SERVING SOUTHWEST OREGON THROUGH ADAPTIVE RESEARCH AND EDUCATION

fir report
forestry intensified research

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"FIR REPORT" is a quarterly publication containing information of interest to individuals concerned with forest management in southwest Oregon. It is mailed free on request. Requests should be sent to: FIR REPORT, 1301 Maple Grove Drive, Medford, Oregon 97501.

FIR REPORT communicates recent technological advances and adaptive research pertinent to southwest Oregon, and alerts area natural resource specialists to upcoming educational events. Comments and suggestions concerning the content of "FIR REPORT" are welcome and should be sent to the Maple Grove address.

The Southwest Oregon Forestry Intensified Research Program (FIR) is an Oregon State University, School of Forestry program designed to assist region foresters and other specialists in solving complex biological and management problems unique to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and adaptive research projects specifically tailored to meet regional needs.

Established in October, 1978, the FIR project is a cooperative effort between Oregon State University, the Bureau of Land Management, U.S. Forest Service, O & C Counties, and southwest Oregon timber industries. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

For the FIR Staff,

David H. Lysne
Harvesting Specialist

inside...

Agriculture, Home Economics, 4-H Youth, Forestry, Community Development, and Marine Advisory Programs. Oregon State University, United States Department of Agriculture, and Oregon Counties Cooperating.

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current research

PREDICTIVE EQUATIONS TO DETERMINE CULVERT SIZE FOR SMALL WATERSHEDS

Determining the correct culvert size to install on forest roads is an important and often uncertain process. The Oregon Forest Rules for the Forest Practices Act require that culverts be adequate to accommodate the peak flow from floods having a 25-year return interval. Estimating the peak flow, however, is difficult, particularly for small watersheds. Allan J. Campbell recently addressed this problem in his Master of Science thesis at Oregon State University, "Prediction of Peak Flows for Culvert Design on Small Watersheds in Oregon."

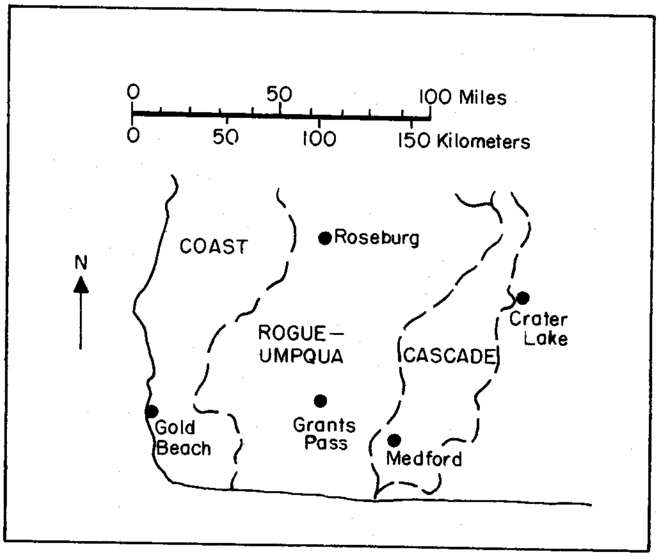


Figure 1. Southwest Oregon physiographic regions.

Five gaging station records with more than 20 years of record were compiled for small primarily forested watersheds within six physiographic regions within Oregon. The three southwest Oregon physiographic regions are shown in Figure 1. Annual peak flow records from the gaging stations were compared with predictions based on four flood frequency distributions using a chi-square goodness of fit test for each physiographic region. The log Pearson type III flood frequency distribution was found to be the best predictor of flood events for each physiographic region. Flood magnitudes estimated from the log Pearson type III distribution were related to physical and climatic indices for all of the gaged drainage basins within each physiographic region using multiple regression analysis techniques. The resulting prediction equations provide a better basis for culvert design on small watersheds than common rules of thumb or empirical methods. The equations obtained to predict peak flows are given below.

