

## Stand Conditions

1. Cole, E.C. and M. Newton. 1989a. Height growth response in Christmas trees to sulfometuron and other herbicides. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol. 42): 129-135.

**Keywords:** release treatments  
chemical release  
growth  
tree/stand health  
stand conditions

**Abstract:** *Abies procera*, *A. grandis* and *Pseudotsuga menziesii* cv. *Menziesii* were evaluated for tolerance to sulfometuron (0.05-0.21 kg/ha), atrazine (4.5 kg/ha) and hexazinone (2.2 kg/ha). Herbicides were applied pre-budbreak and sulfometuron was also applied post-budbreak. Weeds were suppressed equally effectively by all rates and herbicides pre-em. Low rates of sulfometuron were less effective post-em. There was no significant damage to *A. procera* seedlings, although the highest rate of sulfometuron slowed growth significantly. *A. grandis* was not affected by any treatment. All treatments caused injury to 1-year-old *P. menziesii*, primarily needle chlorosis and slight stunting. Growth was best in atrazine-treated plots. For 3-year-old *P. menziesii*, injury was not significant but high rates of sulfometuron caused cosmetic damage. Best growth was observed with hexazinone and worst with sulfometuron. Post-budbreak applications and high rates of sulfometuron reduced growth more than pre-budbreak application and low rates.

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2. Cole, E.C. and M. Newton. 1989b. Seasonal efficacy comparison of two glyphosate formulations. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol. 42): 136-142.

**Keywords:** release treatments  
chemical release  
tree/stand health  
stand conditions

**Abstract:** Glyphosate formulations with 13% (Roundup) and without (Accord) surfactant were compared at 0.84 and 1.68 kg/ha, applied June-Oct. against *Alnus rubra*, *Rubus spectabilis*, *R. parviflorus*, *R. ursinus* and *Pteridium aquilinum* in a *Pseudotsuga menziesii* cv. *menziesii* plantation. No differences in efficacy between the two formulations against any species were noted. All species were controlled better by high rates of herbicide. *R. spectabilis* and *R. parviflorus* were controlled  $\leq 100\%$ , although July applications were least effective. *A. rubra* was reduced  $\leq 80\%$  and early application gave best control. Rates of application had less effect on *Pteridium aquilinum* control ( $\leq 98\%$ ), and Oct. applications were least effective. Damage to *Pseudotsuga menziesii* was worst with June applications and decreased through the year. Oct. treatment caused negligible damage.

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3. Cole, E.C., M. Newton and D.E. White. 1986. Response of northwestern hardwoods, shrubs, and Douglas-fir to Arsenal and Escort. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol.39): 93-101.

**Keywords:** release treatments  
chemical release  
tree/stand health  
stand conditions

**Abstract:** Arsenal (imazapyr) and DPX-T6376 (metsulfuron) were evaluated for scrub control in *Pseudotsuga menziesii* plantations at 3 sites in Oregon in 1984-85. Arsenal produced the most complete and consistent control of *Acer macrophyllum* when applied in late summer, but early summer applications were more effective against the sclerophyll brush species *Arbutus menziesii*, *Ceanothus velutinus* var. *laevigatus*, *Arctostaphylos columbiana* and *A. viscida*. High rates of Arsenal gave good control of *Alnus rubra* and *Rubus spectabilis*, but did not control *R. laciniatus* or *R. procerus*. On all the controlled species, growth of new foliage was decreased or prevented. DPX-T6376 reduced the crown vol. of *A. macrophyllum* and killed the sclerophyll brush species, all *Rubus* spp. but not *A. rubra*. Both chemicals produced severe injury to *P. menziesii*.

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4. Cole, E.C., M. Newton and D.E. White. 1988. Efficacy of imazapyr and metsulfuron methyl for site preparation and conifer release in the Oregon Coast Range. *Forest-Research-Laboratory,-Oregon-State-University Research-Note* 81. 7 p.

**Keywords:** release treatments  
chemical release  
tree/stand health  
stand conditions

**Abstract:** Imazapyr (Arsenal) and metsulfuron methyl (Escort) were tested at 3 rates for controlling shrubs in young Douglas fir (*Pseudotsuga menziesii*) plantations on 3 sites in the Oregon Coast Range. Imazapyr was highly effective on red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*), but was less effective on salmonberry (*Rubus spectabilis*) and other blackberry (*Rubus*) species. Metsulfuron-methyl was ineffective on red alder and bigleaf maple, but gave excellent control of salmonberry, Himalaya blackberry (*R. procerus*) and evergreen blackberry (*R. laciniatus*). Both chemicals caused severe injury to Douglas fir seedlings, especially when applied during the growing season. It is concluded that these herbicides are promising for site preparation, but have limited use for release of Douglas fir.

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5. DeBell, D.S. and T.C. Turpin. 1989. Control of red alder by cutting. *Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-414*. ii + 10 p.

**Keywords:** release treatments  
manual release  
stand conditions

**Abstract:** Effects of tree age, month of cutting, and height and angle of the cut on sprouting of red alder (*Alnus rubra*) stumps were evaluated in a study designed to develop an effective method for controlling red alder in Douglas fir (*Pseudotsuga menziesii*) plantations in the Oregon Coast Range.

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6. Dimock, E.J., II and E.B. Collard. 1981. Postplanting sprays of dalapon and atrazine to aid conifer establishment. Pacific-Northwest-Forest-and-Range-Experiment-Station,-USDA-Forest-Service Research-Paper PNW-RP-280. iii + 16 p.

**Keywords:** release treatments  
chemical release  
growth  
tree/stand health  
stand conditions

**Abstract:** A mixture of dalapon and atrazine at 8 and 4 lb/acre, respectively, or dalapon or atrazine alone were applied to control perennial grasses and forbs competing with newly planted seedlings of ponderosa pine and Douglas fir. In 4 studies in Oregon in 1975, herbicides were spot sprayed around individual seedlings. In 2 studies in Washington and Oregon in 1976, herbicides were broadcast sprayed. The mixture consistently controlled grass and forbs better than either herbicide alone, reducing grass and forb cover respectively by 80-82% and 48-58% in the first year. Control persisted for 2-4 yr. Varying results are reported as to the effects of the different treatments on height growth and survival.

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7. Drever, C.R. and K.P. Lertzman. 2003. Effects of a wide gradient of retained tree structure on understory light in coastal Douglas-fir forests. *Canadian-Journal-of-Forest-Research* 33(1): 137-146.

**Keywords:** thinning  
stand conditions

**Abstract:** We characterize understorey light of seven stands that varied along a gradient of tree retention. Using hemispherical canopy photographs and digital image, we estimated gap light or solar radiation reaching the understorey through the canopy. Using nonlinear regressions, we related gap light to several structural attributes in the examined silvicultural treatments. The silvicultural treatments affected both the median and range of gap light in the understorey. As overstorey removal increased from uncut second growth to green-tree retention, the median value of light increased from 8 to 68% full sun, while the range of light increased from 3-22% to 26-88% full sun. We found strong, significant, and negative nonlinear relationships between gap light at a particular microsite (0.04 ha) in the understorey and the height, diameter at breast height, density, and volume of surrounding retained

trees ( $r^2=0.77-0.94$ ). These relationships can aid planning of treatments that retain forest structure, such as variable retention, by allowing predictions of understorey light from commonly used field data. These predictions allow forest managers to understand some of the ecological consequences and tradeoffs associated with retaining structure during harvesting.

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8. Feller, M.C. 1990. Herbicide application followed by prescribed fire to convert a brushfield into a conifer plantation in south coastal B.C.: a combination of the initial effects of two treatments. B.C. Ministry of Forests FRDA Report 146. 40 p.

**Keywords:** site preparation  
chemical preparation  
prescribed fire  
growth  
tree/stand health  
soil properties  
stand conditions

**Abstract:** A field study was carried out in *Pseudotsuga menziesii* stands in British Columbia, Canada, to investigate the effects on vegetation of glyphosate applications in September 1987 or July 1988, followed by burning in October 1988. Results did only show slight differences between treatments.

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9. Figueroa, P.F. 1989. Bigleaf maple control: triclopyr thin-line and spot-foliar application treatments using imazapyr, metsulfuron, and glyphosate. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol. 42): 104-119.

**Keywords:** release treatments  
chemical release  
stand conditions  
economics

**Abstract:** Field trials were conducted to compare the efficacies of March applications of triclopyr thin-line +or- 1 kg/ha Mor-act or 2,4-D (1:1) with June spot-foliar applications of 0.6 or 1.1 kg/ha imazapyr, 0.170 kg/ha metsulfuron and 6.7 kg/ha glyphosate to control *Acer macrophyllum* in a *Pseudotsuga menziesii* plantation. All thin-line treatments gave 80% control 2 years later; complete sanding was hindered by stems growing along the ground. Dilution did not affect control. Spot-application success depended on degree of crown coverage. metsulfuron and glyphosate were not effective, but imazapyr control reached 60-70% 2 years after treatment. Only triclopyr and full coverage imazapyr suppressed *A. macrophyllum* growth to below the height of *P. menziesii*. Crown volume was held to pre-treatment levels with metsulfuron and glyphosate but decreased with imazapyr. The two treatment methods tested are potentially cost-effective; triclopyr costs are higher but spot-application carries higher labour

costs. Application rates of 2 ml triclopyr/ Msuperscript 2 crown area will give 100% control if all stems are banded; with delivery rates of 59 ml/clump a 45% solution can be used.

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**10.** Figueroa, P.F. 1991. Ground applied herbicide methods for red alder control: herbicide efficacy, labor costs, and treatment method efficiency. *In* Proceedings-of-the-Western-Society-of-Weed-Science,12-14-March-1991. pp. 44: 53-68.

**Keywords:** release treatments  
chemical release  
economics  
stand conditions

**Abstract:** A study was conducted to develop the cost estimates for ground-applied manual control methods in variable density red alder [*Alnus rubra*] stands and to evaluate the efficacy of the various herbicide formulations for each system. Field trials were initiated in 3 Douglas fir [*Pseudotsuga menziesii*] plantations located on Weyerhaeuser Company land located in SW Washington. Two 6-year-old plantations had streamside buffer zones remaining from the previous year's operational herbicide spray programme; the 3rd was a 13-year-old plantation which had not been previously treated with herbicides to control *A. rubra*. The treatments tested were as follows: 50% triclopyr, 45% glyphosate and 10% imazapyr applied to the cut stump surface; low-vol. basal application of 5, 10 and 15% triclopyr and 2 and 4% imazapyr; thin-line application of 50, 75 and 100% triclopyr and 20 and 40% imazapyr; stream-line application of 10, 30 and 50% triclopyr and 4 and 20% imazapyr; hack-and-squirt application with imazapyr applied to 1 cut at 0.25, 0.5 and 0.75 ml and to 2 cuts at 0.25 and 0.5 ml; and capsule injection of 1 or 2 glyphosate capsules. A discussion of the results is presented and total treatment costs are given. It is concluded that ground application treatments have advantages over aerially applied treatments, including being useful for the treatment of areas of public sensitivity and when other environmental risks need to be minimized.

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**11.** Figueroa, P.F. 1993. Efficacy and cost of ground-applied herbicide methods for red alder control. *Down to Earth* 48(1): 6-10.

**Keywords:** release treatments  
chemical release  
stand conditions  
growth  
tree/stand health

**Abstract:** The effects on red alder [*Alnus rubra*] mortality, diam. at breast height and height, and any phytotoxic effects to Douglas fir [*Pseudotsuga menziesii*] of Garlon 4 (triclopyr) at 4 lb/gallon and Chopper EC (imazapyr) at 2 lb, applied by stream line, thin line and low vol. treatments, and of Garlon 3A (triclopyr) at 3 lb, Roundup (glyphosate) at 3 lb and Arsenal (imazapyr) at 4 lb applied by cut stump

treatment were evaluated in streamside buffer zones in two 6-year-old *P. menziesii* plantations in SW Washington. All treatments resulted in good control of *A. rubra*, but the most cost-effective control was achieved by the stream line application of Garlon 4, followed by low vol. basal or thin line treatments of Garlon 4 and cut stump treatment with 50% Garlon 3, 45% Roundup and 10% Arsenal. Negligible *P. menziesii* damage was caused by cut stump treatments, but damage occurred with basal-bark treatments although Garlon 4 generally caused less injury than Chopper EC.

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12. Figueroa, P.F. and V.F. Carrithers. 1993. Bigleaf maple control: thinline basal applications using triclopyr and triclopyr plus picloram. *In Proceedings-of-the-Western-Society-of-Weed-Science*, 9-11-March-1993. pp. 46: 24-30.

**Keywords:** release treatments  
chemical release  
stand conditions  
economics

**Abstract:** A field trial was conducted at Mt. St. Helens Tree Farm, Cowlitz county, Washington, in 1988-91 to determine the min. threshold level of herbicide needed to control bigleaf maple [*Acer macrophyllum*] stump sprouts in Douglas fir [*Pseudotsuga menziesii*]. Garlon (triclopyr) at 0.24-3 lb/gal was applied on 6 Dec. 1990, 6 Feb. 1991 and 11 Apr. 1991, and triclopyr + picloram at 1 + 0.5 lb was applied on 6 Feb. 1991 using thinline applications to the entire circumference of each stem in the bigleaf maple clump. The threshold level of Garlon for  $\geq 90\%$  control was found to be between 1.1 and 1.7 ml/m<sup>2</sup> of crown area. Most treatments produced clumps that appeared to be dead during the 1st year but which resprouted in the 2nd year; it is suggested that such inconsistencies in mortality among treatments are due to the inability to completely band every stem. Economic considerations for herbicide costs are discussed.

