Yield

1. 1987. Impact of intensive forestry practices on net stand values in British Columbia. B.C. Ministry of Forests FRDA-Report 014. 109 p.

Keywords: release treatments
fertilization
thinning
yield
economics

Abstract: Yield responses to major silvicultural treatments (regeneration method, brushing and weeding, spacing and thinning and fertilizer use) are analysed in relation to growth and yield theory, and their translation into operational use of treatments to increase merchantable vol. is considered. Data from coastal Douglas fir (Pseudotsuga menziesii), western hemlock (Tsuga heterophylla) and western hemlock/Abies amabilis stands and interior white spruce (Picea glauca), lodgepole pine (Pinus contorta) and wet belt Douglas fir stands are used to quantify the net present value of treatments in terms of improvement in net stand values and merchantable vol. Potentially viable treatment options are identified for each stand type present.

OSU Link
Non-OSU Link

2. Aubry, C.A., W.T. Adams and T.D. Fahey. 1998. Determination of relative economic weights for multitrait selection in coastal Douglas-fir. Canadian-Journal-of-Forest-Research 28(8): 1164-1170.

Keywords: genetic tree improvement
yield
wood quality
economics

Abstract: Relationships between tree traits and tree value for lumber production were investigated. For the purposes of estimating relative economic weights for use in multitrait selection in coastal Douglas fir (Pseudotsuga menziesii var. menziesii), tree height, diameter at breast height, and branch diameter were measured on 164 trees (ages 36-66 yr) sampled from 11 intensively managed stands with a wide range of site attributes, growing conditions, ages and stocking histories in western Washington and Oregon. Increment cores from asubsample (92) of these trees were assayed by X-ray densitometry to determine wood density. Bole volume was derived by summing the log volumes of all logs from each tree. Value of lumber recovered from each tree was determined in a separate mill study using both visual and machine stress rated (MSR) grading rules. Multiple linear regression was used to relate tree value to the growth and wood quality traits. Stem volume and branch diameter significantly influenced tree value under visual grading, with relative economic weights of 0.06dmsuperscript 3 and -5.22 cm, respectively. Wood density significantly influenced tree value under MSR grading (relative economic weights: 0.06 dmsuperscript 3, -6.69 cm, and 0.06 kg/msuperscript 3, respectively), where lumber strength is measured more accurately. These regression coefficients can be used directly as economic weights in selection indices in the development of advanced breeding programmes for Douglas fir.

OSU Link
Non-OSU Link

3. Barbour, R.J., S. Johnston, J.P. Hayes and G.F. Tucker. 1997. Simulated stand characteristics and wood product yields from Douglas-fir plantations managed for ecosystem objectives. Forest-Ecology-and-Management 91(2/3): 205-219.

Keywords: thinning
yield
wood quality

Abstract: Hundreds of thousands of hectares of Douglas fir (Pseudotsuga menziesii) plantations in coastal forests in the US Pacific Northwest have been established over the past 40 years. Density management regimes designed to increase structural and compositional diversity in these plantations are being tested and implemented on an operational scale, in order to satisfy goals of ecosystem management. These regimes are designed to promote various tree and stand characteristics, such as trees with large limbs, stands with multi-layered canopies, and dense unthinned patches. Changes in forest management policy associated with these types of regimes raise questions about whether it is possible to manage for both ecosystem values and timber production. State-of-the-art growth models were used to simulate stand development and wood product yields under
several silvicultural prescriptions. The results indicated that timing and intensity of early thinnings are critical in determining both stand structure and wood quality. It is concluded that it should be possible to manage Douglas fir plantations to provide a high degree of structural diversity, and wood products with a quality similar to that grown in many industrial plantations.

OSU Link
Non-OSU Link

4. Busing, R.T. and S.L. Garman. 2002. Promoting old-growth characteristics and long-term wood production in Douglas-fir forests. Forest-Ecology-and-Management 160(1/3): 161-175.

Keywords: thinning
yield
wood quality

Abstract: Trade-offs among wood production, wood quality and ecological characteristics in the management of harvested forest stands are explored through model simulation of
various silvicultural regimes. Long-term production of merchantable wood, production of various types of high-quality wood, and the level of certain quantitative ecological indicators are projected for coniferous forests of Pacific Northwestern USA. The set of ecological indicators used is based on the species composition and physical structure of old, unloggedforest stands. Simulations are performed with an ecological model of forest stand dynamics that tracks the fate of live and dead trees. Short rotations (<50 years) produce the least amount of high-quality wood over the multi-century simulation period. They also fail to generateecological attributes resembling those of old forest stands. Production of high-quality wood is moderate to high under all rotations of 80 years or more; however, most ecological indicators require longer rotations unless alternatives to clear felling are applied. Alternatives examined include retention of 15% cover of live tree canopy at each harvest in combination with

artificial thinning between harvests. Thinning from below can expedite the development of large live and dead trees, and canopy height diversity without greatly diminishing wood quantity or quality. Proportional thinning retains understorey stems, thereby expediting the recruitment of shade-tolerant trees. A possible drawback to thinning, particularly proportional thinning, is the diminished production of clean-bole wood at rotations of 150 and 260 years. It is concluded that most wood quantity, wood quality and ecological objectives can be met with long rotations (approximately 260 years). Certain objectives can be met with shorter rotations (80-150 years) when treatments of thinning and canopy tree retention are applied.

OSU Link
Non-OSU Link

5. Cahill, J.M., T.A. Snellgrove and T.D. Fahey. 1988. Lumber and veneer recovery from pruned Douglas-fir. Forest-Products-Journal 38(9): 27-32.

Keywords: pruning
yield
wood quality

Abstract: Logs were selected from a 75-yr-old stand of Douglas fir (Pseudotsuga menziesii) in Washington, that had been pruned 35 yr previously, to include 146 sawlogs (97 pruned, 49 unpruned) and 151 veneer logs (100 pruned, 51 unpruned) and assessed for vol. and grade yields for sawn and peeled products. Results showed that pruned logs recovered the same vol. of products as unpruned logs but recovered more high-grade lumber or veneer. Recovery of high-grade lumber or veneer increased as the diam. of the knotty, unprunedcore decreased. Issues are listed that need consideration in order to decide whether pruning would be profitable for specific stands of young growth.

OSU Link
Non-OSU Link

6. Cameron, I.R. 1988. An evaluation of the density management diagram for coastal Douglas-fir. BC Ministry of Forests FRDA-Report 024. vi + 17 p.

Keywords: planting operations
growth
yield

Abstract: Yield predictions based on Drew and Flewelling's (1979) density management diagram for coastal Douglas fir (Pseudotsuga menziesii) were compared with remeasured plot data from British Columbia. The diagram overestimated standing volume by 64% and mean diameter by 24% on average. Volumes predicted for plantations established at initial densities between 300 and 3000 trees per hectare exceeded nearly all the plots in the database. Because of the unattainable production targets set by the diagram, strategic plans based on its predictions would be seriously in error. Consequently, the diagram cannot be used in its current form as a silvicultural planning tool in stands of Douglas fir on the coast of British Columbia.