Physiographic region	Equation	R^2
Coast	$Q_{10} = 5.87A^{1.04}E^{0.49}$	.83
	$Q_{25} = 6.31A^{1.01}E^{0.51}$	.79
	$Q_{50} = 7.77A^{1.01}E^{0.50}$	.79
	$Q_{100} = 8.40A^{1.00}E^{0.50}$	.78
Cascade	$Q_{10} = 0.010A^{0.44}P^{2.15}$	.80
	$Q_{25} = 0.032A^{0.44}P^{1.97}$	.86
	$Q_{50} = 0.063A^{0.45}P^{1.87}$	.81
	$Q_{100} = 0.111A^{0.46}P^{1.78}$	.71
Rogue-Umpqua	$Q_{10} = 125A^{0.75}$	.39
	$Q_{25} = 163A^{0.77}$	.46
	$Q_{50} = 191A^{0.80}$	.50
	$Q_{100} = 221A^{0.82}$	.53

Q_t = peak flow having a probability of occurring one time in t years, cubic feet per second. A = drainage area, square miles. P = mean annual precipitation, inches. E = mean basin elevation, feet.

Application of a regression equation beyond the range of the data used to derive the equation is very risky because the equation may no longer apply. The regression equations were derived from watersheds at least 40 percent forested. The ranges of the independent variables are given below.

Physiographic region	Area $(mi)^2$	Precipitation (in.)	Elevation (ft)
Coast	0.29-2.58		260-2,820
Cascade	0.21-8.00	50-88	
Rogue-Umpaua	0.75-6.42		

D. L.

adaptive fir

AUGER PLANTING IMPROVES SURVIVAL

In 1980 Adaptive FIR and the Josephine County Department of Forestry initiated a study to compare power auger and hoe planting methods in terms of Douglas-fir seedling survival and growth. Two test sites were located southeast of Cave Junction in southern Josephine County. Both sites were at an elevation of 549 m (1,800 ft), but one had a south aspect with a 25 percent slope while the other was southwest with a 55 percent slope. Soils on both sites were loams. A randomized, complete-block experimental design with three replications was the basis for field-plot layout on each site. On each site 150, 2-0 bare-root Douglas-fir seedlings were auger-planted and 150 hoe-planted. Seedlings were from the same seedlot, planted by the same crew (personnel were rotated between planting methods), and both sites were planted on the same day under ideal weather conditions. Mean height and diameter with corresponding standard deviations at the time of planting were 24.93 cm (± 4.66) and 5.26 mm (± 1.39), respectively. Survival and growth were measured during 1980 and 1981. Seedling predawn plant moisture stress, soil moisture, and soil temperature were measured every three weeks during the summer of 1980.

Method of planting had little effect on seedling survival two years after outplanting on the south aspect, but did have a significant effect on the southwest aspect.

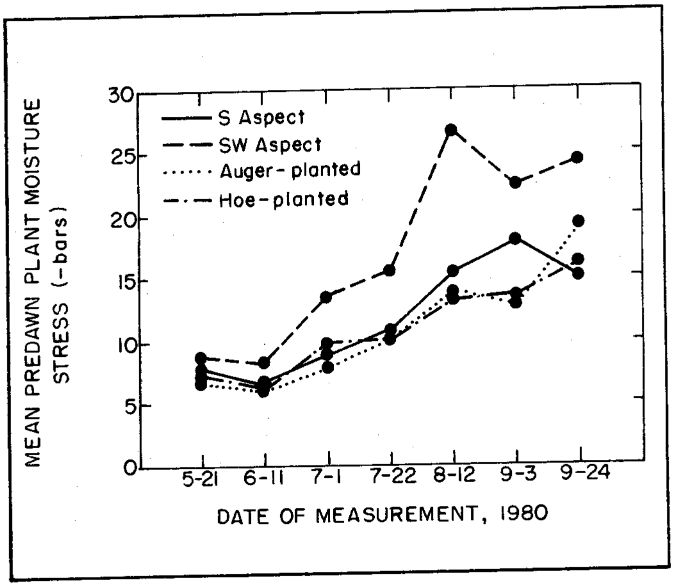
Treatment	Survival (%) November 1980	Survival (%) October 1981
South aspect		
Auger	67	48
Hoe	58	42
Southwest aspect		
Auger	86	67
Hoe	58	37

Planting method did not affect total seedling height on either site, but seedlings grew taller and produced more caliper on the south aspect.

Treatment	Mean total height (cm)	Mean total diameter (mm)
South aspect		
Auger	45.35(10.85)[a]	10.43(2.18)
Hoe	45.65(10.15)	10.42(2.34)
Southwest aspect		
Auger	41.83(9.68)	8.76(2.13)
Hoe	40.84(9.89)	8.14(1.93)

[a](± one standard deviation).