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13. Harrington, T.B., J.C. Tappeiner, II and T.F. Hughes. 1991. Predicting average growth and size distributions of Douglas-fir saplings competing with sprout clumps of tanoak or Pacific madrone. *New-Forests* 5(2): 109-130.

**Keywords:** release treatments  
manual release  
growth  
stand conditions

**Abstract:** Average growth and size distributions of 3- to 6-year-old (in 1983) Douglas fir (*Pseudotsuga menziesii*) saplings in three plantations in SW Oregon were studied for 7 years (1983-1989) after thinning of associated sprout clumps of tanoak (*Lithocarpus densiflorus*) or Pacific madrone (*Arbutus menziesii*); in some cases shrubs and herbs were also suppressed. Biologically based nonlinear equations explained 66, 90, and 53% of variation in average annual increment of Douglas fir height, diameter-squared, and crown cover, respectively. Equations for annual increment of crown cover of broadleaved

and understory vegetation explained only 10 to 12% of the variation, because these parameters exhibited a high degree of variability. Model simulations demonstrated that, for the same initial levels of cover, tanoak had faster rates of crown cover growth than madrone and also caused greater limitations in Douglas fir growth. Suppression of shrubs and herbs increased growth of Douglas fir only when broadleaved species were absent. Weibull functions adequately described size distributions for Douglas fir in 92% of individual-tree data sets. Regression functions of broadleaved crown cover and average Douglas fir size explained 51, 93, and 24% of variation in the Weibull A, B, and C parameters, respectively. Model simulations with predicted Weibull parameters demonstrated that broadleaved competition caused a positive skewing in size distributions for height and stem diameter of Douglas fir.

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**14.** Harrington, T.B., R.G. Wagner, S.R. Radosevich and J.D. Walstad. 1995. Interspecific competition and herbicide injury influence 10-year responses of coastal Douglas-fir and associated vegetation to release treatments. *Forest-Ecology-and-Management* 76(1/3): 55-67.

**Keywords:** release treatments  
chemical release  
manual release  
growth  
tree/stand health  
tree physiology  
stand conditions

**Abstract:** Responses of competing vegetation and planted Douglas fir (*Pseudotsuga menziesii* var. *menziesii*) were studied for 10 years after six herbicide and manual release treatments in the Washington and Oregon Coast Ranges. Studies were installed in six 2- or 3-yr-old plantations, with Douglas fir densities of 988 to 1482 plants/ha at time of planting and 721 to 1282/ha 2 to 3 years later. Research objectives were to quantify regional, long-term responses of vegetation (Douglas fir and non-coniferous species) to various levels of competition, light and soil water availability, and intensity versus importance of factors influencing Douglas fir growth. Three treatments reduced shrub cover relative to the untreated check: triclopyr in year 1, glyphosate in years 1-5, and repeated control (via several herbicide applications) in years 1-10. Reductions in woody cover from glyphosate stimulated increases in herb cover in years 3 and 5, while repeated control reduced herb cover in years 1, 2 and 5. Through year 10, Douglas fir survival (86-99%) varied little among treatments. Visual symptoms of herbicide injury to Douglas fir from triclopyr (45% of trees) and glyphosate (17% of trees) were associated with 0.1-0.2 m reductions in first-year height. After adjusting for tree size, Douglas fir growth in stem basal area 2 years after triclopyr was less than that of the untreated check, suggesting prolonged effects of herbicide injury. Because it sustained low levels of interspecific competition, caused minimal tree injury, and prevented overtopping cover from red alder (*Alnus rubra*), repeated control was the only treatment in which Douglas fir size (9.8 m height and 21 cm basal diameter in year 10) significantly exceeded ( $P < 0.02$ ) that of the untreated check (7.8 m height and 12 cm diameter).

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15. Hedin, I.B. 1994. Mechanical site preparation on salal-dominated sites: five-year results. Forest-Engineering-Research-Institute-of-Canada

**Keywords:** site preparation  
mechanical preparation  
growth  
stand conditions

**Abstract:** Trials began in 1987 on sites on Vancouver Island where salal (*Gaultheria shallon*) is a competitor to Douglas fir [*Pseudotsuga menziesii*]. Three equipment types were tested: the Mitsui Miike (an excavator-mounted rock grinding attachment), the TTS Delta disc trencher and an excavator with a ripper tooth and live thumb. All three mechanical site preparation treatments were equally effective at reducing the coverage of salal and other competing vegetation and improving Douglas fir growth performance. On sites where the disc trencher can operate, with gentle slopes and light to moderate slash, it is most cost effective because of greater productivity.

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16. Hedlin, A.F., J. Weatherston, D.S. Ruth and G.E. Miller. 1983. Chemical lure for male Douglas-fir cone moth, *Barbara colfaxiana* (Lepidoptera: Olethreutidae). *Environmental-Entomology* 12(6): 1751-1753.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** Field trapping in British Columbia indicated that males of *Barbara colfaxiana* (Kearfott), the larvae of which feed in the cones of *Pseudotsuga menziesii* and damage the seeds, were attracted to mixtures of (Z)-9-dodecen-1-ol and (Z)-9-dodecenyl acetate. Most blends of these compounds were attractive to some extent, but blends containing 15 to 50% acetate were the most consistently attractive.

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17. Helgerson, O.T. 1990b. Response of underplanted Douglas-fir to herbicide injection of sclerophyll hardwoods in southwest Oregon. *Western-Journal-of-Applied-Forestry* 5(3): 86-89.

**Keywords:** nursery operations  
release treatments  
chemical release  
stand conditions  
tree physiology  
tree/stand health  
growth

**Abstract:** Low-value broadleaf sclerophyll forests in SW Oregon, typically composed of tanoak (*Lithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*) and chinkapin (*Castanopsis chrysophylla*), may be converted to commercially valuable Douglas fir (*Pseudotsuga menziesii*) by underplanting.



Results are given of studies of container-grown plug and nursery-grown bareroot fir seedlings planted out in March 1983 on plots in which all broadleaf stems had been previously (September 1981) injected with triclopyr amine. Although 60% broadleaf cover was killed by injection, 7 years later ground cover was significantly greater on these treated plots because of sprouting. Seedlings planted beneath treated broadleaf trees experienced greater daytime, but less predawn, moisture stress; plugs survived better than bareroots; and survival of seedlings on treated plots was not significantly better until 2 years after planting. Herbicide injection also resulted in increased height, diameter and volume growth rates of Douglas fir seedlings, and is recommended for the establishment of a conifer stand.

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**18.** Henry, C.L., D.W. Cole and R.B. Harrison. 1994. Use of municipal sludge to restore and improve site productivity in forestry: The Pack Forest Sludge Research Program. *Forest-Ecology-and-Management* 66(1/3): 137-149.

**Keywords:** fertilization  
growth  
soil properties  
stand conditions

**Abstract:** Municipal wastewater residuals - sludge or biosolids - represent a major waste by-product from society that must be managed in responsible ways. Because of its high nutrient and organic matter content, sludge can be beneficially recycled into forest sites for site improvement purposes. This paper reviews the opportunities and problems that have been encountered during 20 yr of research into sludge application in forests, based on data from studies carried out in the Pack Demonstration Forest, Washington, on a variety of sites - including clear-felled, young or mature Douglas fir [*Pseudotsuga menziesii*] stands, and rights-of-way. Research to date on forest application of sludge has been very encouraging, clearly demonstrating the validity of this management technique. Forest sites typically display benefits in two ways: (1) an immediate growth response by both overstorey and understorey species; (2) a long-term improvement to the productivity of the site. However, for this practice to have broad utility and acceptance, it is critical that the concerns of the regulatory agencies and general public be addressed regarding public health and environmental issues through continued research. These concerns include the fate of trace metals, including movement, uptake and potential phytotoxicity, and passage into wildlife and human food chains, the fate of pathogens, and leaching of nitrates into groundwater systems. Many concerns are a result of misconceptions or misunderstandings of the potential problems involved and require working with these agencies and the general public through education and demonstration programmes.

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**19.** Hobbs, S.D. and K.A. Wearstler, Jr. 1985. Effects of cutting sclerophyll brush on sprout development and Douglas-fir growth. *Forest-Ecology-and-Management* 13(1/2): 69-81.

**Keywords:** release treatments  
manual release

stand conditions  
tree physiology  
growth

**Abstract:** In SW Oregon, varying amount of brush were removed from a sclerophyll brushfield dominated by *Quercus chrysolepis* and *Arctostaphylos patula* with scattered *Pseudotsuga menziesii* saplings. Brush removal was accomplished by slashing (cut by chainsaw) near ground level at three intensities: (1) total removal, (2) partial removal, and (3) an untreated control. Sclerophyll brush species responded within 3 weeks of slashing by vigorous sprouting, which was greatest in total brush removal areas where 861 513 sprout stems/ha developed during the first year. Soil water potentials and predawn xylem pressure potentials of Douglas fir were less negative in total removal areas than in partial removal and untreated control areas. Relative growth rates of Douglas fir saplings temporarily increased in total and partial brush removal areas, but were not significantly different from the untreated control 3 yr after treatment. Slashing of sclerophyll brush to release long-suppressed Douglas fir is not recommended because of rapid brush recovery by sprouting.

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20. Huffman, D.W. and J.C. Tappeiner, II. 1997. Clonal expansion and seedling recruitment of Oregon grape (*Berberis nervosa*) in Douglas-fir (*Pseudotsuga menziesii*) forests: comparisons with salal (*Gaultheria shallon*). *Canadian-Journal-of-Forest-Research* 27(11): 1788-1793.

**Keywords:** thinning  
stand conditions

**Abstract:** Seedling regeneration and morphology of Oregon grape (*Berberis nervosa*) and salal (*Gaultheria shallon*) were studied in thinned and unthinned Douglas fir (*Pseudotsuga menziesii*) stands in the central Coast Range, Oregon. Above- and below-ground growth of both species were significantly and negatively correlated with stand density. Oregon grape appears to have less potential for vegetative spread than does salal. It produced two to three times fewer rhizome extensions, and rhizome extensions were only half as long as those of salal. Oregon grape seedlings were common in areas of moss ground cover among patches of the two species. Salal seedlings were restricted to decaying logs. Seedling densities of Oregon grape in thinned stands were more than six times those in unthinned stands. For Oregon grape, understorey establishment is accomplished by seedling establishment and recruitment of new genets. In contrast, salal maintains itself in forest understories primarily through vegetative growth, since its seedling establishment is restricted mainly to decayed wood. Continual recruitment of new aerial stems or ramets enables Oregon grape to maintain a dense cover once it is established in the understorey.

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21. Huffman, D.W., J.C. Tappeiner, II and J.C. Zasada. 1994. Regeneration of salal (*Gaultheria shallon*) in the central Coast Range forests of Oregon. *Canadian-Journal-of-Botany* 72(1): 39-51.

**Keywords:** thinning

stand conditions

**Abstract:** Regeneration of salal (*Gaultheria shallon*) by seedling establishment and vegetative expansion was examined in Douglas fir (*Pseudotsuga menziesii*) stands that had been thinned, clear felled or undisturbed in the central Coast Range of Oregon. Size and expansion rate of individual clonal fragments were negatively correlated with overstorey stand density ( $p \leq 0.039$ ). As overstorey basal area increased from 25 to 75  $\text{m}^2/\text{ha}$ , mean annual growth percentage of clone rhizome systems decreased from 23.7 to 0% and mean total rhizome length decreased from 102 to 0.89 m. Interclonal competition in dense clumps of salal apparently caused rhizomes to die and clones to fragment. In these patches, rhizome biomass and density, aerial stem biomass and density, and total biomass of *G. shallon* were negatively correlated with overstorey density ( $p \leq 0.01$ ). In clear fellings, salal clumps had up to 177.7  $\text{m}^2/\text{ha}$  rhizome and 346 stems  $\text{m}^2/\text{ha}$ , whereas patches under dense overstoreys had as few as 10.6  $\text{m}^2/\text{ha}$  rhizome and 19 stems  $\text{m}^2/\text{ha}$ . Aerial stem populations had uneven-age distributions in all overstorey densities. This structure is apparently maintained through annual production of new ramets. Salal seedling establishment rates were significantly affected by study site location, overstorey density, and substrate ( $p \leq 0.05$ ). Two-year survival was highest on rotten logs and stumps in thinned stands.

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**22.** Hulme, M.A. and G.E. Miller. 1988. Potential for control of *Barbara colfaxiana* (Kearfott): (Lepidoptera: Olethreutidae) using *Trichogramma* sp. *Colloques de l'INRA* (43): 483-488.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** The efficacy of *Trichogramma minutum* for the control of the tortricid *Barbara colfaxiana* on *Pseudotsuga menziesii* was assessed. *T. minutum* was obtained from the tortricid *Choristoneura fumiferana* in Ontario and reared through over 30 laboratory generations in eggs of the gelechiid *Sitotroga cerealella*. *B. colfaxiana* eggs were readily parasitized at 25 degrees C. About 3 million parasitized eggs glued to 100 cards were suspended throughout 19 trees (height 4 to 8 m) in British Columbia. Daytime shade temperatures during the following week peaked at 15-20 degrees C. After 1 day, 6% of the parasitoids had emerged. After 5 days, 54% of sampled parasitized *S. cerealella* eggs had emergence holes, but eggs on half the cards had been eaten by formicids. Of the *B. colfaxiana* eggs sampled, 2-4% were parasitized by *T. minutum*, regardless of whether samples were on the same branch as the cards or on remote branches. It is concluded that *T. minutum* can parasitize *B. colfaxiana* in the field and that *Trichogramma* species which are adapted to *B. colfaxiana* at temperatures of 15-20 degrees C are needed.