OSU Link
Non-OSU Link

7. Comeau, P. and D. Sachs. 1992. Simulation of the consequences of red alder management on the growth of Douglas-fir using FORCYTE-11. B.C. Ministry of Forests FRDA Report 187. 45 p.

Keywords: planting operations
yield
computer modeling

Abstract: The ecosystem model FORCYTE-11 was used to investigate the effects of initial red alder (Alnus glutinosa) density on yields of Pseudotsuga menziesii and alder over a 80-year rotation, the effects of delayed planting of red alder on stand yields, and the effects of 5 management strategies on the total yield over a 240-year period.

OSU Link
Non-OSU Link

8. Curtis, R.O., G.W. Clendenen and D.J. DeMars. 1981. A new stand simulator for coast Douglas-fir: DFSIM user's guide. Pacific-Northwest-Forest-and-Range-Experiment-Station,-USDA-Forest-Service General-Technical-Report PNW-GTR-128. ii + 79 p.

Keywords: planting operations
thinning
precommercial thinning
commercial thinning
fertilization
yield
computer modeling

Abstract: A description of a computer program, written in FORTRAN IV, for simulating managed stands. The program has been developed from remeasured plot data contributed by many organizations in the Pacific Northwest USA. It can produce yield tables which include estimates of effects of initial spacing, precommercial and commercial thinning and addition of N fertilizer. Topics discussed include program limitation and potential for further development. Appendices include operating instructions and notes on testing. The program is available from the authors on request.

OSU Link
Non-OSU Link

9. Curtis, R.O. and D.D. Marshall. 2002. Levels-of-growing-stock cooperative study in Douglas-fir: report no. 14 - Stampede Creek: 30-year results. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-543. xi + 77 p.

Keywords: thinning
commercial thinning
growth

yield
tree morphology
tree/stand health

Abstract: Results of the Stampede Creek installation of the levels-of-growing-stock (LOGS) study in Douglas-fir (Pseudotsuga menziesii) are summarized. To age 63 (planned completion of 60 feet of height growth), volume growth on the site III natural stand has been strongly related to level of growing stock, but basal area growth-growing stock relations were considerably weaker. Marked differences in tree size distributions have resulted from thinning. Periodic annual volume increments at age 63 are two to three times greater than mean annual increment; this stand is still far from culmination. Results for this southwest Oregon installation are generally similar to those reported from other LOGS installations, although development has been slower than on the site II installations that make up the majority of the series.

OSU Link
Non-OSU Link

10. Curtis, R.O., D.D. Marshall and J.F. Bell. 1997. LOGS: a pioneering example of silvicultural research in coast Douglas-fir. Journal-of-Forestry 95(7): 19-25.

Keywords: thinning
commercial thinning
growth
yield

Abstract: A regional levels-of-growing-stock (LOGS) study of young Douglas fir (Pseudotsuga menziesii) stands in western Oregon and western Washington, USA and Vancouver Island, British Columbia, Canada, was conducted between 1961 and 1970. The objective was to determine how the amount of growing stock retained in repeatedly thinned stands of P. menziesii affects cumulative wood production, tree size and growth:growing stock ratios. Nine LOGS installations were established during the study period, each consisting of 27 one-fifth acre plots, with 8 thinning treatments (and controls). All plots received initial calibration thinning. After the first 10 feet of height growth and at intervals of 10 feet thereafter, 5 subsequent thinning treatments were made. As of 1994, all installations on site class II, and most installations on site classes III and IV had completed the planned thinning sequence over 60 ft of height growth. Periodic annual increment of both basal area and volume was clearly related to basal area of growing stock and several measures of density. Thinning accelerated diameter growth, and diameter and volume distributions differed greatly among treatments. Mean annual increment and periodic annual increment showed no sign of approach to culmination in either total or merchantable cubic volume. Cumulative volume production (live stand plus thinning) of the controls exceeded all thinning treatments to date when measured in total cubic volume of all trees, although when volume was measured in merchantable cubic feet several thinning treatments exceeded net volume production of the controls. A discussion of the results includes: a comparison with other thinning studies; an analysis of application of the Langsaeter hypothesis (that the same cubic volume production could be obtained over a wide range of stand densities); growth trends and rotations; thinning gains; non-timber values; and critical analysis of the study design. The continuing value of the demonstration stands is discussed.

OSU Link
Non-OSU Link

11. Duryea, M.L. and S.K. Omi. 1987. Top pruning Douglas-fir seedlings: morphology, physiology, and field performance. Canadian-Journal-of-Forest-Research 17(11): 1371-1378.

Keywords: nursery operations
nursery pruning
tree phenology
tree/stand health
growth
yield

Abstract: Seedlings from 9 seed sources at 6 nurseries in Washington, Oregon and California were treated with various pruning treatments including tall and short ht. (25 and 15 cm, respectively), early and late timing (6 wk after bud burst or 6 wk after bud set, respectively), pruning twice or no pruning. Seedlings were evaluated for phenology and quality, and graded in the nursery. For each seed source, seedlings were planted at field sites in their own zone and on one common site. Seedlings pruned tall and early began growing again within 5 wk and set buds 2 wk later than unpruned seedlings. Shippable yield of seedlings pruned tall and early and of unpruned seedlings were n.s.d, although more pruned seedlings had multiple leaders. Pruned seedlings were smaller than unpruned seedlings at the time of planting. Survival and growth were the same for pruned and unpruned seedlings in the 1st year after planting. Pruned seedlings grew more than unpruned seedlings in the 2nd year, but were still shorter after 2 yr. Field growth was greater in seedlings pruned tall or early than in seedlings pruned short or late. It is concluded that pruning should be continued as a cultural practice if it benefits nurseries, but that late short pruning should be avoided.

OSU Link
Non-OSU Link

12. Emmingham, W.L., P. Oester, M. Bennett, F. Kukulka, K. Conrad and A. Michel. 2002. Comparing short-term financial aspects of four management options in Oregon: implications for uneven-aged management. Forestry-Oxford 75(4): 489-494.

Keywords: thinning
commercial thinning
economics
yield

Abstract: Private family forest owners are often more interested in comparing short-term financial outcomes of management options, as opposed to longer time horizons and classical economic analyses including net present value. Therefore, we compared projected 10-year value of timber and land for four theoretical management scenarios starting with stands ripe for thinning. The options were (1) hold for 10 years (i.e. no thinning), (2) thin for even-age, or (3) partial cut for uneven-age and (4) clearcut now. To simulate the outcomes of these scenarios, we marked and measured 2-ha plots in 10 stands typical of private forest ownerships across Oregon and projected timber yields and revenues. The financial analysis included current market values for logs, payment of taxes and typical reforestation

costs and computation of net asset values (NAV) at a 7 per cent interest rate. The hold option consistently gave the highest NAV for timber and land after 10 years, and the thin option was within 2 per cent. For the eight western Oregon stands, the partial-cut option averaged about 3 per cent less, and the clearcut option ranged from 8 to 17 per cent less than holding. Pine stands of eastern Oregon showed similar trends; however, all options were within about 6 per cent of the hold option. Thus, using financial criteria typical of those used by private forestowners, we found that there was little short-term financial loss in choosing to thin toward even-age, partial cut toward uneven-age, or the hold approach in well-stocked stands.