Predawn plant moisture stress levels did not differ significantly between treatments on the south site, but did on the southwest site where moisture stress levels were consistently higher in hoe-planted trees. Soil moisture was lower and soil temperature (at the 20 cm depth) higher on this test site.



Although the south site was more moderate in terms of soil moisture and temperature, survival rates for both auger- and hoe-planted seedlings were less than that of auger-planted seedlings on the more severe southwest aspect. In spite of poor survival on the south site, seedlings generally were bigger. These data anomalies cannot be explained with existing information. Consequently, FIR researchers are now excavating and mapping seedling root systems, studying soil physical characteristics and searching for evidence of animal damage on both sites. As soon as this work has been completed and the data analyzed, a more detailed report will be published.

S. H.

HARDWOOD INJECTION AND DOUGLAS-FIR UNDERPLANTING STUDY - AN UPDATE

Injection of hardwoods with Garlon 3A (trichlopyr amine mixed 1:1 with water) was finished September 9. About six quarts of Garlon 3A were applied per acre. On the average, each worker was able to cover between 0.41 and 0.45 acres per 8-hour day (corrected for transportation time) in stands of hardwoods that averaged between 253 and 298 ft^2/ac basal area and between 1,170 to 1,380 stems per acre. Four hours travel time per day cut the corrected production rate in half. On October 21, the lower leaves of tanoak and chinkapin were wilted and yellowed. No change was noticed on madrone leaves.

O. H.

EVALUATING MACHINE SITE PREPARATION

In cooperation with the Medford District, BLM (Albert Abee, co-investigator) Adaptive FIR has initiated a study to evaluate machine site-preparation techniques. The objective of the study is to determine the effect different intensities of site preparation with crawler tractors have on seedling survival and growth.

The site selected is approximately 25 miles west of Grants Pass in the southwest corner of the Galice Resource Area. The site is classified as a Low Intensity Management Unit. The site was clearcut harvested. The slopes are southerly, 5 to 40 percent, with moderately deep to deep soils derived from granitoid parent materials. The soils are mapped as the Holland Series, fine-loamy, mixed, mesic Ultic Haploxeralf.

Five treatments are being evaluated: no machine site preparation but vegetation controlled; scarification with a slash rake on a D-7 tractor; scarification followed by ripping with a small tractor; removing 4-6 inches of soil including slash, brush and root collars (gouging); and gouging followed by ripping. Treatments were randomly assigned within each of three replications. An individual treatment block is a square of approximately 0.25 acre, an area large enough to permit evaluation of the long-term effects of the site preparation practices on forest productivity.

Soil samples were collected from each block prior to site preparation to help document changes in soil fertility. An elevational grid, established before site preparation, will be re-surveyed to determine total amoung of soil removed from each block. Bulk density will be measured across the rip tracks and treatments. Competing vegetation will be sampled around permanent plots established in each treatment block.

Douglas-fir seedlings will be planted on the site in the spring. Survival, height, and diameter growth will be measured after one, two, and five years.

D. M.

NEW ADAPTIVE FIR RESEARCH

Two additional research projects designed to answer regeneration questions are being initiated by Adaptive FIR. The first will compare methods of shading on 2-0 bare root Douglas-fir planted on two south facing sites; one in the Galice area and the other in the Little Applegate drainage. The shading treatments are east and south shade from shade cards, shade blocking on the south by woody debris and unshaded controls.

The second project is a long term endeavor designed to assess the regeneration potential of Bureau of Land Management lands withdrawn from the allowable cut base because of regeneration problems. Classification of withdrawn lands by regeneration potential would allow forest managers to better define lands which truly cannot be regenerated within current guidelines. Sites representing the spectrum of withdrawn lands will be selected and planted to Douglas-fir seedlings. Seedling survival and growth, monitored annually, will then be related to site characteristics. The results of this study should also apply to withdrawn lands held by other organizations.