**23.** Humphreys, N. 1995. Douglas-fir beetle in British Columbia. In *Forest-Pest-Leaflet 14*. Pacific-Forestry-Centre, -Canadian-Forest-Service.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** Notes are provided on the recognition, detection, biology, injuriousness and control of the scolytid *Dendroctonus pseudotsugae* on Douglas fir (*Pseudotsuga menziesii*) (and occasionally western larch (*Larix occidentalis*)) in British Columbia. The damage caused is described under the headings gallery system; effect on the tree; host susceptibility and attack pattern; association with root disease (including *Armillaria ostoyae*, *Phaeolus schweinitzii* and *Phellinus weirii*); and defoliation (by *Choristoneura occidentalis* and *Orgyia pseudotsugata*). Control of *D. pseudotsugae* is discussed under the headings preventive measures (including log and slash disposal, general logging practices), remedial measures (which include the use of trap trees and pheromones) and brood destruction (by burning and similar measures).

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24. Karl, M.G. and P.S. Doescher. 1993. Regulating competition on conifer plantations with prescribed cattle grazing. *Forest-Science* 39(3): 405-418.

**Keywords:** release treatments  
manual release  
stand conditions  
tree physiology  
soil properties

**Abstract:** On conifer plantations, competitive understorey vegetation often retards growth and establishment of tree seedlings. Livestock grazing is one method of controlling the understorey vegetation and increasing the availability of site resources to tree seedlings. It was hypothesized that prescribed cattle grazing ameliorates water stress of young tree seedlings by reducing root growth of competing understorey species. On a Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) plantation in SW Oregon planted in 1986, seedling water stress was evaluated using the pressure chamber technique and gravimetric soil water determinations in 1986-89. Root growth of orchardgrass (*Dactylis glomerata*), the major understorey competing species, was quantified in 1988 and 1989 using the root periscope/mini-rhizotron technique. Seedling water stress levels during spring and summer were similar in cattle-grazed areas and ungrazed areas in 1986 to 1988, but in summer 1989, water stress was reduced significantly in the grazed area. Soil water content was higher in the grazed area in 1989, especially at the 10-20 cm soil depth. End of season (July) orchardgrass root growth in grazed plots was 18% less in 1988 and 15% less in 1989 than root growth in ungrazed plots. It is concluded that repeated cattle grazing of orchardgrass reduced transpirational surface area and root growth sufficiently to increase soil water availability to tree seedlings. Thus, prescribed cattle grazing on conifer plantations can enhance seedling physiological status by acting as a regulator of above- and belowground competition.

[OSU Link](#)

[Non-OSU Link](#)

25. Kelpas, B.R. 1987. Seasonal impacts of fluroxypyr and triclopyr on conifers and shrubs. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol.40): 128-129.

**Keywords:** release treatments

chemical release  
tree/stand health  
stand conditions

**Abstract:** Release of *Pseudotsuga menziesii* from *Rubus spectabilis* and *Alnus rubra* in a plantation in the Pacific Northwest could be achieved by 1.12 kg fluroxypyr/ha applied in May at the early foliar stage without appreciable long-term injury. *P. menziesii* tolerated 1.12 kg triclopyr/ha but was severely damaged by 1.12 kg and 2.24 kg fluroxypyr when applied during the dormant season in Mar. Both fluroxypyr and triclopyr were more effective against *A. rubra* than *R. spectabilis*. Control of *R. spectabilis* with triclopyr was marginal.

[OSU Link](#)

[Non-OSU Link](#)

**26.** Ketchum, J.S., R. Rose and B. Kelpsas. 1999. Weed control in spring and summer after fall application of sulfometuron. *Western Journal of Applied Forestry* 14:80-85.

**Keywords:** site preparation  
mechanical preparation  
chemical preparation  
stand conditions

**Abstract:** This study tested the residual spring and summer efficacy of sulfometuron after applications in the autumn in second growth Douglas fir (*Pseudotsuga menziesii*) with red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*) forest sites in the central Coast Range, Oregon, USA, which had been harvested in the summer. Sulfometuron alone (S) and sulfometuron plus imazapyr and glyphosate (SIG) were applied to vegetation on mechanically scarified sites and unscarified sites. The applications were replicated each month throughout autumn 1994. Vegetation cover was assessed in mid-June and mid-August 1995. The SIG treatment gave better control of vegetation than the S treatment, although cover was significantly lower for both herbicide treatments (9% to 54% for summed cover) compared to the control site (64% to 104% for summed cover). On scarified sites, the month of application, early or late autumn, did not significantly influence the efficacy of either treatment. On unscarified sites, however, applications of the SIG treatment later in autumn were less effective than early autumn treatments. Results suggest that autumn applications of sulfometuron are still effective in spring and may eliminate the need to treat sites again in the spring in order to achieve effective weed control.

[OSU Link](#)

[Non-OSU Link](#)

**27.** Ketchum, J.S., R. Rose and B. Kelpsas. 2000. Comparison of adjuvants used in fall-release herbicide mixtures for forest site preparation. *Tree-Planters' Notes* 49(3): 66-71.

**Keywords:** site preparation  
chemical preparation  
release treatments  
chemical release  
tree/stand health

stand conditions

**Abstract:** Tank mixes of the herbicides imazapyr and glyphosate were applied at 3 rates with 3 adjuvants (LI-700Reg., Nu-Film-IRReg., Silwet L-77Reg.) over California hazelnut (*Corylus cornuta* var. *californica*), vine maple (*Acer circinatum*), and brackenfern (*Pteridium aquilinum* var. *lanuginosum*) on a 2-year-old clearcut of Douglas fir (*Pseudotsuga menziesii*) in Oregon. The herbicide 2,4-D was applied at 3 rates with 2 adjuvants (HerbimaxReg., Nu-Film-IR) over greenleaf manzanita (*Arctostaphylos patula*) on a 4-year-old Douglas fir clearcut in Oregon. Tank mixes of imazapyr and glyphosate with LI-700 or Nu-Film-IR were sprayed at 3 rates over 1-year-old seedlings of Douglas fir on 2 sites in Oregon. The herbicide rate strongly influenced the percentage of foliage injured and percentage of stems killed for all herbicide treatments. The adjuvants evaluated did not influence efficacy of herbicide applications on California hazelnut, vine maple, or brackenfern. Herbimax increased visual foliar damage resulting from 2,4-D application on greenleaf manzanita. Douglas fir foliage was damaged by the higher herbicide rates; the damage was greater from Nu-Film-IR than from LI-700.

[OSU Link](#)

[Non-OSU Link](#)

**28.** Knowe, S.A. and W.I. Stein. 1995. Predicting the effects of site preparation and protection on development of young Douglas-fir plantations. *Canadian-Journal-of-Forest-Research* 25(9): 1538-1547.

**Keywords:** site preparation  
release treatments  
tree/stand protection  
growth  
tree morphology  
tree/stand health  
stand conditions

**Abstract:** Diameter prediction models based on the Weibull distribution function and stand-table projection models based on changes in relative diameter were developed for 2- to 10-year-old Douglas fir (*Pseudotsuga menziesii*) plantations in Oregon. Both modelling approaches incorporated the effects of site preparation, animal protection, and competing vegetation. The diameter distribution approach is appropriate when information on initial diameters is not available. The stand-table projection approach may be applied when tree diameters in a plantation are measured two or more growing seasons after planting. At young ages, the stand-table approach provided more accurate representation of observed diameter distributions than the diameter distribution approach. At age 10 the two methods provided comparable diameter distributions. The equations derived for predicting survival, height growth of dominant trees, height-diameter relationships, and the development of woody vegetation over time will facilitate the study and comparison of stand structure and dynamics after various site-preparation and animal protection treatments.

[OSU Link](#)

[Non-OSU Link](#)

**29.** Knowe, S.A., W.I. Stein and L.J. Shainsky. 1997. Predicting growth response of shrubs to clear-cutting and site preparation in coastal Oregon forests. *Canadian-Journal-of-Forest-Research* 27(2): 217-226.

**Keywords:** planting operations  
site preparation  
chemical preparation  
mechanical preparation  
prescribed fire  
stand conditions

**Abstract:** Cover-projection models were developed based on algebraic difference formulations of an exponential-power function to describe shrub recovery and development patterns following clear cutting, site preparation and Douglas fir (*Pseudotsuga menziesii*) planting at 4 sites in the Siuslaw National Forest, Oregon. The sites formed part of the Coastal Site Preparation Study initiated in 1980, in which the effects were tested of 6 treatments on shrub growth patterns. Treatments were: none other than scalping a 30-cm spot when each 2-0 seedling was planted (control); spot clearing by cutting to 15 cm height all woody vegetation within a 1.2 m radius of the seedling; spraying with glyphosate (2.52 kg a.e./ha) in early autumn 1980; broadcasting burning slash in midsummer 1980; manually slashing all woody vegetation in June 1980 and broadcast burning later in the summer; and spraying with picloram + 2,4-D (Tordon 101) in May or June 1980 (at 1.49 + 5.97 kg a.e./ha) and broadcast burning in the summer. Results on the development of Douglas fir and associated vegetation to age 10 yr have already been reported for this study (Stein (1995) Research Paper - Pacific Northwest Research Station, USDA Forest Service, No. PNW-RP-473; Knowe & Stein (1995) Canadian Journal of Forest Research 25 (9) 1538-1547). The shrub cover-projection models were developed by incorporating indicator variables into the model rate and shape parameters for the recovery of 3 specific shrubs (salal, *Gaultheria shallon*; thimbleberry, *Rubus parviflorus*; and salmonberry, *Rubus spectabilis*), and all shrubs. For salal, the shape parameter included an adjustment for burning treatments that delayed maximum cover by several years in comparison with unburned treatments. The rate parameter in the thimbleberry model was adjusted for burning treatments; maximum cover occurred about 2 yr earlier in burned than in unburned treatments. Both rate and shape parameters in the salmonberry model were adjusted for burning treatments; delayed established but increased growth rate and less salmonberry cover are characteristic of burned treatments compared with the unburned treatments. The rate and shape parameters in the model for the shrub group included adjustments for burning treatments. Overstorey removal fostered shrub development, whereas site preparation treatments slowed and curtailed it. The final cover-projection models accounted for 68-92% of the total variation in cover, with the adjustments for burning accounting for 1.5-3.3% of the variation. The predicted growth patterns are consistent with trends in site occupancy and published autecological characteristics.

[OSU Link](#)

[Non-OSU Link](#)

**30.** Leininger, W.C. and S.H. Sharrow. 1987. Seasonal diets of herded sheep grazing Douglas-fir plantations. *Journal-of-Range-Management* 40(6): 551-555.

**Keywords:** release treatments  
tree/stand health  
stand conditions

**Abstract:** The seasonal diets of herded sheep grazing cutover Douglas-fir (*Pseudotsuga menziesii*) forests in the Coast Range of Oregon were studied during 1981 and 1982. Both 4- to 6-year-old non-grass-seeded and 2-year-old grass-seeded plantations were included. Sheep grazing was monitored in spring,

summer and late summer. Forage on offer ranged from 764 to 2459 kg/ha. Vegetational composition of sheep diets varied by year, season and plantation age class. Averaged over the 2 years of grazing, graminoids and forbs were nearly equal, at about 40% each, in sheep diets in older plantations. In contrast, diets of sheep in young grass-seeded plantations averaged 70% graminoids and only 16% forbs. Ferns were a minor component (<2%) of sheep diets in both plantation age classes. Browse averaged 15 and 12% of sheep diets in old and young plantations, respectively. Douglas-fir was most palatable to sheep in spring soon after bud break. It was generally avoided, however, and never comprised more than 3% of sheep diets. Results suggest that sheep can be most effectively used for biological control of unwanted brush species during summer and late summer when differences in relative preference indices for target brush species and Douglas-fir are greatest.

[OSU Link](#)

[Non-OSU Link](#)

**31.** Lindsey, G.D. and J. Evans. 1983. Evaluation of zinc phosphide for control of pocket gophers on Christmas tree plantations. *Tree-Planters' Notes* 34(2): 11-14.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** In laboratory tests, pocket gophers (*Thomomys* and *Geomys* spp.) were offered 5 kinds of treated bait, including 1% Zn phosphide in oats, 0.75% Zn phosphide in fresh carrots, and 0.5% strychnine in rolled oats (3 mixtures). The carrot bait was found to be as effective for killing gophers as the strychnine mixtures. Plots in a 4-yr-old *Pseudotsuga menziesii* and *Pinus monticola* plantation in Washington, with occupied *T. mazama* burrows, were baited with the carrot or one of the strychnine mixtures in Nov. 1981. Both baits produced only a 63% reduction in gopher activity, possibly because of the availability of abundant alternative vegetative food. It was estimated that tree mortality due to root pruning by gophers was >10% on this site. It is recommended that the carrot/Zn sulphide bait be registered for special local needs where safety to wildlife and domestic animals is important.

[OSU Link](#)

[Non-OSU Link](#)

**32.** Mason, R.R. and B.E. Wickman. 1991. Integrated pest management of the Douglas-fir tussock moth. *Forest-Ecology-and-Management* 39(1-4): 119-130.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions  
growth

**Abstract:** The Douglas-fir tussock moth (*Orgyia pseudotsugata*) is one of the most destructive forest defoliators of Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*) and white fir (*A. concolor*) in western North America. An outline is given of current pest-management programmes used in Oregon, which emphasize the annual monitoring of insects in forests with outbreak histories to determine early changes in population numbers and to predict trends. When outbreaks develop, several



environmentally safe chemical and microbial insecticides are effective in reducing larval numbers and preventing serious defoliation. Computer models predicting growth loss, tree mortality, and top-kill during outbreaks are available as aids to making management decisions. Silvicultural practices favouring seral nonhost species on high-risk sites may be the best prescription for reducing the effect of tussock moth outbreaks.