OSU Link
Non-OSU Link

13. Fight, R.D., J.M. Cahill, T.D. Fahey and T.A. Snellgrove. 1987a. Financial analysis of pruning coast Douglas-fir. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-390. ii + 17 p.

Keywords: pruning
fertilization
economics
wood quality
yield
computer modeling

Abstract: Unpruned stands of Douglas fir (Pseudotsuga menziesii) will yield little clear material under current management regimes in western Oregon and western Washington. Data from a recent study of grade recovery from pruned logs were analysed and a spreadsheet program was developed and used to simulate the increase in grade recovery and financial returns from pruning. Results are presented for a range of site indices, ages at time of pruning and time of harvest, product prices and interest rates, and for stands with and without nitrogen fertilizer treatment. Results showed that a 5-yr difference in the time of pruning can make a substantial difference in the financial return. An earlier age at pruning always gave a higher return. At 4 and 8% interest rates, the return was generally greatest when the harvest was 40-50 yr or 30-40 yr, respectively, after pruning. Fertilizer treatment substantially increased the return from pruning, especially on poor sites.

OSU Link
Non-OSU Link

14. Fight, R.D., J.T. Chmelik and E.A. Coulter. 2001. Analysts guide: TreeVal for Windows, Version 2.0. Pacific-Northwest-Research-Station,-USDA-Forest-Service General-Technical-Report PNW-GTR-514. 21 p.

Keywords: pruning
economics
wood quality
yield

Abstract: TreeVal for Windows provides financial information and analysis to support silvicultural decisions in coast Douglas-fir (Pseudotsuga menziesii). It integrates the effect of growth and yield, management costs, harvesting costs, product and mill type, manufacturing costs, product prices, and product grade premiums. Output files from the ORGANON growth and yield simulator can be read directly into TreeVal. All management actions, including pruning, are supported. Results, including product recovery information, net value, and financial analysis of silvicultural regimes, are available in both tabular and graphical forms to facilitate comparison of alternative regimes and sensitivity analysis with prices, costs, and other assumptions.

OSU Link
Non-OSU Link

15. Gardner, E.R. 1990. Fertilization and thinning effects on a Douglas-fir ecosystem at Shawnigan Lake: 15-year growth response. Canadian-Forest-Service, Pacific and Yukon Region Information-Report BC-X-319. ix + 42 p.

Keywords: fertilization
thinning
growth
yield
tree morphology
tree/stand health

Abstract: Responses after 15 yr to 3 rates of nitrogen (urea), applied at 0, 224 or 448 kg N/ha to a 24-yr-old Douglas fir (Pseudotsuga menziesii) stand in the very dry maritime region of British Columbia, were analysed on the basis of per hectare, individual tree, crop tree and tree size class. Thinned and unthinned plots were measured.

OSU Link
Non-OSU Link

16. Garman, S.L., J.H. Cissel and J.H. Mayo. 2003. Accelerating development of late-successional conditions in young managed Douglas-fir stands: a simulation study. Pacific-Northwest-Research-Station,-USDA-Forest-Service General-Technical-Report PNW-GTR-557. ii + 57 p.

Keywords: thinning
commercial thinning
yield

Abstract: The goal of this simulation study was to provide information for defining thinning regimes for young Douglas-fir (Pseudotsuga menziesii) stands in the Central Cascades Adaptive Management Area, located in west-central Oregon, USA. Specifically, this study used the ZELIG.PNW (3.0) gap model to evaluate effects of experimental thinning treatments on the development of late-successional attributes and on extracted merchantable volume. Sixty-four thinning treatments were simulated for four rotation intervals (260, 180, 100, and 80 years) starting with a 40-year-old managed Douglas-fir stand. The amount of time for five late successional attributes to reach defined threshold levels, long-term developmental trends of these attributes, and amount of extracted merchantable volume were

recorded for each treatment. Stand conditions of selected treatments were used in a subsequent harvest rotation in which 64 additional experimental thinning treatments were applied and evaluated. A total of 1744 thinning treatments was evaluated in this study. Results of this study confirm previous recommendations for accelerating development of late-successional attributes in young managed stands. Additionally, results show the potential for a range of thinning treatments to attain late-successional conditions in about the same amount of time, but with different trade-offs in terms of merchantable volume and long-term stand conditions. In general, heavy thinning of existing stands at ages 40 and 60 years promoted rapid development of large boles, vertical diversity, and tree-species diversity, but provided the least amount of extracted volume and required artificial creation of dead wood. Treatments that retained more than 40% of the original overstorey and thinned to 99 trees per hectare at age 60 delayed attainment of late-successional conditions by 10 to 30 years but provided 12 to 20% more extracted volume, resulted in higher levels of most late-successional attributes at the end of a rotation, and required less artificial creation of dead wood. Treatments providing the fastest development of late-successional conditions in subsequent rotations varied with the amount of canopy cover retained at the end of the first rotation. For stands starting with <more or =>30% canopy cover, delaying the first commercial thin for 40 years promoted the most rapid development of vertical structure and shade-tolerant stems. Lower canopy-retention levels required heavy or light thins in subsequent entries, depending on the rotation interval, for rapid development of late-successional attributes.

OSU Link
Non-OSU Link

17. Haight, R.G. 1993b. Technology change and the economics of silvicultural investment. Rocky-Mountain-Forest-and-Range-Experiment-Station,-USDA-Forest-Service General-Technical-Report RM-GTR-232. ii + 18 p.

Keywords: planting operations
site preparation
prescribed fire
release treatments
chemical release
tree/stand protection
thinning
commercial thinning
precommercial thinning
yield
economics

Abstract: Financial analyses of intensive and low-cost reforestation options are conducted for loblolly pine (Pinus contorta) stands with broadleaved competition in the Southern USA, and Douglas fir with red alder (Pseudotsuga menziesii with Alnus rubra) in the Pacific Northwest. Results show that the expected present values (EPVs) of low-cost options that result in mixtures of conifers and broadleaves are superior in some situations to the EPVs of the intensive options.

OSU Link
Non-OSU Link

18. Hermann, R.K. and D.P. Lavender. 1999. Douglas-fir planted forests. New-Forests 17(1/3): 53-70.

Keywords: genetic tree improvement
nursery operations
planting operations
site preparation
release treatments
fertilization
thinning
pruning
tree/stand protection
growth
yield

Abstract: A combination of superior wood quality and high productivity has made Douglas fir (Pseudotsuga menziesii) one of the premier timber trees in the world. As such, it is grown as a plantation species in several countries in Europe and South America, and in New Zealand and Australia, as well as throughout its extensive natural range in western North America. Decades of experience with the silviculture of young stands have demonstrated that practices such as planting, the use of genetically improved seedlings, precommercial and commercial thinning, and fertilizing may dramatically increase the yield of industrial products over that of natural forests. Further, such silviculture is compatible with the production of desired amenities. Vigorous implementation of such practices wherever Douglas fir is cultivated will increase the world's timber resources, and be an effective strategy for reducing the pressure, occasioned by the world's rapidly increasing population, to harvest the fragile tropical and boreal forests.