O. H.

fundamental fir

PULLING BRUSH WITH CABLE LOGGING SYSTEMS

Hank Froehlich and Daryl Steffan, both in the Forest Engineering Department at Oregon State University, are preparing a problem analysis for the Fundamental phase of the FIR Program. The objective of their analysis is to provide a basis for analyzing the potential use of cable systems for controlling brush on slopes where other mechanical methods are not feasible. A wide range of options are being considered in this preliminary review of the problem. If the brush material has some value as fuel or fiber when brought to a landing, such as is the case with tanoak, alder, and madrone, cutting and yarding the brush in a conventional yarding operation may be feasible. Pulling the brush out by the roots and yarding the material to the landing in one operation may also be feasible. This method might reduce the rate of resprouting as compared with cutting the plants above ground. Cable strengths and yarder power will need to be appreciably greater when pulling uncut brush.

An indication of the power requirements for pulling uncut brush was obtained by pulling a number of plants of eight species of brush in southwest Oregon. Line tensions of approximately 18,000 pounds were required to pull Oregon white oak having a basal area of 25 square inches. Red alder and madrone of similar size could be pulled with line tensions of 7,500-8,000 pounds. Chinkapin and bitter brush required a pull of 6,300-6,500 pounds while the same size of snowberry, ocean spray, and manzanita could be pulled with a tension of approximately 5,000 pounds. For each species except oak, an additional pull of approximately 1,000 pounds was required for each five square-inch increase in basal area. For oak, an increase of five square-inches of basal area required approximately 3,000 pounds increase in line tension.

Other methods of brush control are also being considered, such as a simple scarification tool operated by highlead yarding systems. The final report will be submitted to the Forest Service's Pacific Northwest Forest and Range Experiment Station, Seattle, in January, 1982.

D. L.

continuing education

MANAGING THE IMPACTS OF SOIL COMPACTION ON FOREST LAND

February 9-10, 1982. Oregon State University, Corvallis. The program, designed for forest land managers, forest engineers and soil scientists, will cover such topics as recognizing and measuring compaction, the impact of compaction on soil properties and seedlings, logging equipment alternatives to limit compaction, and soil tillage to recover from the effects of compaction. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-3709.

CHEMISTRY, BIOCHEMISTRY, AND TOXICOLOGY OF PESTICIDES

February 10-11, 1982. Oregon State University Extension Service, Medford, Oregon. The fundamental course will provide an understanding of pesticide chemistry. Topics will include pesticide grouping, behavior, and hazards. It is expected that very few people attending will have had previous chemistry training. The course is approved for 15 hours recertification credit. The workshop will be held at the Red Lion Motor Inn, Medford, Enrollment is limited. CONTACT: Mary Sorenson, Conference Secretary, Oregon State University Extension Service, 1301 Maple Grove Drive, Medford, OR 97501, (503)776-7371.

SITE PREPARATION AND FUELS MANAGEMENT ON STEEP TERRAIN

February, 15-17, 1982. Spokane, WA. The symposium will emphasize the role of equipment and fire in site preparation, including fuels and vegetation management and site effects. CONTACT: Forestry Conferences, Cooperative Extension, 323 Ag. Sciences, Washington State University, Pullman, WA 99164, (509)335-2511, Extension 250.

FOREST PESTICIDES IN THE PACIFIC NORTHWEST

February 23-25, 1982. Oregon State University and Washington State University Cooperative Extension Services, Portland, OR. Short course to provide practical information on the use of pesticides in the forest environment. Training and successful completion of an examination is necessary for licensing in Washington, Oregon and Idaho. The examination will be given following the program. CONTACT: Forestry Conferences, Cooperative Extension, 323 Ag. Sciences, Washington State University, Pullman, WA 99164, (509)335-2511, Extension 250.

OREGON LOGGING CONFERENCE

February 25-27, 1982. Lane County Fairgrounds, Eugene. This year's theme is, "Prospect for Prosperity." An equipment show will accompany the conference. CONTACT: Ricky Harpole, Oregon Logging Conference, P.O. Box 10669, Eugene, OR 97440, (503)686-9191.

FOREST VEGETATION MANAGEMENT

March 2-4, 1982. Oregon State University, Corvallis. A technical workshop on forest manager's use of herbicides is planned. Specific topics to be covered include herbicide prescriptions for various vegetation problems, pre- and post-treatment evaluations and herbicide application technology. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-3709.

STREAMSIDE MANAGEMENT

April 14-16, 1982. Oregon State University, Corvallis. An inter-disciplinary approach to streamside management will be presented. Topics will include defining streamside management units (SMUs), significance of debris, timber harvesting impacts, yield potential of SMUs, silvicultural and engineering systems to minimize stream impacts, and special management considerations of old-growth timber and wildlife habitats. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-3709.