[OSU Link](#)

[Non-OSU Link](#)

**33.** McDonald, P.M. and G.O. Fiddler. 1996. Development of a mixed shrub-tanoak-Douglas-fir community in a treated and untreated condition. Pacific-Southwest-Research-Station, USDA-Forest-Service Research-Paper PSW-RP-225. iv + 16 p.

**Keywords:** release treatments  
manual release  
chemical release  
tree/stand health  
growth  
tree morphology  
stand conditions  
economics

**Abstract:** On a medium site in northern California, a tanoak (*Lithocarpus densiflorus*)-mixed shrub community in a Douglas fir plantation was given several treatments (manual release two and three times, a combination chainsaw and cut surface herbicide (Garlon 3A [triclopyr]) treatment, two foliar herbicides (2,4-D or Garlon 4), and a tank mix of the two herbicides) to study its development in both a natural (control) and treated condition. The herbicides were each applied twice. Survival of planted Douglas fir (*Pseudotsuga menziesii*) seedlings was recorded for 11 years and growth was quantified for 9 years after the last treatment application. In addition to Douglas fir, data are presented individually for the two most abundant species (tanoak and snowbrush, *Ceanothus velutinus* var. *hookeri*), for greenleaf manzanita (*Arctostaphylos patula*), and for the hardwood tree and shrubs combined. At the study's end in 1992, combined vegetation in the control had a mean density of 1800 plants/acre, foliar cover of 23 700 ft<sup>2</sup>/acre, and height of 11.2 ft. In contrast, combined tree and shrubs in the most effective treatment for controlling them (cut and spray Garlon 3A) had a mean density of 150 plants/acre, foliar cover of 150 ft<sup>2</sup>/acre and height of 5.9 ft at study end. Because competition for site resources was low, Douglas fir seedlings developed best in this treatment. Mean Douglas fir diameter was 4.6 inches at 12 inches above mean ground line, height averaged more than 21 ft, and mean foliar cover was 39 850 ft<sup>2</sup> at the end of the study. The cost was \$227 per acre.

[OSU Link](#)

[Non-OSU Link](#)

**34.** McDonald, P.M. and G.O. Fiddler. 1999. Ecology and development of Douglas-fir seedlings and associated plant species in a Coast Range plantation. Pacific-Southwest-Research-Station, USDA-Forest-Service Research-Paper PSW-RP-243. ii + 18 p.

**Keywords:** release treatments

manual release  
chemical release  
stand conditions  
growth  
tree morphology  
economics

**Abstract:** On an average site in northern coastal California, USA, a tanoak (*Lithocarpus densiflorus*)-mixed shrub community was given several treatments (manual release one, two, and three times; a combination chainsaw and cut surface chemical treatment; two foliar chemicals; and a tank mix of the two chemicals) to study its development over an 11-year period (1981-91) in both a broadcast-burned (untreated control) and released (treated) condition. The chemicals were 2,4-D, Garlon [triclopyr] 3A, and Garlon 4, each applied two times. The site had been planted with 2+0 seedlings of Douglas fir (*Pseudotsuga menziesii*) in 1979. In addition to Douglas-fir, data are presented individually for the four most abundant and well distributed species (tanoak, hairy manzanita (*Arctostaphylos columbiana*), huckleberries (*Vaccinium ovatum* and *V. parviflorum*), and rhododendron (*Rhododendron macrophyllum*)), and for these plus two more of the tallest and most abundant (but poorly distributed) species (snowbush (*Ceanothus velutinus*), elderberry (*Sambucus mexicana*)) combined. In 1991, combined shrubs in the control had a mean density of 4733 plants per acre, foliar cover of 16 800 ft<sup>2</sup> per acre, and height of 9.5 feet. In contrast, combined shrubs in one of the most effective treatments for controlling them (2,4-D) had a mean density of 2000 plant per acre, foliar cover of 2600 ft<sup>2</sup> per acre and height of 5.5 feet at the end of the study. Here, mean Douglas-fir diameter was 4.0 inches at 12 inches above mean ground line, height averaged 18.7 feet, and mean foliar cover was 34 800 ft<sup>2</sup> per acre. The cost (including chemical) was \$77 per acre. The biological and economical data in this paper provide the ecosystem manager, wildlife biologist, and fuels manager with knowledge on how to attain plant communities with different density and development potentials, and the cost of creating them.

[OSU Link](#)

[Non-OSU Link](#)

35. McNabb, D.H., K. Baker-Katz and S.D. Tesch. 1993. Machine site preparation improves seedling performance on a high-elevation site in southwest Oregon. *Western-Journal-of-Applied-Forestry* 8(3): 95-98.

**Keywords:** site preparation  
mechanical preparation  
tree/stand health  
stand conditions  
growth

**Abstract:** Douglas fir (*Pseudotsuga menziesii*) seedlings planted on areas receiving one of four site preparation treatments (scarify, scarify/till, soil removal, and soil removal/till) and on unprepared control areas were compared for 5 yr at a high-altitude, nutrient-poor site in the western Siskiyou Mountains. Fifth-year survival of seedlings was at least 85% among machine-prepared plots, compared to 42% on control plots. Cover of competing vegetation remained less than 25% during the period for all machine treatments. In contrast, vegetation cover on control plots was 30% at the time of planting and increased to nearly 75% after 5 yr. Competing vegetation clearly impeded seedling performance. The effects of unusually droughty conditions at the time of planting in 1982 were

examined further by interplanting additional seedlings in the soil-removal treatment in 1985. The interplanting was followed by more normal spring precipitation, and seedlings grew better over 5 yr than those planted in 1982. The slow recovery of competing vegetation and generally poor seedling growth on all treatments during both planting years are attributed to low soil fertility.

[OSU Link](#)

[Non-OSU Link](#)

**36.** Messier, C. and A.K. Mitchell. 1994. Effects of thinning in a 43-year-old Douglas-fir stand on above- and below-ground biomass allocation and leaf structure of understory *Gaultheria shallon*. *Forest-Ecology-and-Management* 68(2/3): 263-271.

**Keywords:** thinning  
stand conditions

**Abstract:** *Salal* (*Gaultheria shallon*) was studied in an unthinned and a heavily thinned (two-thirds of basal area removed) 43-yr-old Douglas fir (*Pseudotsuga menziesii*) plot 6 yr after thinning at Shawnigan Lake on southern Vancouver Island, British Columbia. The increase in both above- and below-ground resources caused by thinning resulted in a smaller fine-root/leaf biomass ratio in the thinned (1.2) than the unthinned (2.0) plot. The balance between the production of fine-roots to acquire limited water and of foliage to acquire limited light is suggested as an explanation for this shift in carbon allocation from fine-root to leaf biomass between the two plots. The responses of *G. shallon* to thinning are discussed in relation to its role as a competitor for below-ground resources.

[OSU Link](#)

[Non-OSU Link](#)

**37.** Miller, J.C. and K.J. West. 1987. Efficacy of *Bacillus thuringiensis* and diflubenzuron on Douglas-fir and oak for gypsy moth control in Oregon. *Journal-of-Arbiculture* 13(10): 240-242.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** In studies at Corvallis, 20 trees of each of *Quercus garryana* and Douglas fir [*Pseudotsuga menziesii*] were sprayed from the ground on 6 May 1986 until foliage dripped. Foliage was collected 1 day before spraying and 1-64 days after spraying and bioassayed with 2nd instar larvae of gypsy moth [*Lymantria dispar*]. Larval mortality was n.s.d. between tree species or between insecticides. Both *B. thuringiensis* and diflubenzuron caused high larval mortality and were effective for at least 64 days at the doses applied.

[OSU Link](#)

[Non-OSU Link](#)

**38.** Miller, R.E., D.H. McNabb and J. Hazard. 1989. Predicting Douglas fir growth and response to nitrogen fertilization in western Oregon. *Soil-Science-Society-of-America-Journal* 53(5): 1552-1560.

**Keywords:** fertilization  
growth  
soil properties  
stand conditions

**Abstract:** The objective of this study was to determine the efficacy of various stand (site index, age, and relative density), climatic (total precipitation, average daily solar radiation), site (elevation, soil depth, and available water-holding capacity), and soil-test variables (anaerobically mineralized N, total N, organic matter, and C:N ratio) to predict relative and absolute response of *Pseudotsuga menziesii* stands to a single application of 224 Kg/N ha as urea. The core equation with stand variables accounted for 70% of residual variation in average annual volume growth. Predicting response of fertilized stands proved much less precise. The best core equation explained 37% of the residual variation for average percentage response in volume growth and explained less variation in absolute response in both volume and basal area. Of the site, climatic, and soil-test variables, C:N ratio in the surface soil was the only one that significantly increased precision of the core equations. The best combined equation explained 46% of the variation in percent volume response. The anaerobic N mineralization test failed to make a significant contribution to the core equation and had a lower correlation with response than did the C:N ratio. Stand variables remain the most reliable predictors of fertilizer response in this region; any improvement from including soil data for N or organic matter is not justified because of their additional cost.

[OSU Link](#)  
[Non-OSU Link](#)

39. Moldenke, A.F., R.E. Berry, J.C. Miller, R.G. Kelsey, J.G. Wernz and S. Venkateswaran. 1992. Carbaryl susceptibility and detoxication enzymes in gypsy moth (Lepidoptera: Lymantriidae): influence of host plant. *Journal-of-Economic-Entomology* 85(5): 1628-1635.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** Toxicity of carbaryl and levels of detoxifying enzymes were determined in larvae of *Lymantria dispar* reared from hatching on either white alder (*Alnus rhombifolia*) or Douglas fir (*Pseudotsuga menziesii*). Foliar chemistry was also examined. Larvae were treated topically with carbaryl 2 days into the 3rd or 5th instar and LD50s were established based on survival 48 h after treatment. Surviving 3rd-instar larvae were fed on their original diet until death or pupation and sublethal effects were assessed. Levels of detoxifying enzymes were determined in larvae of the same age and rearing group. Larvae reared on Douglas fir were significantly more tolerant of carbaryl. Sublethal effects were found only in larvae fed Douglas fir, in which mortality after 48 h and time to pupation were significantly greater in treated larvae than in controls. Levels of detoxification enzymes were generally higher in tissues of larvae raised on Douglas fir, but significantly higher in only a few instances. Nitrogen and phenolic contents were higher in alder than in Douglas fir. Terpenes were abundant in Douglas fir foliage but were not detected in alder.

[OSU Link](#)  
[Non-OSU Link](#)

40. Moldenke, A.F., R.E. Berry, J.C. Miller and J.G. Wernz. 1997. Toxicity of acephate to larvae of gypsy moth as a function of host plant and bioassay method. *Entomologia-Experimentalis-et-Applicata* 84(2): 157-163.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** The toxicity of acephate to 3rd-instar larvae of *Lymantria dispar* was examined under different conditions of administration method, availability of food to larvae during bioassay, host plant, and activity of detoxifying enzymes. Larvae that had been fed field-collected foliage of white alder (*Alnus rhombifolia*) were less susceptible 48 h after treatment with topically applied acephate if they were allowed to continue feeding on foliage during the bioassay period (LD50 = 60.6 micro g/g larva) than if they were not (LD50 = 13.5 micro g/g larva). All surviving larvae were replaced on their original food plant after the 48-h bioassay; of these, 14.4% of the larvae not fed during treatment died before pupation, compared with 1.3% of the larvae fed alder during treatment. The LD50 obtained for topically treated larvae reared and treated on Douglas fir (*Pseudotsuga menziesii*) (51.1 micro g/g larva) was comparable to that obtained for larvae fed alder (60.0 micro g/g larva) throughout treatment. Larvae treated orally with acephate, however, were slightly more susceptible when reared on Douglas fir (LC50 = 20.3 ppm) than when reared on alder (LC50 = 27.0 ppm). Post-treatment mortality in orally treated larvae was 10.3% in those fed alder and 9.5% in those fed Douglas fir. Higher cytochrome P-450 activities in larvae reared on Douglas fir apparently did not enhance tolerance to acephate. Both sexes of orally treated larvae took significantly longer to pupate than did controls on both foliage types, as did topically treated males fed Douglas fir. Pupal weight generally was slightly, but not always significantly, higher in treated than untreated larvae under all dietary and treatment regimes.

[OSU Link](#)

[Non-OSU Link](#)

41. Moldenke, A.F., R.E. Berry, J.C. Miller, J.G. Wernz and X.H. Li. 1994. Toxicity of *Bacillus thuringiensis* subsp. *kurstaki* to gypsy moth, *Lymantria dispar*, fed with alder or Douglas-fir. *Journal-of-Invertebrate-Pathology* 64(2): 143-145.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** The response of larvae of *Lymantria dispar*, reared on either *Alnus rhombifolia* or *Pseudotsuga menziesii* following collection of egg masses from the field in Maryland in 1990, to treatment via an artificial diet with *Bacillus thuringiensis* subsp. *kurstaki* (Javelin, 5% a.i.) was evaluated in the laboratory. Mortality was independent of dose in both food plant treatments, but was significantly greater for larvae fed the treated *P. menziesii* diet. Sub-lethal effects and the role of food plant constituents with respect to susceptibility to this biological control agent are also briefly discussed.