OSU Link
Non-OSU Link

19. Hummel, S. and R. Hummel. 2004. Five-year thinning response of an overgrown Douglas-fir Christmas tree plantation. Western-Journal-of-Applied-Forestry 19(3): 171-174.

Keywords: planting operations
thinning
growth
yield
economics

Abstract: A 15-year-old Douglas-fir Christmas tree plantation in western Oregon was thinned in 1996 according to regional sawtimber conversion guidelines. The plantation comprised two strata, distinguished by initial planting density (Area 1=5x5 ft and Area 2=10x10 ft).Unthinned control plots were established in both Area 1 and Area 2 at the time of the thinning treatment. Five years later, the quadratic mean diameter (QMD) in Area 1 (thinned) was 6.4 in. versus 5.2 in. in Area 1 (unthinned), while in Area 2 (thinned) the QMD was 11.4 in. compared to 9.3 in. in Area 2 (unthinned). Over the same period, the volume/ac in Area 1 (thinned) (1,080 ft3/ac) was nearly twice that of Area 1 (unthinned) (576 ft3/ac). In contrast, the volume/ac in Area 2 (thinned) (2,318 ft3/acre) was almost half that of Area 2 (unthinned) (4,264 ft3/ac). These results suggest that while thinning was timely for Area 1, the thinning treatment could have been delayed for Area 2. By plantation age 30, the treated units in

Area 1 and Area 2 have estimated yields of 9.6 and 11.6 thousand bd ft (mbf), respectively, with no additional thinning. Given 2002 average prices for #3 sawmill grade logs, gross return at age 30 would range between $5,000 and $6,000/ac.

OSU Link
Non-OSU Link

20. King, J.E., D.D. Marshall and J.F. Bell. 2002. Levels-of-growing-stock cooperative study in Douglas-fir: report no. 17 - the Skykomish study, 1961-93; the Clemons study, 1963-94. Pacific-Northwest-Research-Station, USDA-Forest-Service Research-Paper PNW-RP-548. vii + 120 p.

Keywords: thinning
commercial thinning
growth
yield
tree/stand health

Abstract: A study was conducted at the Skykomish Tree Farm, and at the Clemons Tree Farm, Washington, USA, to determine how the amount of growing stock in repeatedly thinned stands of Douglas Fir (Pseudotsuga menziesii) affects cumulative wood production, tree size and growth-growing stock ratios. Initial stands were thinned to the same level of growing stock so that all plots would have virtually the same growth potential except the unthinned controls. The Skykomish and Clemons stands were 24 and 19 years old, respectively, when the studies were started. Stand treatments were completed at ages 42 and 36, and measurements were continued to ages 56 and 50. After 32 years at Skykomish and 31 years at Clemons, the basal area per acre in the eight regimes ranged from 119-244 ft2 atSkykomish and 101-195 at Clemons. The corresponding gross yields in cubic feet per acre were 8709-13 579 at Skykomish and 6329-9072 at Clemons. Volume in thinnings were 18-53% of the gross yield. Stand treatments included four regimes with different combinations of heavy and light thinning and four regimes with constant intensities of thinning. Variable regimes were found to have consistent advantage over constant regimes. Within a given level of growing stock, the constant regimes are recommended for applications where wood production is the primary objective. A substantial increase in the yield was produced in all regimes during the post thinning holding period. Based on standing volume after the last thinning, the holding period of 4 years produced approximately 30% more volume in all regimes. Extending the period to 9 years produced approximately 70% more volume, and at 14 years, the standing volume was more than double the volume remaining after the last thinning. This extra yield enhanced by the high quality of the stands makes the length of the holding period an important factor in the scheduling of final harvest.

OSU Link
Non-OSU Link

21. Knapp, W.H., T.C. Turpin and J.H. Beuter. 1984. Vegetation control for Douglas-fir regeneration on the Siuslaw National forest: a decision analysis. Journal-of-Forestry 82(3): 168-173.

Keywords: planting operations
site preparation
chemical preparation

mechanical preparation
prescribed fire
release treatments
chemical release
manual release
growth
yield
economics

Abstract: Records from 324 plantations in Oregon were used to calculate the effect on stocking of various methods of controlling competing vegetation before and after plantation establishment. A decision tree analysis using 6 management regimes on 5 stocking classes indicated that if no site preparation or release (other than broadcast burning to reduce fuels) were practised, the forest would produce 63% of the m.a.i. and 35% of the present net worth (PNW) expected if all means of control (chemical, manual and burning) were available and used. If only manual control methods were used 78% of the max. m.a.i. and 57% of the max. PNW would be expected. When all methods except phenoxy herbicides were available, the expected m.a.i. and PNW were reduced to no less than 90%. The yield reduction varied with aspect, and the type of prelogging vegetation. Declines were least on SW-facing sites that were originally predominantly conifers, and greatest on NE-facing slopes that had supported broadleaves. Limitations of the analysis are discussed.

OSU Link
Non-OSU Link

22. Knowe, S.A. 1994c. Silvicultural and economic value of vegetation management in the Pacific northwest. *In* Weed science education: the cost of ignorance: Proceedings of the 47th annual meeting of the Southern Weed Science Society, Dallas, Texas, USA, 17-19 January, 1994. pp. 92-97.

Keywords: planting operations
release treatments
yield
economics

Abstract: Models indicated that the yield and net present value (NPV) of young Pseudotsuga menziesii stands in Oregon varied with site index and planting density. Effects of hardwood competition in 20-year-old plantations were predicted using the Regional Vegetation Management Model (RVMM). A stand table so produced was used for developing ORGANON, which simulated silvicultural treatments and growth for 40-60 years. Output from this was used to evaluate the economic consequences of hardwood competition using ORGECON. It was found that the least impact was observed at low site index with high planting density. Modifications to the models are suggested.

23. Kramer, H. and J.H.G. Smith. 1985. Establishment of Douglas fir stands in British Columbia. Forstarchiv 56(1): 9-13.

Keywords: planting operations
thinning

pruning
growth
yield
economics
wood quality

Abstract: Square spacing trials were established NW of Haney (180 m alt.) at 0.91, 1.83, 2.74, 3.66 and 4.57 m. Growth to age 25 yr, and simulation estimates up to 100 yr are reported. Results indicated that extra costs (incurred by thinning) of stands closer than 4 m spacing are difficult to justify in economic terms, because the market for Douglas fir timber grown in British Columbia is such that only production of large timber is economically viable. The quality of timber from trees grown at wide spacing without thinning is acceptable in relation to Canadian requirements, and could be improved if wide spacing were combined with pruning. It is recommended that close spacings be used only if availability of land is limited or demand for biomass is very strong.

OSU Link
Non-OSU Link

24. Marshall, D.D. and R.O. Curtis. 2002. Levels-of-growing-stock cooperative study in Douglas-fir: report no. 15 - Hoskins: 1963-1998. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-537. 80 p.