# of interest

CHINA GULCH SHADE CARD ORIENTATION STUDY

A shade card study by foresters on the Jacksonville Resource Area of the Medford District, Bureau of Land Management, indicated that neither shading nor orientation of shade cards had a significant effect on first-year survival of healthy, vigorous-appearing Douglas-fir 2-0 seedlings planted in February, 1981.

The site was located 3 kilometers (2 miles) northwest of Ruch, Oregon, near the Applegate Valley floor at an elevation of 548 m (1,800 feet). Shade cards were installed during the first week of July on both sides of a draw with uniform slopes, with one aspect facing N. 80°W. and the other S. 20° E. Seedlings on the two aspects received the following shade card treatments: no shade (controls), east shade, southeast shade, south shade, southwest shade and west shade. The wooden lath shade cards were driven flush to the ground and inclined 10 to 15 degrees toward the seedlings at a distance of 15 to 20 cm (6 to 8 inches) from the seedling tops.

Survival across all treatments on the westerly aspect ranged from 93 percent to 99 percent, averaging 96 percent. Differences were greater on the southeastern aspect where survival ranged from 57 percent for the control to 75 percent for the southeast shade card orientation, averaging 68 percent. Although shade card orientation was not significantly associated with survival, a x^2 test indicated that survival was, however, very strongly associated with aspect. This is consistent with undocumented field observations from other sites and could be related to the greater solar radiation loads on the southeasterly facing slope.

O. H.

SEEDLING MORTALITY RESULTING FROM TRACTOR LOGGING A SHELTERWOOD OVERSTORY

Alan Bergstrom has informed me that the Ashland Ranger District, Rogue River National Forest, recently conducted an informal case study of seedling damage resulting from tractor logging a shelterwood overstory. The case study was located on 53 acres of generally flat terrain, although a small portion of the area sloped 10-15 percent. Skid trails, located to limit the maximum bull line pulling distance to 100 feet, were designated prior to falling. The overstory trees were felled towards the skid trails. The overstory consisted of 32 trees per acre over ten inches diameter breast-height (d.b.h.) for a gross overstory volume of 14.0 Mbf per acre. The average overstory tree d.b.h. was 20.4 inches.

Stocking surveys consisting of 198, 0.01 acre plots (approximately a four percent sample) were taken before and shortly after logging. A stocked acre was defined as one with at least 300 seedlings, determined by finding at least three seedlings within a stocking survey plot. Seedlings were distributed evenly throughout the study area before logging because the study area was planted on an 8-ft by 8-ft grid after the regeneration harvest.

Logging reduced the original 68 percent stocking level to 40 percent, a reduction of 28 percent. The 28 percent seedling mortality observed in this tractor logging case study cannot be compared directly with the 40 percent mortality resulting from skyline logging an overstory reported in Vol. 3 No. 3 of the FIR REPORT because the sampling procedures were different in the two case studies. The results of both case studies represent only the specific procedures and conditions encountered in the studies and should not be used to draw general conclusions about logging systems or terrain.

D. L.

MAINTAINING CULVERTS

Attempting to clean blocked culverts during the recent fall rains has refreshed my memory about the problem of maintaining culvert openings for proper removal of runoff. The main problem has been an inability to locate the end of the culvert. I have observed also that cleaning culverts with backhoes can increase the need for culvert maintenance. Both problems can be solved easily and inexpensively by marking the ends of culverts and minimizing the volume of soil removed with backhoes. Very few southwest Oregon organizations mark the ends of culverts, a common practice in other parts of the Pacific Northwest.

While southwest Oregon may receive less rainfall than other areas, frost heaving of cutbanks contributes large amounts of sediment to the ditch line. Thus, we have plenty of culverts to clean.

Reasons for not marking the end of culverts include the initial cost of the posts and the replacement of stolen posts. These objections may be overcome by using inexpensive material with limited alternative uses, such as reinforcing rod. Small diameter re-bar (1/4-inch) would probably be satisfactory. The re-bar would also help the backhoe operator locate and avoid the culvert.

Carelessly cleaning culvert inlets with backhoes greatly increases the probability of culvert failure. Improperly used, backhoes may puncture, mangle and partially collapse culvert entrances, particularly if the culvert is made of lightweight aluminum. Damaged culvert entrances impede the flow of runoff during storms and provide an opportunity for debris to catch on the culvert entrance, further reducing flow. Once runoff flow is restricted, failure is imminent.