[OSU Link](#)

[Non-OSU Link](#)

42. Morrison, D. 1984. Evaluation of impact - Advances in control. *In* Proceedings of the Sixth International Conference on Root and Butt Rots of Forest Trees, International Union of Forestry

Research Organizations (IUFRO) Working Party S2.06.01., Melbourne, Australia, August 25-31, 1983. Ed. G.A. Kile. pp. 359-397.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** Five papers

[OSU Link](#)

[Non-OSU Link](#)

**43.** Murray, M.D. and R.E. Miller. 1986. Early survival and growth of planted Douglas-fir with red alder in four mixed regimes. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-366. ii + 13 p.

**Keywords:** planting operations  
release treatments  
growth  
stand conditions

**Abstract:** To quantify interactions between species, the survival and growth of planted Douglas fir in association with volunteer or planted red alder (*Alnus rubra*) were studied at a site on the W. side of the Cascade Range, Washington. The planted alders were wildings taken either from a nearby site or from a distant coastal site and interplanted in a 3-yr-old Douglas fir plantation. The volunteer alders established during the first year and were cut when the plantation was 3 or 7 yr old. There was no apparent advantage in using non-local alder to reduce aboveground competition with Douglas fir. Survival of both sources of transplanted alder was high. Retaining about 1100 plants/ha of volunteer alders until plantation age 7 yr had no measurable effect on Douglas fir. It is recommended that, with alder densities of <1250/ha, alder control on most land of average or below average site quality can be delayed until 6-8 yr after planting Douglas fir. This will reduce alder sprouting and allow simultaneous control of alder and precommercial thinning of Douglas fir.

[OSU Link](#)

[Non-OSU Link](#)

**44.** Newton, M. and E.C. Cole. 1989. Where does sulfometuron fit in Pacific northwest silviculture? Proceedings-of-the-Western-Society-of-Weed-Science (Vol. 42): 121-128.

**Keywords:** release treatments  
chemical release  
stand conditions  
tree/stand health

**Abstract:** Field trials in the Oregon Coast Range were conducted to evaluate sulfometuron for weed control in established and newly-planted stands of *Pseudotsuga menziesii*. North Coast sites were aerially-sprayed with 0.11 or 0.22 kg/ha sulfometuron +or- 2.2 kg/ha 2,4-D. South Coast sites received 0.11 or 0.165 kg/ha sulfometuron, and this was compared with 1.65 kg/ha hexazinone, 4.4 + 0.42 or

0.40 kg/ha atrazine + glyphosate +or- 1.25% surfactant (R-11). Weed cover and tree damage were assessed visually. In South Coast sites, all treatments reduced weed cover >50%. Broadleaved weeds and grasses were well controlled, but none of the treatments suppressed shrub growth. Broadleaved weeds were best controlled by hexazinone, and all other weeds by sulfometuron. On North Coast sites, all treatments reduced weed cover. Broadleaved weeds, grasses, shrubs and *Rubus ursinus* were all suppressed, but ferns were not. 2,4-D enhanced the effect of sulfometuron on broadleaved weeds and *R. ursinus*, but injury to *P. menziesii* was also greater. This was acceptable on terminal growth <3-5 cm, above which foliage necrosis, terminal dieback and growth check occurred. Timing of sulfometuron treatment alone was not significant, and the effects of rate of application were not clear from the first season's observations.

[OSU Link](#)

[Non-OSU Link](#)

**45.** Newton, M., E.C. Cole and D.E. White. 1986. What influences control of coastal deciduous brush with glyphosate. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol.39): 86-92.

**Keywords:** release treatments  
chemical release  
stand conditions  
tree/stand health

**Abstract:** The effects of 0.5, 1.0 or 1.5 lb a.e. glyphosate/acre as Rodeo or Roundup applied in July or Aug. at 2 spray vol. with or without surfactant were studied on 5 woody species in the Oregon Coast Range. Glyphosate was more effective in 10 than 3 gallons spray/acre. Aug. applications were best, except in the case of *Alnus rubra* and conifers which were best controlled by July treatments. Addition of surfactant improved efficiency at low rates and vol. of glyphosate. *Rubus spectabilis* was most susceptible in Aug. and *Sambucus racemosa* was equally sensitive at both dates, but *R. procerus* and *R. laciniatus* were resistant. In a 2nd trial against *Acer macrophyllum*, crown reduction ranged from 60 to 85% with no differences between rates but decreasing efficacy with lower spray volumes. Plantings of *Pseudotsuga menziesii* were injured by all treatments in July but not in Aug.

[OSU Link](#)

[Non-OSU Link](#)

**46.** Oliver, C.D. and M.D. Murray. 1984. Stand structure, thinning prescriptions, and density indexes in a Douglas-fir thinning study, Western Washington, U.S.A. *Canadian-Journal-of-Forest-Research* 13(1): 126-136.

**Keywords:** thinning  
commercial thinning  
growth  
stand conditions

**Abstract:** In a stand regenerated after logging in 1930, thinnings to set b.a. values were carried out in 1959, 1962, 1966, and 1970. On each plot both large and small trees were removed since av. b.a. per tree was kept constant before and after thinning. Volume growth varied greatly between plots of the

same age, initial b.a., and site because of differences in stand structure. Large trees on a plot grew more per tree and per b.a. than small trees. Stand b.a., stand vol., number of stems, or number of dominant and codominant trees were not closely related to vol. growth/ha, although density indexes giving weight to larger trees showed the closest relationship. The lack of a close relationship between stand density indexes and growth probably means the indexes do not uniquely define structures; it does not necessarily mean that thinning will not increase volume growth/ha. Volume growth/ha after thinning to a given b.a. will be greater and probably more consistent if larger trees are left and enough time is allowed for the stand to recover following thinning.

[OSU Link](#)

[Non-OSU Link](#)

47. Otvos, I.S., J.C. Cunningham and R.I. Alfaro. 1987. Aerial application of nuclear polyhedrosis virus against Douglas-fir tussock moth, *Orgyia pseudotsugata* (McDunnough) (Lepidoptera: Lymantriidae); II. Impact 1 and 2 years after application. *Canadian-Entomologist* 119(7-8): 707-715.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** Following aerial application of a nuclear polyhedrosis virus of *Orgyia pseudotsugata* against this lymantriid on Douglas fir (*Pseudotsuga menziesii*) in British Columbia in 1982, the impact of treatment was studied in 1983 and 1984. The virus appeared to have spread from treated plots to adjoining areas in 1982, effectively reducing lymantriid populations. This observation suggests the spraying of alternate swaths to reduce the amount of microbial pesticide used. A naturally occurring viral epizootic reduced lymantriid populations in 2 of 3 check plots in 1983, but severe tree mortality occurred in 2 of these plots, with 60 and 62% of sample trees dead in 1984. The corresponding tree mortality in 2 of 4 treated plots was 4 and 7%.

[OSU Link](#)

[Non-OSU Link](#)

48. Otvos, I.S. and R.F. Shepherd. 1991. Integration of early virus treatment with a pheromone detection system to control Douglas-fir tussock moth, *Orgyia pseudotsugata* (Lepidoptera: Lymantriidae), populations at pre-outbreak levels. *Forest-Ecology-and-Management* 39(1-4): 143-151.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** The development and integration of a pheromone monitoring system with a nuclear polyhedrosis virus treatment is described. Stands of Douglas fir (*Pseudotsuga menziesii*) in British Columbia susceptible to tussock-moth outbreaks are defined by overlying maps of past outbreaks, forest and habitat types, and climatic zones. Pheromone-baited traps are placed and monitored annually at permanent locations in susceptible areas. Measuring annual trends of moth density indicates time and location of the next outbreak. Trap-catch data provide an early warning of impending outbreaks, confirmed by ground reconnaissance. Insect density and defoliation are predicted from egg-mass and



larval sampling. The virus can then be applied from the air or from the ground into threatened stands to initiate an epizootic to prevent development of an outbreak and to minimize tree damage. The virus appears to spread, and field tests with reduced dosages indicate that the small amount of virus applied can still greatly reduce larval populations and prevent tree mortality, at considerably reduced cost.

[OSU Link](#)

[Non-OSU Link](#)

**49.** Overhulser, D.L., J.D. Walstad and R.P. Bowers. 1980. Twig weevil damage to Douglas-fir seedlings and a field test of Dursban for control. *Tree-Planters' Notes* 31(2): 17-20.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** Damage categories are described for young plantations in Oregon mostly 2+1 seedlings, planted in 1975-76 and surveyed in 1977 after attack by *Cylindrocopturus furnissi* in 1976. A test using Dursban 4E (chlorpyrifos) spray at 0-4% a.i., applied in July 1977, showed n.s.d. in % damaged trees between treated and control areas after 4 months, but this may have been due to a natural decline in weevil numbers. Spraying with 2% a.i. Dursban in Aug. 1977 significantly reduced the numbers of weevils present.

[OSU Link](#)

[Non-OSU Link](#)

**50.** Prescott, C.E., L.P. Coward, G.F. Weetman and S.P. Gessel. 1993a. Effects of repeated nitrogen fertilization on the ericaceous shrub, salal (*Gaultheria shallon*), in two coastal Douglas-fir forests. *Forest-Ecology-and-Management* 61(1-2): 45-60.

**Keywords:** fertilization  
growth  
stand conditions

**Abstract:** Understorey vegetation changes were quantified following nitrogen fertilizer trials at two sites in the Pacific Northwest. In the Pack Forest, Washington, USA, - second growth (70-yr-old) Douglas fir (*Pseudotsuga menziesii*) - salal (*Gaultheria shallon*) was eliminated in a plot that had been fertilized with nitrogen alone (1540 kg N/ha as ammonium nitrate and urea between 1950 and 1982), but was unchanged in a plot that received phosphorus and sulfur in addition to nitrogen (1082 kg N/ha). In a trial near Parksville, Vancouver Island - logged in 1947, stand comprising 75% Douglas fir, site index 33 m at age 50 yr - salal cover was reduced with increasing amounts of nitrogen, and was eliminated in plots that received 600 kg N/ha as urea in three applications. Reductions were less pronounced in plots that received sulphur in addition to nitrogen. In the Pack Forest trial, the cover of snowberry (*Symphoricarpos albus*) increased in the plot where salal was eliminated; in the Parksville trial, no other species became more abundant in the absence of salal. Tree stem volume and stem volume increment in each plot were not related to salal cover in the plots. Results suggest that high concentrations of ammonium and nitrate in the forest floors of N-fertilized plots may render salal less competitive, or may

interfere with ericoid mycorrhizae, contributing to reduced cover of salal in forests receiving repeated N-applications.

[OSU Link](#)

[Non-OSU Link](#)

**51.** Reynolds, P.E., K. King, R. Whitehead and T.S. MacKay. 1986. One-year results for a coastal British Columbia glyphosate conifer release trial. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol.39): 107-117.

**Keywords:** release treatments  
chemical release  
stand conditions  
growth  
tree/stand health

**Abstract:** In trials on the W. coast of Vancouver Island in 1984, fir plantations on a reclaimed watershed were aerially treated with 2 kg glyphosate/ha. A single spray gave good control of *Rubus spectabilis* but very variable control of *Alnus rubra* ranging from 0 to 100%. *Gaultheria shallon* [G. shallon] was not controlled by glyphosate. Control of many species was greater on upper slopes than in the watershed valley bottom. There was minor crop tree injury to *Tsuga heterophylla* and *Thuja plicata* with recovery after 1 year, but no injury to *Picea sitchensis*, *Pseudotsuga menziesii*, *Abies amabilis* or *A. grandis*. Some increases in crop tree height were noted after herbicide treatment.

[OSU Link](#)

[Non-OSU Link](#)

**52.** Richmond, R.M. 1983. Problems and opportunities of forestland grazing in the Pacific Northwest. *In Forestland Grazing: Proceedings of a Symposium held February 23-25, 1983, Spokane, Washington. Eds. B.F. Roche, Jr and D.M. Baumgartner, Pullman, USA:Washington State University. pp. 71-73.*

**Keywords:** release treatments  
stand conditions  
tree/stand health

**Abstract:** Grazing as a means of brush control in Douglas-fir plantations after clearcut timber harvest was investigated in 1980-2 near Alsea, Oregon. Plots were restricted to clearcut areas with dominant vine maple [*Acer circinatum*]/sword fern [*Polystichum munitum*] communities. In 1980-1 a flock of 600 ewes with lambs was used and in 1982 900 dry ewes were used. The sheep were kept as a single flock and moved from clearcut to clearcut on a scheduled basis from mid-May to late Aug. Approx. 6 acres were used per day. This management reduced brush competition with Douglas fir seedlings, did not significantly damage fir seedlings, stimulated regrowth of grazed plants improving forage quality for big game and controlled *Senecio jacobaea*. Av. daily weight gain of lactating ewes in 1981 was less than for the dry ewes in 1982. Forage digestibility was adequate for dry ewes, but did not always meet the requirements of the lactating ewes with lambs. These results are discussed in the general context of forest management in the Pacific Northwest.

[OSU Link](#)

[Non-OSU Link](#)

**53.** Riley, C.M., C.J. Wiesner, D.W. Scott, J. Weatherby and R.G. Downer. 1992. Evaluating the field efficacy of *Bacillus thuringiensis* Berliner against the western spruce budworm (Lepidoptera: Tortricidae). *In* Pesticide formulations and application systems: 11th volume. *Eds.* L.E. Bode and D.G. Chasin, ASTM, Philadelphia, USA. pp. 271-290.