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

Abstract: The cooperative levels-of-growing-stock (LOGS) study in Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) was begun to study the relations between growing stock, growth, cumulative wood production, and tree size in repeatedly thinned stands. This report summarizes results from the Hoskins installation through age 55. Growing stock has been allowed to accumulate for 19 years since the last treatment thinning was applied in this high site class II natural stand. Volume and diameter growth were strongly related to growing stock. Basal area growth-growing stock relations were considerably weaker. Differences in tree size and volume distribution were considerable. Culmination of mean annual increment has not occurred for any of the treatments, although the control has culminated for total stem cubic volume and is near culmination for merchantable cubic volume. Only small differences are seen in growth percentages between thinning treatments. Results demonstrate potential flexibility in managing Douglas-fir to reach a range of objectives.

OSU Link
Non-OSU Link

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

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

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

OSU Link
Non-OSU Link

26. Miller, R.E., R.E. Bigley and S. Webster. 1993a. Early development of matched planted and naturally regenerated Douglas-fir stands after slash burning in the Cascade Range. Western-Journal-of-Applied-Forestry 8(1): 5-10.

Keywords: planting operations
growth
yield

Abstract: Comparisons were made of matched planted and naturally regenerated plots in 35- to 38-yr-old Douglas fir (Pseudotsuga menziesii var. menziesii) stands at seven locations in western Washington and Oregon. The total number of live stems was similar in both stand types, but stands planted to Douglas fir averaged 26 more live stems/acre of Douglas fir and 39 fewer stems/acre of other conifers than did naturally regenerated stands. Despite an average 2 yr delay in planting after burning, dominant Douglas fir in planted stands average 3 fewer years than natural regeneration to attain breast height after burning. Volume of all live trees (1.6 in. diameter at breast height (d.b.h.) and larger) and of Douglas fir averaged 40% greater on planted plots. Volume of live conifers 7.6 in. d.b.h. and greater averaged 41% more on planted plots than on naturally regenerated plots (2977 vs. 2118 ftsuperscript 3/acre). Differences that developed on these plots were probably less than differences that would be shown by plantations being established today with prompt planting, and improved nursery stock and planting methods.

OSU Link
Non-OSU Link

27. Miller, R.E., E.L. Obermeyer and H.W. Anderson. 1999. Comparative effects of precommercial thinning, urea fertilizer, and red alder in a site II, coast Douglas-fir plantation. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-513.ii + 25 p.

Keywords: fertilization
thinning
precommercial thinning
growth
yield
tree/stand health
soil properties

Abstract: The number of red alder (Alnus rubra) trees retained with 300 Douglas-fir (Pseudotsuga menziesii) per acre was varied on a high-quality site in coastal Oregon. Alder densities of 0, 20, 40, and 80 per acre were tested. A fifth treatment eliminated nitrogen-fixing alder, but substituted nitrogen fertilizer. Treatment 6 had neither thinning nor alder control. Treatments were randomly assigned within each of three blocks in a 9-year-old plantation. Stand density was reduced within 15 of these 18 experimental units. Surplus conifers were cut, but surplus red alder were controlled by the "hack-and-squirt" method. Because numerous trees of other species regenerated naturally, combined density of all species before thinning ranged from 1400 to 5700 trees per acre. Subsequent 17-year change in number, average height, basal area, and volume of Douglas-fir were compared. Retaining 20, 40, or 80 alder per acre reduced numbers of associated Douglas-fir by about 10, 17, and 23 percent, respectively. In pure Douglas-fir plots, gross volume growth was similar for non-fertilized and fertilized plots, indicating no measurable benefits of additional nitrogen. In mixed stands, red alder reduced yield of associated Douglas-fir, but not yield of combined species. Similar comparisons are needed at other locations, especially those with known nitrogen deficiency.

OSU Link
Non-OSU Link

28. Mitchell, K.J. and J.R. Cameron. 1985. Managed stand yield tables for coastal Douglas-fir: initial density and precommercial thinning. Ministry-of-Forests, British-Columbia

Keywords: planting operations
thinning
precommercial thinning
growth
yield

Abstract: Yield tables are presented for second growth stands of Pseudotsuga menziesii, established naturally (4440 trees/ha) or planted with 300, 500, 750, 1110 or 2500 trees/ha in British Columbia. Separate tables describe the development of stands thinned to 500 or 1100 stems/ha when 6 m tall. The yield tables were produced by a biologically oriented tree and stand simulation model (TASS) calibrated to conform with the yield of remeasured plots.

OSU Link
Non-OSU Link

29. Murray, M.D. 1988. Growth and yield of a managed 30-year-old noble fir plantation. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Note PNW-RN-475. 8 p.

Keywords: planting operations
growth
yield
economics

Abstract: Yield of noble fir (Abies procera) from a managed (urea application 15 yr after planting, precommercially thinned after 17 and 24 yr) stand in the Doty Hills, western Washington was measured and compared with the simulated yield of a Douglas fir (Pseudotsugamenziesii) plantation of the same age. Noble fir produced 3450 ftsuperscript 3/acre at age 30 yr; more than half this volume was in trees of <more or =>10 inches d.b.h. Current annual increment during the 6 yr after the second thinning (to 300 trees/acre) was 295ftsuperscript 3/acre. Ornamental boughs had been harvested annually for 15 yr. Total noble fir volume was about 5% less than the simulated volume of Douglas fir. The estimated value of noble fir after 48 yr, including sawlogs and boughs, could exceed the value of Douglas fir at the same age grown on the same site.

OSU Link
Non-OSU Link

30. O'-Hara, K.L. 1990. Twenty-eight years of thinning at several intensities in a high-site Douglas-fir stand in western Washington. Western-Journal-of-Applied-Forestry 5(2): 37-40.

Keywords: thinning
commercial thinning
growth
yield

Abstract: Results are presented of a 28-year thinning study of a dense (182-452 tree/acre) natural, second growth Douglas fir (Pseudotsuga menziesii) stand at Delezenne, which compared 3 thinning treatments with an unthinned control. Treatments were: an increasing basal area treatment; a constant basal area treatment (of approximately 140 ftsuperscript 2/acre); a decreasing/increasing reserve basal area treatment; and control plots, which were 35 to 37-years-old with basal area 80-203 ftsuperscript 2/acre in 1957 when the tests were started. Gross, net, and total recoverable periodic cubic volume increments of the control treatment (10 396, 9108 and 16 092 ftsuperscript 3/acre, respectively) were not significantly different from the highest yielding treatment, which was the increasing reserve basal area thinning treatment (8896, 8594 and 16 636 ftsuperscript 3/acre, respectively). These results, and options for thinning schedules, are discussed; it is suggested that commercial thinnings of dense or fully stocked plantations of Douglas fir may produce similar results, that is, vigorous stands with rapid growth potential.

OSU Link
Non-OSU Link

31. O'-Hara, K.L. and C.D. Oliver. 1988. Three-dimensional representation of Douglas-fir volume growth: comparison of growth and yield models with stand data. Forest-Science 34(3): 724-743.

