hasten the development of multistorey stands by recruitment of conifer regeneration in the understorey as well as by enabling the survival of small overstorey trees and growth of advanced understorey regeneration. Thinning will also help develop the shrub layer by increasing tall shrub stem density and cover of some low shrubs.

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2. Brandeis, T.J., M. Newton and E.C. Cole. 2001. Underplanted conifer seedling survival and growth in thinned Douglas-fir stands. Canadian-Journal-of-Forest-Research 31(2): 302-312.

Keywords: planting operations
thinning
commercial thinning
site preparation
chemical preparation
release treatments

chemical release
growth
tree/stand health
regeneration

Abstract: In a multilevel study conducted at the Oregon State University's McDonald-Dunn Research Forest, Oregon, USA, to determine limits to underplanted conifer seedling growth, Douglas-fir (Pseudotsuga menziesii), grand fir (Abies grandis), western redcedar (Thujaplicata) and western hemlock (Tsuga heterophylla) seedlings were planted in January 1993 beneath second-growth Douglas-fir stands that had been thinned in 1992 to basal areas ranging from 16 to 31 m2/ha. Understorey vegetation was treated with a broadcast herbicide (glyphosate + imazapyr) application prior to thinning, a directed release herbicide (glyphosate, plus triclopyr for tolerant woody stems) application 2 years later, or no treatment beyond harvest disturbance. Residual overstorey density was negatively correlated with percent survival for all four species. Broadcast herbicide application improved survival of grand fir and western hemlock. Western redcedar, grand fir and western hemlock stem volumes were inversely related to overstorey tree density and this effect increased over time. There was a strong indication that this was also the case for Douglas-fir. Reduction of competing understorey vegetation resulted in larger fourth-year stem volumes in grand fir and western hemlock.

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3. Buermeyer, K.R. and C.A. Harrington. 2002. Fate of overstory trees and patterns of regeneration 12 years after clearcutting with reserve trees in Southwest Washington. Western-Journal-of-Applied-Forestry 17(2): 78-85.

Keywords: thinning
regeneration
tree/stand health

Abstract: Changes in management objectives for some forestlands in the Pacific Northwest have spurred interest in the creation of multistoried stands and the use of natural regeneration systems, but data on such systems are lacking. We assessed the status of the overstorytrees and the regeneration 12 yr after a clearcut harvest with reserve trees in an even-aged, 145-yr-old Douglas-fir stand on a moderately productive site (site class 3) in southwest Washington. The 15 ha harvest unit was superimposed over two areas differentially thinned 15 and 34 yr before clearcutting. The clearcut harvest retained 18 trees/ha with a mean diameter of 63 cm. The reserved overstory trees had a 93% survival rate after 12 yr; most dead trees had been windthrown. Diameter growth for the reserved trees averaged 3.3 cm and was greatest during the most recent 3 yr period, which also had the highest growing-season precipitation. In a 1 ha mapped area, there were 5,854 seedlings/ha, and more than 99% of the regeneration was Douglas-fir. Most seedlings were less than 2 m tall. Seedling density was somewhat clumped (value of 2.1 for Pielou's index of nonrandomness), but 79% of randomly located 4.04 m2 (mil-acre) plots and 98% of 5x5 m grid cells had at least one conifer seedling. There was no obvious pattern of regeneration based on direction from the reserved trees, but both seedling density and seedling size within the drip lines of reserved tree crowns were less than in the rest of the area. The number of seedlings was similar on the two halves of the plot corresponding to the original thinning blocks, but seedling size and age differed. In the half of the study plot that had been twice lightly thinned, only 14% of the seedlings were >0.5 m tall; however, 41% of the seedlings were >0.5 m in the block that had been

thinned more heavily. There was no difference between the thinning blocks in the ages of seedlings <less or =>0.5 m tall (mean age of 5 yr). This example of clearcutting with reserve trees resulted in reasonable survival of the overstory trees and adequate stocking but slow growth rates in the naturally regenerated Douglas-fir. Heavier thinning before harvest was associated with more advance regeneration, more shrub cover, and less windthrow of the reserved trees than in the more lightly thinned block. If an abundance of tree species other than Douglas-fir was desired on this site, interplanting would be required.

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4. Miller, M. and B. Emmingham. 2001. Can selection thinning convert even-age Douglas-fir stands to uneven-age structures? Western-Journal-of-Applied-Forestry 16(1): 35-43.

Keywords: thinning
commercial thinning
growth
yield
tree/stand health
regeneration

Abstract: Uneven-age management of Douglas-fir (Pseudotsuga menziesii) stands can be used to address aesthetic, wildlife habitat, biodiversity and sustainability concerns, but there has been little long-term experience with this type of management. To develop timely information on converting even-age stands to uneven-age forests, we used retrospective stand reconstruction methods to document harvest frequency, intensity and stand structural development at four sites in western Oregon, USA. We studied stands managed by selection thinning and identified strategies for creating and managing uneven-age forests. Selection thinning benefited mid- and understorey trees and stimulated natural regeneration. Although stand growth was less than expected from low thinning, growth per unit of growing stock was similar to that in unmanaged stands. Douglas-fir often dominated natural regeneration and had satisfactory vigour at stocking levels about half that considered full stocking for even-age management, but good growth of regeneration may require even lower overstorey stocking. Shade-tolerant grand fir (Abies grandis) and western hemlock (Tsuga heterophylla), however, were more abundant at higher stocking levels. Selection thinning of young Douglas-fir (Pseudotsuga menziesii) stands can sometimes be effective in promoting viable regeneration while providing regular income and biodiversity. Because this was a retrospective study only, further, long-term testing is necessary.

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