**Keywords:** tree/stand protection  
stand conditions  
tree/stand health

**Abstract:** A detailed assessment of spray deposition and efficacy of 2 formulations of *Bacillus thuringiensis* was carried out as part of a control programme against *Choristoneura occidentalis* on *Pseudotsuga menziesii* and *Abies grandis* in Oregon in 1988. An analysis of covariance model that was used to examine the relationship between deposit density and field efficacy (larval mortality and defoliation) could not be justified, and the relationships between variables were investigated using chi-squared analysis. This paper was presented at a conference on pesticide formulations and application systems, held in San Antonio, USA, on 14-15 November 1991.

[OSU Link](#)

[Non-OSU Link](#)

**54.** Rose, R. and J.S. Ketchum. 2002. Interaction of vegetation control and fertilization on conifer species across the Pacific Northwest. *Canadian-Journal-of-Forest-Research* 32(1): 136-152.

**Keywords:** fertilization  
release treatments  
chemical release  
growth  
tree/stand health  
tree physiology  
stand conditions

**Abstract:** An experiment evaluating three levels of vegetation competition control (no control, 1.5 m<sup>2</sup> of vegetation control, and 3.3 m<sup>2</sup> of vegetation control), each with two fertilizer application treatments (fertilizer application at the time of planting with complete slow-release fertilizer (WoodaceReg. IBDU), or no fertilizer application), was installed at five sites. Two of these sites were planted with Douglas-fir (*Pseudotsuga menziesii*) in the Oregon Coast Range, one with ponderosa pine (*Pinus ponderosa*) in eastern Washington, one with western hemlock (*Tsuga heterophylla*) in the coastal hemlock zone in Oregon, and one with coastal redwood (*Sequoia sempervirens*) in northern California, USA. At four of the five sites, mean stem volume, basal diameter, and height of seedlings increased significantly with increasing area of weed control, and the magnitude of difference between treatments increased with time. Fertilizer application significantly increased seedling size only at the two sites with adequate soil moisture; increases were marginally significant at a third. Response to fertilizer application was less than from weed control and impacted growth for only the first year, whereas the influence of weed control

continued to influence growth the entire length of the study (4 years). Area of vegetation control and fertilizer application did not interact significantly at any site.

[OSU Link](#)

[Non-OSU Link](#)

**55.** Rose, R. and J.S. Ketchum. 2003. Interaction of initial seedling diameter, fertilization and weed control on Douglas-fir growth over the first four years after planting. *Annals-of-Forest-Science* 60(7): 625-635.

**Keywords:** nursery operations  
fertilization  
release treatments  
chemical release  
growth  
tree/stand health  
stand conditions

**Abstract:** Planting larger stock, fertilizer application and added years of weed control are often employed to increase growth rate of plantations. We evaluated these techniques using a replicated factorial study design repeated in two diverse locations in western Washington State, USA. Two different sizes of planting stock, NPK fertilizer application at planting and in the following year, and two or three years of weed control using herbicides were tested. No significant interactions among the treatment levels were found with all treatments influencing Douglas-fir (*Pseudotsuga menziesii*) growth in an additive manner. Fourth year stem volume gains were greatest from planting larger initial stock: planting seedlings 2 mm larger in basal diameter resulted in fourth-year stem volume gains of 35 and 43%. The fertilizer application treatments used produced early gains, but they were short lived. The third-year weed control treatment had no observable effect on fourth-year stem volume or on volume growth in years three or four.

[OSU Link](#)

[Non-OSU Link](#)

**56.** Rose, R., J.S. Ketchum and D.E. Hanson. 1999. Three-year survival and growth of Douglas-fir seedlings under various vegetation-free regimes. *Forest-Science* 45(1): 117-126.

**Keywords:** release treatments  
chemical release  
growth  
tree morphology  
tree/stand health  
stand conditions

**Abstract:** Responses of Douglas-fir (*Pseudotsuga menziesii*) seedlings were studied for 3 yr (1993-96) following eight vegetation-control treatments in three western Oregon clearcuts. The objectives were to determine seedling growth response to different areas of spot vegetation control and to determine the relative influence of early woody and herbaceous competition on seedling growth. Herbicide treatment

areas varied in size from those receiving no control to full control (9.3 msuperscript 2). Controlled areas were maintained free of herbaceous vegetation for 2 yr and all woody vegetation was controlled for 3 yr. Two additional treatments, complete control of woody vegetation only and complete control of herbaceous vegetation only, were also examined. On two sites (Summit and Marcola), seedling growth parameters were maximized at or near full vegetation control with a tree spacing of 3 m x 3 m. On the third site (Pedee), maximum growth response occurred between 5 and 6 msuperscript 2 of control. Herbaceous vegetation control resulted in increased seedling growth at all sites while woody vegetation control yielded increased seedling growth only at the Pedee site. Cumulative 3 yr herbaceous cover accounted for 68% and 41% of the variability in stem volume at Summit and Marcola, respectively. Adding cumulative 3 yr woody cover to the model accounted for an additional 18% and 49% of the variability in stem volume at Summit and Marcola, respectively. At Pedee, neither herbaceous nor woody cover significantly influenced 3 yr stem volume, suggesting that factors other than vegetation cover were responsible for differences measured.

[OSU Link](#)

[Non-OSU Link](#)

57. Ross, D.W., K.E. Gibson, R.W. Thier and A.S. Munson. 1996. Optimal dose of an antiaggregation pheromone (3-methylcyclohex-2-en-1-one) for protecting live Douglas-fir from attack by *Dendroctonus pseudotsugae* (Coleoptera: Scolytidae). *Journal-of-Economic-Entomology* 89(5): 1204-1207.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** The *Dendroctonus pseudotsugae* antiaggregation pheromone, 3-methylcyclohex-2-en-1-one (MCH), was applied to stands of Douglas fir, *Pseudotsuga menziesii* in Oregon, Montana, Idaho and Utah, at high risk for infestation to determine the lowest effective dose for protecting live trees. MCH was applied at rates of 50, 100, and 150 bubble capsules per hectare (20, 40, and 60 g/ha, resp.) in 1994, and 15, 30, and 50 bubble capsules per hectare (6, 12, and 20 g/ha, resp.) in 1995. Mean release rates throughout the beetle flight periods in 1994 and 1995 were 1.63 and 1.23 milligrams per capsule per day, resp. For both years, catches of Douglas fir beetles in pheromone-baited traps located at the plot centers were significantly lower on all MCH-treated plots compared with untreated plots, but there were no differences among the 3 doses of MCH. In contrast, MCH had no effect on the numbers of 3 predators (*Thanasimus undatulus*, *Enoclerus sphegeus* and *Temnochila chlorodia* [*Temnoscheila chlorodia*]) collected in the traps during either year. In 1994, the percentage of Douglas fir <more or =>20 cm diameter at breast height (dbh) that were mass attacked was significantly lower on MCH-treated plots compared with the untreated control, and all 3 doses were equally effective. In 1995, there were no significant differences in the percentage of mass-attacked trees among the treatments. These results demonstrate that MCH applied at rates as low as 20 g/ha (50 bubble capsules per hectare) can reduce the probability that high-risk Douglas fir will become infested.

[OSU Link](#)

[Non-OSU Link](#)

58. Sandquist, R.E., D.L. Overhulser and J.D. Stein. 1993. Aerial applications of esfenvalerate to suppress *Contarinia oregonensis* (Diptera: Cecidomyiidae) and *Megastigmus spermotrophus* (Hymenoptera: Torymidae) in Douglas-fir seed orchards. *Journal-of-Economic-Entomology* 86(2): 470-474.

**Keywords:** seed orchard management  
tree/stand protection  
stand conditions

**Abstract:** Aerial application of esfenvalerate significantly reduced populations of *Contarinia oregonensis* and *Megastigmus spermotrophus* in mature seed orchards of *Pseudotsuga menziesii* in Oregon. Populations of *Oligonychus ununguis* increased significantly in treated areas. The results demonstrated that aerial applications can be made under conditions in the Pacific Northwest and can reduce insect damage levels with between 10 to 20-times less insecticide than when high-volume orchard sprayers are used.

[OSU Link](#)

[Non-OSU Link](#)

59. Schneider, W.G., S.A. Knowe and T.B. Harrington. 1998. Predicting survival of planted Douglas-fir and ponderosa pine seedlings on dry, low-elevation sites in southwestern Oregon. *New-Forests* 15(2): 139-159.

**Keywords:** site preparation  
mechanical preparation  
prescribed fire  
tree/stand health  
tree morphology  
stand conditions

**Abstract:** Four equations were developed by logistic regression for predicting the probability of Douglas fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) survival for the first (0-1) and first to third (1-3) growing seasons after applying mulching, radial scalping (removal of all vegetation and a thin layer of soil in a 1-m radius area around each tree), or artificial shading (shade cards) treatments in plantations in SW Oregon. Most of the sites had been burned by wildfire or prescribed fire before planting. Variables describing conifer size, levels of competing vegetation, presence of silvicultural treatments, site factors, and climate factors were collected from 13 sites up to 6 yr after planting and examined as potential predictors of survival. Age, stem diameter, a competition index for shrubs, severity of growing season at time of treatment, average annual precipitation, aspect, and slope angle were predictors of Douglas fir survival during 0-1 and 1-3 growing seasons after treatment; the presence of silvicultural treatments was also a predictor only during the first growing season after treatment. Age, aspect, and slope angle were predictors of ponderosa pine survival over both 0-1 and 1-3 growing seasons after treatment; height-diameter ratio, competition indices for herbs, shrubs, and hardwoods, silvicultural treatment, severity of growing season at time of treatment, and average annual precipitation were also predictors only during the first growing season after treatment; crown width was a predictor of survival only during 1-3 growing seasons after treatment. When significant in the models (equations), predicted probability of survival increases with treatments, less severe weather conditions, diameter, crown width, age, and precipitation; probability decreases with increasing height-diameter ratio and competition indices for herbs, shrubs, and hardwoods.

[OSU Link](#)

[Non-OSU Link](#)

60. Sharrow, S.H., W.C. Leininger and K.A. Osman. 1992b. Sheep grazing effects on coastal Douglas fir forest growth: a ten-year perspective. *Forest-Ecology-and-Management* 50(1-2): 75-84.

**Keywords:** release treatments  
tree/stand health  
stand conditions  
growth

**Abstract:** In a study evaluating effects of controlled sheep grazing on Douglas fir (*Pseudotsuga menziesii*) growth, tree diameter and height growth were measured during 1981-1990 in ungrazed and grazed tree stands in the Siuslaw National Forest, Oregon. Grazed stands were intensively used by a herded flock of 700-900 sheep for 3-4 days each May and August 1981 and 1982. The stand had been clear felled in 1977, burned in 1978, and planted with 3-year-old trees in 1980. Orchardgrass (*Dactylis glomerata*) was also sown aerially in 1980 to provide a food source for large indigenous herbivores and help slow the establishment of unwanted woody vegetation. Understorey vegetation phytomass and its utilization by sheep was evaluated using a before-and-after technique in 1981 and 1982. Sheep removed 28% and 64% of new tree lateral branches in 1981 and 1982, respectively. The major effect of browsing, however, appeared to be removal of terminal leaders which reduced 1990 Douglas fir tree height by 61 cm and diameter at breast height (d.b.h.) by 1.9 cm for each terminal removed. Sheep browsed terminal leaders of 38% and 77% of grazed plantation trees in 1981 and 1982, respectively. Grazing proved very effective in reducing red alder (*Alnus rubra*) establishment and growth. Total tree basal area in 1990 was similar for grazed and ungrazed stands. However, red alder trees contributed over 45% of tree basal area on ungrazed stands compared with 19% on grazed stands. Vegetation control by sheep, without associated browsing of terminal leaders, increased 1990 Douglas fir height by 16% and d.b.h. by 34%. Net effect of grazing (taking into account the negative effects of browsing together with the positive effects of reduced competing vegetation) was to increase 1990 Douglas fir height by 6% and d.b.h. by 22% on grazed compared with ungrazed timber stands.

[OSU Link](#)

[Non-OSU Link](#)

61. Sharrow, S.H., W.C. Leininger and B. Rhodes. 1989. Sheep grazing as a silviculture tool to suppress brush. *Journal-of-Range-Management* 42(1): 2-4.

**Keywords:** release treatments  
stand conditions  
growth

**Abstract:** Three 4- to 6-year-old Douglas fir (*Pseudotsuga menziesii*) plantations were grazed by sheep once each year during the May to Sep. grazing season in 1981-82. Estimates of current year's growth present in Oct. both inside and outside a livestock enclosure on each plantation, were used to evaluate the effects of grazing on the growth of *Acer circinatum* and *Rubus* spp. In general, utilization of brush by sheep was moderate to heavy, except in the spring of 1982, when brush was lightly utilized. Sheep grazing effectively reduced both total understorey plant growth and brush net current year's growth on all plantations. Reduced brush biomass on grazed areas was associated with greater Douglas fir diam. growth in 1981-82 and 1982-83. By 1985, trees in grazed areas were 5% higher and 7% greater in diam. than trees on ungrazed controls.

[OSU Link](#)

[Non-OSU Link](#)

62. Shepherd, R.F. 1994. Management strategies for forest insect defoliators in British Columbia. *Forest-Ecology-and-Management* 68(2/3): 303-324.