Keywords: planting operations
thinning
growth
yield
computer modeling

Abstract: Growth and yield estimates for unthinned stands from the Douglas fir Stand Simulator (DFSIM) and the Tree and Stand Simulator (TASS) were used to construct graphical three-dimensional representations of Douglas fir (Pseudotsuga menziesii) stand growth on site index 44 m (50 yr). The three-dimensional models used three variables: trees per hectare, b.h. age, and either mean tree vol. or stand vol. The TASS and DFSIM models were in agreement over most of their common range of age and number of trees. At wider spacingsand older ages, however, the volumes predicted by the DFSIM model exceeded those predicted by the TASS model by as much as 25%. Comparisons of these three-dimensional models to unthinned and thinned stand data from a site of similar quality in the Delezennethinning trial, Washington, found the models to be reasonably accurate representations of unthinned stand growth. The thinned stands, however, had greater mean tree and stand volumes than those indicated by the TASS model for unthinned stands at similar spacings. Complete comparisons were not possible with the DFSIM model because of its limited range of number of trees. These results suggest that the TASS model, and to a lesser extent, the DFSIM model may be underestimating the growth of widely spaced stands, or thinning may actually increase the growth of thinned trees over that of trees which had always grown at the post-thinning spacing.

OSU Link
Non-OSU Link

32. Omule, S.A.Y. 1984. Results from a correlated curve trend experiment on spacing and thinning of coastal Douglas fir. B.C. Ministry-of-Forests Research-Note 93. ix + 22 p.

Keywords: thinning
precommercial thinning
growth
yield
tree/stand health

Abstract: Plots were established in 1952 in 13-yr-old plantations and given a variety of thinning treatments to produce post-thinning densities of 125-3000 stems/ha. Trees were measured at intervals up to 1980. Analysis showed that diam., ht. and their growth increased with decrease in density. Mortality, b.a., total vol. and b.a. growth decreased as density decreased. Stand merchantable vol. was not affected by density except at extremes. Prolonged early suppression appeared to reduce the ability of a stand to respond to subsequent thinning in terms of b.a. and total vol.

OSU Link
Non-OSU Link

33. Omule, S.A.Y. 1987b. Early growth of four species planted at three spacings on Vancouver Island. B.C. Ministry of Forests FRDA-Report 009. vii + 22 p.

Keywords: planting operations
tree/stand health
growth
yield

Abstract: Seedling survival and 24- to 26-yr growth were measured of (a) Douglas fir (Pseudotsuga menziesii), (b) western hemlock (Tsuga heterophylla), (c) Sitka spruce (Picea sitchensis) and (d) Thuja plicata grown at 2.7x2.7, 3.7x3.7 and 4.6x4.6 m spacings on the W. coast of Vancouver Island, British Columbia. Initial spacing had no significant effect on survival, which was 86% in (a), 56% in (b), 87% in (c) and 91% in (d). Effects of spacing on growth and yield were as expected (little effect on ht.; wider spacings produced larger trees, but vol./ha was lower) in (a), but were delayed or confounded in (b) by poor seedling survival, in (c) by weevil (Pissodes strobi) damage and in (d) by salal (Gaultheria shallon) competition and browsing.

OSU Link
Non-OSU Link

34. Omule, S.A.Y. 1988. Growth and yield 35 years after commercially thinning 50-year-old Douglas-fir. B.C. Ministry of Forests FRDA-Report 021. vi + 15 p.

Keywords: thinning
commercial thinning
growth
yield
tree/stand health

Abstract: Remeasurement data over a period of 35 years from fourteen 0.2023-ha permanent plots were analysed to determine the growth and yield effects of commercially thinning 50-year-old Douglas fir (Pseudotsuga menziesii) stands on a good site on Vancouver Island, British Columbia. Compared to unthinned stands, the commercially thinned stands had: virtually the same total volume gross annual increment, top height and top height increment; 12% more potentially usable total volume yield (including thinnings); 18% less total volume at final harvest age 86 yr; virtually the same crop tree (193 largest diameter trees per hectare) average diameter, but 24% larger entire stand quadratic mean diameter; and 11% less total volume production lost to mortality. These results show that commercial thinning slightly increased total stand yield (including thinnings) and produced larger stand diameter at rotation age 86 yr, but that it also reduced usable total volume at final harvest and had virtually no effect on size of the crop trees. Data from this study are useful for validating growth models, and for constructing and comparing managed stand yield tables for various commercial thinning regimes.

OSU Link
Non-OSU Link

35. Ralston, R., J. Buongiorno and J.S. Fried. 2004. Potential yield, return, and tree diversity of managed, uneven-aged Douglas-fir stands. Silva-Fennica 38(1): 55-70.

Keywords: thinning
commercial thinning
economics
yield

Abstract: The effects of different management regimes on uneven-aged Douglas-fir stands in the Pacific Northwest of the United States were predicted with a simulation model. Management alternatives were defined by residual stand structure and cutting cycle. The residual stand structure was set by basal area-diameter-q-ratio (BDq) distributions, diameter-limit cuts (assuming concurrent stand improvement), or the current diameter distribution. Cutting cycles of 10 or 20 years were applied for 200 years. The current diameter distribution was defined as the average of the uneven-aged Douglas-fir stands sampled in the most recent Forest Inventory and Analysis conducted in Oregon and Washington. Simulation results were compared in terms of financial returns, timber productivity, species group diversity (hardwoods vs softwoods), size class diversity, and stand structure. Other things being equal, there was little difference between 10- and 20-year cutting cycles. The highest financial returns were obtained with either a 58.4 cm diameter-limit cut, or a BDq distribution with 8.4 m2 of residual basal area, a 71.1 cm maximum diameter, and a q-ratio of 1.2. Using the current stand state as the residual distribution was the best way to obtain high tree size diversity, and high species group diversity. Several uneven-aged regimes gave net present values comparable to that obtained by converting the initial, uneven-aged stand to an even-aged, commercially thinned, plantation.

OSU Link
Non-OSU Link

36. Reukema, D.L. and J.H.G. Smith. 1987. Development over 25 years of Douglas-fir, western hemlock, and western redcedar planted at various spacings on a very good site in British Columbia. Pacific-Northwest-Research-Station,-USDA-Forest-Service Research-Paper PNW-RP-381. ii + 46 p.

Keywords: planting operations
pruning
growth
yield
tree morphology

Abstract: Five spacing trials were established during 1957-67 at the University of British Columbia Research Forest, covering a range of spacings from 1 to 5 m and of experimental designs (49-tree-plot, 0.2-ha plot, rectangularity, Nelder and variable block trials). Results showed that initial spacing is among the most important factors influencing stem and crown development, and stand growth and yield for Douglas fir (Pseudotsuga menziesii), western hemlock (Tsuga heterophylla) and western redcedar (Thuja plicata). Top heights were initially taller at closer spacings, but are now similar at all spacings. Av. ht. is now shorter at close spacing. Decreases in heights to dead and live crowns and increases in diam. of lower stem, taper and crown size occurred as spacing increased. B.a. and stand vol. increased as spacing decreased until onset of density-related mortality. It is concluded that initial wide spacings with rectangularities up to 2:1 (e.g. 6x3 m) will result in efficient production of large trees of high value and satisfactory quality. Pruning of widely spaced trees to enhance lower stem quality is strongly recommended.