**Keywords:** tree/stand protection  
growth  
tree/stand health  
stand conditions

**Abstract:** A synthesis is presented of outbreak characteristics of common defoliating insects in forests (mainly *Pseudotsuga menziesii*) in British Columbia. Two types of outbreak are identified: fast-cycling and sustained outbreaks. Species with fast-cycling outbreaks rise quickly to visible defoliation levels, cause significant growth loss, tree deformation and mortality, and disappear just as quickly. Fast-cycle species noted include the Douglas fir tussock moth (*Orgyia pseudotsugata*), western blackheaded budworm (*Acleris gloverana*), black army cutworm (*Actebia fennica* [*Ochropleura fennica*]), western hemlock looper (*Lambdina fiscellaria lugubrosa*), false hemlock looper (*Nepytia freemani*), greenstriped forest looper (*Melanolophia imitata*), and the saddleback looper (*Ectropis crepuscularia*). The effect of such outbreaks is closely related to the severity of defoliation during the first year; consequently, the objective of managing these species should be to reduce populations before defoliation occurs, i.e. to prevent the outbreak. To accomplish this objective, identification of susceptible habitats and monitoring with sensitive pheromone traps in areas of expected outbreaks are necessary to detect upwelling populations. Species with sustained outbreaks (typified by the various species of spruce budworms (*Choristoneura* spp.), e.g., the western spruce budworm, *C. occidentalis*, the 2-year cycle budworm, *C. biennis*, and *C. orae*) cause significant growth losses only after defoliation continues for a number of years. Tree mortality usually is not important except where regeneration is being nurtured under a selective or shelterwood silvicultural system. Impact can be significant over the life of a stand because of the length and frequency of outbreaks, but treatments effective for only 1 year usually cannot be justified except where it is important to retain a full crown. Long-term cultural methods appear to be the preferred management system and, of these, utilizing non-host species or resistant or phenologically asynchronous host species may be the best option. Again, determining the location of expected outbreaks is an important component of a management system and, at present, identifying stands by frequency of outbreak within zones of climatic suitability would be useful in selecting treatment areas.

[OSU Link](#)

[Non-OSU Link](#)

63. Shepherd, R.F., T.G. Gray, R.J. Chorney and G.E. Daterman. 1985. Pest management of Douglas-fir tussock moth, *Orgyia pseudotsugata* (Lepidoptera: Lymantriidae): monitoring endemic populations with pheromone traps to detect incipient outbreaks. *Canadian-Entomologist* 117(7): 839-848.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions



**Abstract:** The numbers of adults of *Orgyia pseudotsugata* caught in sticky delta-shaped pheromone traps baited with different concentrations of synthetic lures were compared with egg-mass densities and subsequent tree defoliation throughout a population cycle in British Columbia. A lure containing 0.01% pheromone by weight in the form of a 3 x 5-mm poly(vinyl chloride) rod provided more consistent catches than pheromone concentrations of 0.0001, 0.001, 0.1 or 1.0%. Trap saturation occurred when over 40 moths per trap were caught. To achieve a standard error of 30%, 6 traps were required at each site. There was a poor correlation between numbers of moths caught and egg-mass density or defoliation estimates in the following generation, but a threshold density was found that provides a warning of an incipient outbreak. Ground surveys for egg-masses are recommended to confirm suspected infestations after continuous increases in moth catches for 2-3 years or if an average of 25 moths or more per trap has been caught.

[OSU Link](#)

[Non-OSU Link](#)

64. Shepherd, R.F., I.S. Otvos and R.J. Chorney. 1984a. Pest management of Douglas-fir tussock moth (Lepidoptera: Lymantriidae): a sequential sampling method to determine egg mass density. *Canadian-Entomologist* 116(7): 1041-1049.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** A sequential egg-mass sample system for *Orgyia pseudotsugata* (McDunn.) was designed, based on visual scanning of the lower branches of Douglas firs (*Pseudotsuga menziesii*) in British Columbia. A branch was removed from each quadrant from the upper, middle and lower crown level, and from the lowest whorl of a total of 59 non-defoliated trees in 10 areas. No consistent trend in egg-mass density per branch could be found between crown levels, so the lower whorl of branches was selected for survey purposes. Sample stop lines were determined from egg-mass density and variability data collected on 55 sites, and subsequent defoliation estimates were related to these densities. The system is designed as an early detection tool to be used only in non-defoliated stands at the incipient stage of an impending outbreak.

[OSU Link](#)

[Non-OSU Link](#)

65. Shepherd, R.F., I.S. Otvos, R.J. Chorney and J.C. Cunningham. 1984b. Pest management of Douglas-fir tussock moth (Lepidoptera: Lymantriidae): prevention of an outbreak through early treatment with a nuclear polyhedrosis virus by ground and aerial applications. *Canadian-Entomologist* 116(11): 1533-1542.

**Keywords:** tree/stand protection  
tree/stand health  
stand conditions

**Abstract:** Two application methods were tested using a nuclear polyhedrosis virus as a biological control agent at an early stage in an outbreak of *Orgyia pseudotsugata* on Douglas fir [*Pseudotsuga menziesii*]

in British Columbia in 1981. The virus, which often leads to the development of an epizootic late in the outbreak cycle, was propagated in *O. leucostigma*. Four plots were treated from a helicopter at a dosage of  $2.2 \times 10^{11}$  polyhedral inclusion bodies (PIB) in an emitted spray volume of 11.3 litres/ha; 5-8 weeks after spraying, 77-100% of live larvae were infected. Two plots were treated from the ground at  $2.4 \times 10^{10}$  PIB in 4.5 litres/tree; 8 weeks after treatment 83-85% of live larvae were infected. No egg-masses could be found in the treated plots in the autumn of 1981, and no larvae were found on sample trees in 1982 or 1983. The treatment was effective over a range of initial mean larval densities of 41-206/msuperscript 2 foliage. Populations in untreated areas nearby increased in 1982. Little foliage protection was obtained the year of application, due to the lengthy virus incubation period, but the trees recovered quickly when larval populations disappeared.

[OSU Link](#)

[Non-OSU Link](#)

66. Smith, N.J. 1991. Sun and shade leaves: clues to how salal (*Gaultheria shallon*) responds to overstorey stand density. *Canadian-Journal-of-Forest-Research* 21(3): 300-305.

**Keywords:** release treatments  
stand conditions

**Abstract:** The results are presented of an examination of leaf biomass, leaf area index, specific leaf area and leaf morphology of *Gaultheria shallon* from 37 destructively measured 1 msuperscript 2 quadrats in 13 Douglas fir (*Pseudotsuga menziesii*) second-growth stands on Vancouver Island, British Columbia. In response to light and stand overstorey density, salal shoots produced either mainly sun leaves or mainly shade leaves. Sun leaves were associated with sunflecks in open-grown or variably stocked stands. Shade leaves were associated with diffuse light under denser stands. Sun-leaf quadrats had mean specific leaf areas  $<90 \text{ cm}^2/\text{g}$ ; shade-leaf quadrats had mean specific leaf areas  $>90 \text{ cm}^2/\text{g}$ . Sun leaves were narrower, with average leaf widths  $<5 \text{ cm}$ . Quadrat salal leaf biomass and leaf area index peaked at Curtis' metric relative density 5.9, which corresponded to an availability of 15% of global photosynthetically active radiation. Sun-leaf quadrats occurred below relative density 5; shade-leaf quadrats occurred above relative density 4. A mixture of sun- and shade-leaf quadrats occurred between about relative density 4 and 5, depending on the uniformity of stocking. Application of these observations for salal control (to reduce competition), or to increase salal browse production, are discussed.

[OSU Link](#)

[Non-OSU Link](#)

67. Stapanian, M.A. and D.W. Shea. 1986. Lignosulfonates: effects on plant growth and survival and migration through the soil profile. *International-Journal-of-Environmental-Studies* 27(2): 45-56.

**Keywords:** release treatments  
chemical release  
growth  
stand conditions

**Abstract:** The effects of a refined lignosulfonate product obtained from the sulfite pulping process, on growth and survival of plants were investigated. After applications of 0, 7500, 15 000 and 22 500 mg/kg to plots within a forest plantation, the following were monitored: (1) live aboveground biomass of vascular plants, (2) growth of Douglas fir (*Pseudotsuga menziesii*) and (3) lignosulfonate migration through the soil profile. Biomass of woody vegetation was not affected, and that of herbaceous plants was significantly decreased only at the two greatest application rates. Growth of the Douglas fir trees was not significantly affected. Lignosulfonates disappeared from the soil profile at the same rate regardless of initial concentration. Although it is not practical to use this material as a herbicide in western Washington, land application of lignosulfonates may be environmentally more attractive than traditional disposal methods.

[OSU Link](#)

[Non-OSU Link](#)

**68.** Stein, J.D. and G.P. Markin. 1986. Evaluation of four chemical insecticides registered for control of the Douglas-fir cone gall midge, *Contarinia oregonensis* (Diptera: Cecidomyiidae), and the Douglas-fir seed chalcid, *Megastigmus spermotrophus* (Hymenoptera: Torymidae), in Douglas-fir seed orchards. *Canadian-Entomologist* 118(11): 1185-1191.

**Keywords:** seed orchard management  
tree/stand protection  
stand conditions  
tree/stand health

**Abstract:** The control of *Contarinia oregonensis* and *Megastigmus spermotrophus* on Douglas fir (*Pseudotsuga menziesii*) in Washington and Oregon in 1982 and 1983 depended on the levels of infestation and which of 4 insecticides was used. There was no significant reduction in infestation of either pest when acephate was applied. Oxydemeton-methyl (by spray or injection) and dimethoate (in sprays) significantly reduced damage by *C. oregonensis*. These three compounds and azinphos-methyl were ineffective against *M. spermotrophus* for infestations affecting <10% of extractable seed. Oxydemeton-methyl injections, azinphos-methyl and dimethoate significantly reduced the incidence of the chalcid when infestation was high (61%). There was no statistically significant difference for pairwise comparisons between compounds that significantly reduced infestation with either pest.

[OSU Link](#)

[Non-OSU Link](#)

**69.** Stein, J.D., R.E. Sandquist, T.W. Koerber and C.L. Frank. 1993. Response of Douglas-fir cone and seed insects to implants of systemic insecticides in a northern California forest and a southern Oregon seed orchard. *Journal-of-Economic-Entomology* 86(2): 465-469.

**Keywords:** seed orchard management  
tree/stand protection  
tree/stand health  
reproduction  
stand conditions

**Abstract:** The systemic insecticides acephate, dimethoate and carbofuran were implanted into *Pseudotsuga menziesii* at Oakridge, Oregon and Willow Creek, California, to evaluate their effectiveness in reducing seed and cone insect damage. The acephate-implant treatment significantly reduced seed damage by *Barbara colfaxiana* and *Contarinia oregonensis*, and significantly increased the percentage of filled seed by 300% at the California site. Neither dimethoate nor carbofuran significantly affected any of the seed or cone insects encountered. Acephate was not effective against *Megastigmus spermotrophus* or *Leptoglossus occidentalis*. The association observed between *C. oregonensis* damage and undeveloped seeds suggested that management strategies that include effective control measures should also include methods to monitor and reduce seed abortion.

[OSU Link](#)

[Non-OSU Link](#)

70. Stein, W.I. 1997. Ten-year survival and growth of planted Douglas-fir and western redcedar after seven site-preparation treatments. *Western-Journal-of-Applied-Forestry* 12(3): 74-80.

**Keywords:** site preparation  
chemical preparation  
prescribed fire  
tree/stand protection  
growth  
tree/stand health  
stand conditions

**Abstract:** Western redcedar (*Thuja plicata*) and Douglas fir (*Pseudotsuga menziesii*) were planted together after applying seven site-preparation methods at one cable-logged site in the Oregon Coast Ranges. The treatments, applied during 1980, were: untreated control; spot clear by cutting; aerial spraying with glyphosate; broadcast burning; slash and burn; spray with Tordon 101 (picloram + 2,4-D) and burn; and burn and sow grass. Planting was done in early 1991, and vegetation and trees were measured periodically to 1990. Survival and growth of cedar were markedly less than Douglas fir on this favourable site where both species were components of the original stand. Repeated browsing severely impeded the cedar. Site preparation by broadcast burning generally yielded the best results, but sowing grass after broadcast burning produced Douglas fir responses similar to those for no site preparation. Where grass was sown, herbaceous cover was more abundant and taller, salmonberry (*Rubus spectabilis*) differed little in density but was slightly taller, and development of red alder (*Alnus rubra*) was delayed. Red alder is currently overtopping conifers in all treatments, and release is needed to ensure sufficient conifer survival.

[OSU Link](#)

[Non-OSU Link](#)

71. Stelzer, M.J. and R.C. Beckwith. 1988. Comparison of two isolates of *Bacillus thuringiensis* in a field test on western spruce budworm (Lepidoptera: Tortricidae). *Journal-of-Economic-Entomology* 81(3): 880-886.

**Keywords:** tree/stand protection  
stand conditions

tree/stand health

**Abstract:** Two isolates of *Bacillus thuringiensis* (Thuricide 32LV [*B. thuringiensis* subsp. *thuringiensis*] and SAN-415 32LV) were compared for efficacy against *Choristoneura occidentalis* on Douglas fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) in Oregon. The insecticides were applied aerially at 20 and 30 billion International Units in a spray volume of 7.1 litres/ha. The 30 BIU/ha dosage provided better population control than 20 BIU/ha dosage with both formulations; however, only the difference between dosages for the SAN-415 32LV formulation was significant. Differences in efficacy between the isolates were not significant. The application of *B. thuringiensis* improved foliage protection by 15-25% compared with untreated plots.

[OSU Link](#)

[Non-OSU Link](#)

**72.** Summers, D. and G.E. Miller. 1986. Experience with systemic insecticides for control of cone and seed insects in Douglas-fir seed orchards in coastal British Columbia, Canada. *In* Proceedings of the 2nd Conference of the Cone and Seed Insects Working Party, Station de Zoologie Forestiere, Olivet, France, September 3-5, 1986. *Ed.* A. Roques. pp. 267-283.