OSU Link
Non-OSU Link

37. Riitters, K. and J.D. Brodie. 1984. Implementing optimal thinning strategies. Forest-Science 30(1): 82-85.

Keywords: thinning
economics
growth
yield

Abstract: [See FA 41, 3436; 44, 201] A method is described for comparing the results of optimal thinning analyses based on different management or economic criteria (such as soil expectation value, forest rent or m.a.i.). Optimal thinning regimes for Douglas fir and ponderosa pine were calculated using dynamic programming algorithms based on 2 stand growth simulators. Residual mean tree volumes were then plotted against stand density at varying time intervals. On a graph of this kind, the time trajectory of optimal thinning regimes for even-aged stands is approximately parallel to the line of maximum size/density.

OSU Link
Non-OSU Link

38. Sachs, D. and P. Sollins. 1986. Potential effects of management practices on nitrogen nutrition and long-term productivity of western hemlock stands. Forest-Ecology-and-Management 17(1): 25-36.

Keywords: thinning
commercial thinning
yield
soil properties
computer modeling

Abstract: The FORCYTE-10 computer model, developed by J.P. Kimmins and K. Scoullar for Douglas-fir forests in British Columbia, was modified to simulate growth and nutrient cycling of coastal western hemlock stands in Oregon. Initial calibration indicated that predicted yield was extremely sensitive to the rate of mineralization of soil organic matter (SOM), variation in SOM C/N ratio with site quality, the soil extractable NO3-/NH4+ ratio, and the decomposition rate and N mineralization pattern of large and medium-size roots and woody debris. The predictions suggested that yield and SOM remain stable under a management system consisting of six successive 90-yr rotations. More intensive utilization (e.g., shorter rotations, whole-tree harvesting and commercial thinning) causes depletion of soil and forest floor nitrogen and a small decline in site productivity in later rotations.

OSU Link
Non-OSU Link

39. Sachs, D. and J.A. Trofymow. 1991. Testing the performance of FORCYTE-11 against results from the Shawnigan Lake thinning and fertilization trials on Douglas-fir. Canadian-Forest-Service, Pacific and Yukon Region Information-Report BC-X-324. viii + 58 p.

Keywords: fertilization
thinning
precommercial thinning
growth
yield
tree physiology
carbon allocation
tree/stand health
computer modeling

Abstract: FORCYTE-11 is an ecosystem-based forest growth simulation model. Its performance was evaluated with data on stand and tree biomass, height, stocking (mortality) and foliar assimilation and loss rates for Douglas fir (Pseudotsuga menziesii) in thinning/fertilizer trials in British Columbia.

OSU Link
Non-OSU Link

40. Sonne, E., E. Turnblom, D. Briggs and G. Becker. 2004. Log and lumber grades and value from a Douglas-fir stand 20 years after thinning and biosolids fertilization. Western-Journal-of-Applied-Forestry 19(1): 34-41.

Keywords: fertilization
thinning
economics
yield
wood quality

Abstract: Three replications of four treatments: biosolids fertilizer application, thinning, thinning plus biosolids fertilizer application, and untreated control were established in 1977 in a dense, low site, 55-year-old Douglas-fir (Pseudotsuga menziesii) stand in western Washington, USA. In 1998, 12 trees from each treatment were harvested, bucked into logs, and sawn into visually graded lumber. Taking into account effects of treatments on stand yield and log grades, biosolid fertilizer application only, thinning only, and thinning combined with biosolids increased log value/ac by $1142 (19%), $3642 (62%), and $9969 (155%), respectively, over the untreated control. When treatment effects were viewed in terms of changes in lumber yield and quality, per acre gains over the control were $2107 (26%), $5683 (70%), and $10 708 (132%), respectively. Willingness to pay analysis indicates that if the landowner intends to manage the stand to a rotation of approximately 75 years, each of the treatments, and especially the combination of thinning and applying biosolids, appears to be financially attractive at both 5 and 9% interest rates. However, if the rotation had been set at 55 years, only the thinning/biosolids combination at 5% interest rate would entice management to delay immediate harvest.

OSU Link
Non-OSU Link

41. Stinson, S.D. 1999. 50 years of low thinning in second growth Douglas-fir. Forestry-Chronicle 75(3): 401-405.

Keywords: thinning
growth
yield
wood quality

Abstract: Results are presented from four of the Port Blakely XT series of thinning trials, established during 1948-58 in naturally regenerated Douglas fir [Pseudotsuga menziesii] stands in western Washington. Three trials were designed to evaluate the effects of repeated low thinning and extended rotations, while the fourth compared the effects of different levels of removal on standing volume and wood quality. Periodic and mean annual increment trends were examined in all trials. Results indicated the extension of culmination of mean annual increment in response to low thinning, combined with extended rotations. Thinned plots in 2 trials had increased stem size and total harvested volume. Extended rotations and low thinning increased the quantity of structural log grades when compared with stands harvested on shorter rotations.

OSU Link
Non-OSU Link

42. Stone, M. 1993. An economic evaluation of commercial thinning Douglas-fir in the coastal region of British Columbia. BC Ministry of Forests FRDA-Working-Paper WP-6-002. x + 146 p.

Keywords: thinning
commercial thinning
economics
growth
yield

Abstract: The economic evaluation of commercial thinning of Douglas fir [Pseudotsuga menziesii] in the coastal region of British Columbia, includes an estimation of the economic effects of the thinning on the final harvest. This was done by simulating the growth and yield impacts of a commercial thinning, estimating the potential costs and revenues derived from the thinning and the final harvest, and determining the net present value of the full impacts of commercial thinning.

Non-OSU Link

43. Tappeiner, J.C., J.F. Bell and J.D. Brodie. 1982. Response of young Douglas-fir to 16 years of intensive thinning. Forest-Research-Laboratory,-Oregon-State-University

Keywords: thinning
growth
yield
tree/stand health
economics

Abstract: The report of the thinning study in the Oregon Coast Range includes a financial analysis of representative thinning regimes.

OSU Link
Non-OSU Link

44. Tarrant, R.F., B.T. Bormann, D.S. DeBell and W.A. Atkinson. 1983. Managing red alder in the Douglas-fir region: some possibilities. Journal-of-Forestry 81(12): 787-792.

Keywords: planting operations
fertilization
yield
economics

Abstract: An economic comparison of 3 systems for growing Alnus rubra (rotations of 13,20 and 28 yr) in the Pacific Northwest USA, with or without alternating rotations (45 yr) of Douglas fir, and 2 continuous systems for growing Douglas fir (45-yr rotations with or without treatment with N fertilizer). Anticipated stand yield, and costs of site preparation, planting, fertilization etc. were used to estimate m.a.i. (vol.), present net worth and internal rate of return. The 2 most profitable systems were Douglas fir, thinned and treated with fertilizer twice in 45 yr (present net worth $623/acre) and red alder grown to sawlog size (28 yr) alternating with Douglas fir thinned twice in 45 yr (present net worth $578/acre). The least profitable system was red alder grown continuously in 13 yr rotations (present net worth -$251/acre). Alternate cropping of red alder and Douglas fir or continuous red alder production would be as profitable as growing Douglas fir alone if there were increases in real interest rate, alder stumpage price, or the cost of N fertilizer, or alder sawlog rotation length decreased.