**Keywords:** seed orchard management  
tree/stand protection  
tree/stand health  
reproduction  
stand conditions

**Abstract:** Three systemic insecticides were screened experimentally, and 2 of them used operationally, against cone and seed insects (especially *Contarinia oregonensis*, *Megastigmus spermotrophus* and *Barbara colfaxiana*), in seed orchards of Douglas fir [*Pseudotsuga menziesii*] on Vancouver I., British Columbia. Dimethoate, as a foliar spray, controlled the pests and increased the number of filled seeds per cone, making it the recommended choice. Oxydemeton-methyl, as a foliar spray, was as effective as dimethoate in controlling the insects but appeared less effective in increasing the number of filled seeds. Injections of oxydemeton-methyl were less effective than foliar sprays in controlling insect damage. Acephate as a foliar spray was inconsistent in the level of pest control achieved and as an injection gave poor results; its use was also associated with the development of serious outbreaks of *Adelges cooleyi* [*Gilletteella cooleyi*].

[Non-OSU Link](#)

**73.** Summers, D. and D.S. Ruth. 1987. Effect of diatomaceous earth, malathion, dimethoate and permethrin on *Leptoglossus occidentalis* (Hemiptera: Coreidae): a pest of conifer seed. *Journal-of-the-Entomological-Society-of-British-Columbia* 84: 33-38.

**Keywords:** tree/stand protection  
stand conditions

**Abstract:** Field and laboratory studies were carried out in British Columbia in 1986 to test the efficacy of some insecticides against *Leptoglossus occidentalis* attacking Douglas fir (*Pseudotsuga menziesii*). The

coreids were exposed to diatomaceous earth [diatomite], and sprays of 0.1 and 1.0% Lagon 2E (dimethoate) and 0.1 and 0.01% Ambush 50 EC (permethrin) in both laboratory and field tests and to 0.1% malathion in the laboratory. In field tests, permethrin and dimethoate caused significant mortality for 2 weeks after sprays were applied and permethrin continued to be effective for a 3rd week. Diatomite was not effective in the field tests or in 1 of 2 laboratory tests. Malathion, dimethoate and permethrin caused significant mortality in both laboratory tests.

[OSU Link](#)

[Non-OSU Link](#)

**74.** Trotter, D.B. and G.M. Shrimpton. 1989. Oxyfluorfen (Goal) trials with bareroot forest seedlings in British Columbia 1987. B.C. Ministry of Forestry FRDA Report 092. vi + 22 p.

**Keywords:** nursery operations  
tree/stand health  
stand conditions

**Abstract:** Oxyfluorfen was evaluated at various rates for weed control and crop tolerance on 1+0 and 2+0 bare rooted seedlings of Douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) at Surrey Nursery, British Columbia.

[OSU Link](#)

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**75.** Vihnanek, R.E. and T.M. Ballard. 1988. Slashburning effects on stocking, growth, and nutrition of young Douglas-fir plantations in salal-dominated ecosystems of eastern Vancouver Island. *Canadian-Journal-of-Forest-Research* 18(6): 718-722.

**Keywords:** site preparation  
prescribed fire  
growth  
tree physiology  
stand conditions

**Abstract:** Stocking, ht. growth, basal diam. growth, and foliar nutrient concn. of 5- to 15-yr-old Douglas fir (*Pseudotsuga menziesii*) were evaluated on burned and unburned areas within each of 20 sites on eastern Vancouver Island, which were characterized by ecosystems dominated by salal (*Gaultheria shallon*). Burning significantly reduced salal ht. and cover and significantly increased Douglas fir stocking, ht. growth, basal diam. and foliar P, K, Ca, Fe, and B concn. Foliar concn. of N, Mg, S, Zn and Cu were not significantly affected. Foliar Mn concn. were significantly reduced but remained very far above the deficiency threshold.

[OSU Link](#)

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**76.** Wagner, R.G. and S.R. Radosevich. 1991b. Neighborhood predictors of interspecific competition in young Douglas-fir plantations. *Canadian-Journal-of-Forest-Research* 21(6): 821-828.

**Keywords:** site preparation  
stand conditions  
growth

**Abstract:** Neighbourhood models describing the effect of interspecific competition on the height and stem diameter of 4- to 9-year-old saplings of Douglas fir (*Pseudotsuga menziesii*) were developed from site preparation experiments in the Oregon Coast Range. Existing study records and maps were used to randomly select 787 saplings from 78 study plots at nine sites. The influence of abundance measures, height, distance, and spatial arrangement of nonconiferous woody plants surrounding individual saplings was examined. Optimum neighbourhood heights and radii were defined. The best interspecific competition index for predicting Douglas fir height and stem diameter was total percentage cover for all woody species within a 2.1-m radius. Visual estimates of neighbour cover were superior to objective measures of crown area. The cover of woody species equalling or exceeding the height of the tree provided the best prediction for tree height. Woody species cover equalling or exceeding one-half the height of the tree provided the best index for predicting stem diameter. Accounting for the spatial arrangement of neighbouring woody plants did not improve the competition index. Interaction between the competition index and tree age indicated that the negative effect of interspecific competition on Douglas fir size increased with time. The age-adjusted competition index accounted for 11% of the variation in height and 19% of the variation in stem diameter. Douglas fir stem diameter was more sensitive to neighbouring woody plants than was height.

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77. Wagner, R.G. and M.W. Rogozynski. 1994. Controlling sprout clumps of bigleaf maple with herbicides and manual cutting. *Western Journal of Applied Forestry* 9(4):118-124.

**Keywords:** release treatments  
chemical release  
manual release  
stand conditions

**Abstract:** Trials were conducted in 5 young Douglas fir (*Pseudotsuga menziesii*) plantations for controlling bigleaf maple (*Acer macrophyllum*) clumps. Herbicides tested were glyphosate (Roundup), imazapyr (Arsenal), metsulfuron methyl (Escort), triclopyr amine (Garlon 3A), triclopyr ester (Garlon 4), and 2,4-DP [dichlorprop] + 2,4-D (Weedone 170). Four methods of herbicide application (basal spray, thinline, foliage spray, and cut-surface) and 3 treatment timings (early foliar, late foliar, and dormant periods) were tested. Manual cutting alone was also evaluated at each of the treatment timings. Imazapyr foliage sprays, triclopyr ester thinline, dormant 3% triclopyr ester basal spray, late-foliar 2,4-DP + 2,4-D basal spray, and manual cutting with triclopyr amine cut-surface application provided the best control among the treatments tested over the 3 yr of study. Imazapyr foliage sprays provided the best long-term control by killing most treated clumps. Triclopyr ester thinline treatments provided the most consistent and effective results among the basal applications. Stump applications of triclopyr amine were more effective than manual cutting alone or manual cutting with glyphosate cut-surface application.

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78. Wass, E.F. and R.B. Smith. 1997. Impacts of stump uprooting on a gravelly sandy loam soil and planted Douglas-fir seedlings in south-coastal British Columbia. Pacific-Forestry-Centre,-Canadian-Forest-Service Information-Report BC-X-368. vi + 15 p.

**Keywords:** site preparation  
mechanical preparation  
tree/stand protection  
soil properties  
stand conditions  
growth

**Abstract:** Studies to determine levels and impacts of soil disturbance caused during root-disease control by stump removal were initiated on a cutover on southern Vancouver Island immediately prior to the control operation and the establishment of a plantation of Douglas-fir (*Pseudotsuga menziesii*). Soil surface condition was assessed on the stumped area. Soil disturbance was measured at 699 planting spots. Vegetation development was assessed at 10% of the spots. Of all planting spots, 180 were undisturbed soil, 277 deposits and 242 gouges. The soil, a gravelly sandy loam, increased naturally in soil density with depth from 1.05 t/m<sup>3</sup> at the surface to over 1.60 t/m<sup>3</sup> at depths more than 40 cm. Disturbance did not significantly increase soil density. Unlike previous studies of this nature, ease of soil penetrability was increased by the stump uprooting disturbance and vegetation development was not greatly dissimilar between disturbed and undisturbed soil. The relatively low soil impacts were attributed to the ability of the excavator to pile stumps without pushing topsoil, and the low site sensitivity to compaction. These low impacts on soil and reduced vegetative competition on disturbed soil resulted in tree growth rates which were significantly greater after 10 years on deposits (12% in height and 18% in diameter) and gouges (6% in height and 8% in diameter) than on undisturbed soil.

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79. White, D.E. and M. Newton. 1983. Effects of glyphosate and two formulation of hexazinone in young conifer plantations. *Proceedings-of-the-Western-Society-of-Weed-Science* (Vol.36): 54-56.

**Keywords:** release treatments  
chemical release  
growth  
stand conditions  
tree/stand health

**Abstract:** In April 1979, 1 month after transplanting 3-yr-old Douglas fir (*Pseudotsuga menziesii*), hexazinone liquid and solid formulations at 0, 1.11, 1.68 or 2.23 kg/ha were applied to the plots separately and in combination with 0 or 0.62 kg glyphosate/ha. There was no significant difference between formulations of hexazinone in effect on the herbaceous community which was dominated by *Arrhenatherum elatius*, *Holcus lanatus*, *Elymus glaucus* and *Rubus ursinus*. However, addition of glyphosate increased the mean weed-free condition from 67.25 to 85.1%. At the same time, in glyphosate-treated plots, mean ht. of 4th yr trees was 149.9 cm compared with 162.6 cm in hexazinone-only plots. Survival of 2nd yr trees was also affected.



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**80.** White, D.E. and M. Newton. 1989. Competitive interactions of whiteleaf manzanita, herbs, Douglas-fir, and ponderosa pine in southwest Oregon. *Canadian-Journal-of-Forest-Research* 19(2): 232-238.

**Keywords:** release treatments  
chemical release  
growth  
stand conditions

**Abstract:** Whiteleaf manzanita (*Arctostaphylos viscida*) was established on 3 sites in Oregon in 1983 at densities ranging from 0 to 27 000 seedlings/ha in 2-yr-old mixed Douglas fir (*Pseudotsuga menziesii*)/ponderosa pine (*Pinus ponderosa*) stands. Invading herbs were controlled by spraying all plots with glyphosate and hexazinone, except one at each site at the 13 500 density. Intraspecific manzanita competition reduced individual shrub basal diameter, leaf area, biomass, and canopy volume by the 3rd year of the study. Stem volume of 5-yr-old conifers was reduced in relation to manzanita density, biomass, LAI, and canopy cover. The presence of herbaceous vegetation reduced both manzanita and conifer growth by the 3rd year.

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**81.** White, D.E. and M. Newton. 1990. Herbaceous weed control in young conifer plantations with formulations of nitrogen and simazine. *Canadian-Journal-of-Forest-Research* 20(11): 1685-1689.

**Keywords:** release treatments  
chemical release  
fertilization  
stand conditions  
tree/stand health  
growth

**Abstract:** Weed control and second year survival and growth of newly planted 2+0 Douglas fir (*Pseudotsuga menziesii*) and 2+0 noble fir (*Abies procera*) seedlings were measured at 3 sites in Oregon after application of herbicide and fertilizer in a replicated complete factorial experiment with 4 levels of simazine (0, 2.2, 4.4, 8.8 kg/ha), 3 levels of N (0, 110, 220 kg/ha), 2 types of N (urea prill; urea + trimamino-s-triazine (TST) prill) and 2 kinds of formulations (co-granular prill of simazine + nitrogen; nitrogen prill followed by liquid simazine). For the first growing season, total weed and grass control increased with increasing simazine rates. Total weed control was better when urea + TST, rather than urea alone, was applied in conjunction with simazine. Formulation and nitrogen rate were not significant. After plot treatment with 1.1 kg liquid hexazinone/ha at the beginning of the second growing season, Douglas fir survival decreased as the rate of urea alone increased; survival decreased with little or no weed control and remained constant or increased with good weed control as the rate of urea + TST increased. Noble fir height and diameter, and Douglas fir diameter, decreased with poor weed control, but increased at least to the levels of untreated seedlings with good weed control. Noble fir diameter responded positively to added nitrogen. Although simazine may be toxic to first year conifers,

this study suggests that more complete weed control in conjunction with fertilization may benefit young conifer plantations.

[OSU Link](#)

[Non-OSU Link](#)

**82.** White, D.E., L. Witherspoon-Joos and M. Newton. 1990. Herbaceous weed control in conifer plantations with hexazinone and nitrogen formulations. *New-Forests* 4(2): 97-105.

**Keywords:** release treatments  
chemical release  
fertilization  
stand conditions  
growth  
tree/stand health

**Abstract:** In order to determine if herbicide efficacy is affected by nitrogen fertilizer, and to examine the effects of treatments on growth and survival of newly-planted 2-year-old Douglas fir (*Pseudotsuga menziesii*) and 3-year-old noble fir (*Abies procera*), the influence of different nitrogen fertilizers applied in different combinations with hexazinone formulations were evaluated on three herbaceous weed communities in Oregon. Field studies comparing three application methods in conifer plantations showed greatest reduction in total weed cover with a co-granular formulation of hexazinone and the slow-release nitrogen fertilizer triamino-s-triazine (TST). Slightly less control was achieved with separate applications of liquid hexazinone and TST granules, and poorest control with granular urea followed by liquid hexazinone. Weed control increased with an increase in hexazinone rate. Statistical analysis of the effect on conifers showed that the highest hexazinone rate significantly increased survival of noble fir, stem diameter of both noble fir and Douglas fir, and that the highest nitrogen rate significantly reduced survival of both species but did not affect stem diameter. Survival of noble fir and diameter of both noble fir and Douglas fir were significantly increased where a co-granular formulation of hexazinone and TST granules was used.

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