OSU Link
Non-OSU Link

45. Tesch, S.D., G.M. Filip, S.A. Fitzgerald and D.D. Marshall. 1994. Silvicultural treatments for enhancing tree value, vigor, and growth in 70- to 120-year-old stands dominated by noble fir on the Warm Springs Indian Reservation: a synthesis of the literature. ForestResearch Laboratory, College of Forestry, Oregon State University. iii + 21 p.

Keywords: fertilization
thinning
pruning
tree/stand protection
growth
yield
tree/stand health

Abstract: The Warm Springs Indian Reservation, Oregon, apparently contains some 30 000 acres of naturally regenerated, largely unmanaged stands of 70- to 120-year-old mixed conifer forest dominated by noble fir (Abies procera), with Douglas-fir [Pseudotsugamenziesii], and some Pacific silver fir [Abies amabilis] and western hemlock [Tsuga heterophylla]. The synthesis focuses on growth and yield, thinning, pruning, fertilizer treatment, disease, minimizing stand damage during thinning, and insect pests.

Non-OSU Link

46. Walstad, J.D., J.D. Brodie, B.C. McGinley and C.A. Roberts. 1986. Silvicultural value of chemical brush control in the management of Douglas-fir. Western-Journal-of-Applied-Forestry 1(3): 69-73.

Keywords: release treatments
chemical release
growth
yield
economics

Abstract: Retrospective analyses were made of 3 Douglas fir plantations (age 12-39 yr) in western Oregon and Washington, to determine the long-term silvicultural effects and economic value of chemical brush control 10-25 yr earlier. Stocking and growth of Douglas fir were significantly greater on areas that received at least one aerial application of 2,4-D or 2,4,5-T than on untreated areas. On two sites, invading Alnus rubra virtually excluded Douglas fir in the absence of brush control. On the third site, Ceanothus velutinus var. laevigatusreduced Douglas fir stocking and diam. growth on untreated areas. On all three sites, projections of mature yield and economic returns based on current stand conditions indicated substantial benefits for areas where brush control treatments were applied.

OSU Link
Non-OSU Link

47. Wang, T., S.N. Aitken, J.H. Woods, K. Polsson and S. Magnussen. 2004. Effects of inbreeding on coastal Douglas fir growth and yield in operational plantations: a model-based approach. Theoretical-and-Applied-Genetics 108(6): 1162-1171.

Keywords: genetic tree improvement
seed orchard management
planting operations
yield

Abstract: In advanced generation seed orchards, tradeoffs exist between genetic gain obtained by selecting the best related individuals for seed orchard populations, and potential losses due to subsequent inbreeding between these individuals. Although inbreeding depression for growth rate is strong in most forest tree species at the individual tree level, the effect of a small proportion of inbreds in seed lots on final stand yield may be less important. The effects of inbreeding on wood production of mature stands cannot be assessed empirically in the short term, thus such effects were simulated for coastal Douglas fir [Pseudotsuga menziesii var. menziesii (Mirb.) Franco] using an individual-tree growth and yield model TASS (Tree and Stand Simulator). The simulations were based on seed set, nursery culling rates, and 10-year-old field test performance for trees resulting from crosses between unrelated individuals and for inbred trees produced through mating between half-sibs, full-sibs, parents and offspring and self-pollination. Results indicate that inclusion of a small proportion of related clones in seed orchards will have relatively low impacts on stand yields due to low probability of related individuals mating, lower probability of producing acceptable seedlings from related matings than from unrelated matings, and a greater probability of competition-induced mortality for slower growing inbred individuals than for outcrossed trees. Thus, competition reduces the losses expected due to inbreeding depression at harvest, particularly on better sites with higher planting densities and longer rotations. Slightly higher breeding values for related clones than unrelated clones would offset or exceed the effects of inbreeding resulting from related matings. Concerns regarding the

maintenance of genetic diversity are more likely to limit inclusion of related clones in orchards than inbreeding depression for final stand yield.

OSU Link
Non-OSU Link

48. Weetman, G.F., C.E. Prescott, F.L. Kohlberger and R.M. Rournier. 1997. Ten-year growth response of coastal Douglas-fir on Vancouver Island to N and S fertilization in an optimum nutrition trial. Canadian-Journal-of-Forest-Research 27(9): 1478-1482.

Keywords: fertilization
growth
yield
tree physiology

Abstract: A 27-year-old stand of coastal Douglas fir (Pseudotsuga menziesii) on Vancouver Island, British Columbia, was fertilized four times (1981, 1983, 1986 and 1988) with N as urea at six rates from 0 to 250 kg N/ha, with and without S coating (0-50 kg/ha). Current-year foliage was collected annually during 1981-85 and in 1990. Foliar N levels declined in the control plots over the 10-year period, but remained elevated in the fertilized plots. The increase in foliar N concentrations was commensurate with the amount of N added. Stand basal area response increased with increasing rates of N addition. The greatest response in relative basal area net increment was 4.52 msuperscript 2/ha (40%) in plots that received a total of 1000 kg N/ha during the 10 years. Over a 60-year rotation, about 62msuperscript 3 of extra wood would be produced under this regime. There was no additional response to S added in conjunction with N, so the N + S plots received only a single application of fertilizer. Mortality was confined to smaller suppressed stems, mostly of species other than Douglas fir. Foliar N concentrations and basal area increment declined steadily following cessation of fertilizer application in these plots, but remained greater than those in control plots for the 10-year measurement period. The results suggest that sustained increases in growth response of Douglas fir can be achieved through repeated additions of N that maintain elevated concentrations of N in foliage.

OSU Link
Non-OSU Link

49. Wilson, J.S. and P.J. Baker. 2001. Flexibility in forest management: managing uncertainty in Douglas-fir forests of the Pacific Northwest. Forest-Ecology-and-Management 145(3): 219-227.

Keywords: planting operations
thinning
yield
tree morphology
economics
tree/stand health

Abstract: Long planning horizons generate substantial uncertainty in forest management, making management flexibility, the ability to choose between multiple options or opportunities, a desirable attribute of managed forests. Flexibility in forest management reflects both the relative rigidity of

intervention requirements and the potential range of development pathways for a stand. The wind stability of Pacific Northwest Douglas-fir (Pseudotsuga menziesii) plantations is used to demonstrate the concept of management flexibility. Dense Douglas-fir plantations develop high height to diameter ratios in the dominant trees making them unstable and prone to wind damage. The management of these plantations is inflexible, because without early and timely thinning, the stands do not contain stable trees that could be expected to survive long rotations or late thinnings. A combination of reduced planting densities and site-specific management reduces both the necessity and rigidity of intervention requirements (e.g., thinning) and expands the number of potential developmental pathways for these stands. The cost of greater management flexibility is reduced efficiency of wood volume production; however, greater adaptability to changing markets, labour conditions, and management objectives may be more important for many forest owners. While this approach to management is complex, it frees owners and managers from rigid management requirements and allows for a wider range of future stand conditions.

OSU Link
Non-OSU Link