Removing an excessive amount of soil from around a culvert entrance also contributes to culvert failure or the need for additional maintenance. Excessive soil removal includes digging deep holes below the entrance or enlarging the road ditch at the entrance of a culvert by digging back into the cutbank. Excavating below the culvert entrance disrupts the flow of runoff in the ditch line by creating a sediment basin. Disruption of flow continues even after the basin has filled with sediment because an alluvial fan is formed in the basin. The fan forms opposite the culvert, widening and decreasing in gradient as it extends out into the basin. The widening of the ditch line and reduction of grade creates a braided, meandering channel accelerating sediment disposition. Finally, the fan may extend into the culvert entrance with runoff often flowing from around the end of the culvert to enter the opening, at which time the culvert can become easily blocked. More excavation is required and more sediment must be transported to a disposal site.

D. M.

HEIGHT GROWTH PATTERNS IN SOUTHWEST OREGON - SOME SPECULATION

The growth and yield of southwest Oregon forests is a frequently discussed subject. But most often the discussion leads to the conclusion that information directly applicable to southwest Oregon is limited. Opinions vary on the priority of growth and yield research in view of other research needs, but many landowners in the region are involved with separate in-house data collection and analyses to bolster their information base. In the past there has been little coordination between landowners collecting this data, limiting the regional availability or utility of this information.

A major growth and yield research program has been initiated in southwest Oregon by David Hann, Oregon State University, to provide broader-based, regionally applicable information. While funding limitations may limit data collection to primarily the mixed conifer zone, his species-specific growth information should be more applicable to this area than any other non-proprietary resource available at this time.

Results of Hann's study are not scheduled to be available until at least 1985. Meanwhile, local foresters frequently seek research results from outside the region that may provide insight into the pattern and process of tree growth in southwest Oregon. Based on clues provided by these external studies, limited trials within the region may verify their usefulness as interim management planning resources.

Site quality assessment is an important part of the forest management planning and decision-making process. Site index has been the traditional tool used to provide potential height-growth information, but its usefulness in existing stands has been challenged in some parts of southwest Oregon. This is because vegetative competition early in stand development makes it very difficult to find good non-suppressed site trees. However, until other classification systems become available which provide more precise estimates of potential productivity, site index remains widely used. Site index is a valid concept and, in fact, its utility may improve in managed stands as "free to grow" site trees become easier to find.

Currently, the most commonly used height-growth information for Douglas-fir comes from USDA Bulletin 201, by McArdle and others. This publication contains no data from this region and primarily represents data collected from more mesic sites farther north in Oregon and into Washington. McArdle's curves are characterized by very rapid height-growth at young ages, with minor increments in height by 160 years. Speculation that differences may exist between the pattern of height growth of Douglas-fir growing in southwest Oregon and that presented in Bulletin 201 has been supported by work both within and outside the region.

Joe Means, a research forester for the Forest Service PNW Experiment Station in Corvallis, completed a Ph.D. dissertation in 1980 entitled "Dry coniferous forests in the western Oregon Cascades." He presents evidence that Douglas-fir trees on drier sites in the Cascades grow in height more slowly at younger ages, but continue significant height increment much longer than the pattern suggested by Bulletin 201. Means' results are based on the stem analysis of 40 site trees, including trees nearly 300 years old. No data was collected within southwest Oregon, but Means feels the community types he sampled are well represented in the region, particularly in the Umpqua Drainage.

Curtis and others published height growth information for high elevation Douglas-fir in the Oregon-Washington Cascades in 1974. Again, based on the stem analysis of 52 dominant Douglas-fir, the results suggest a pattern of height-growth similar to that of Means. Height-growth was slower at younger ages and continued at a more rapid rate at older ages than that proposed by McArdle. No specific mention of community types appears in this publication to index its usefulness to southwest Oregon, but higher elevation stands are also influenced by environmental stresses which will alter the pattern of height-growth as compared to coastal Douglas-fir.

Finally, some work has been done in southwest Oregon on the Galice Ranger District, Siskiyou National Forest, by Dave Craig, Bill Warner, and Harry Cody using stem analysis and Dave Craig and Tom Levering, Siskiyou National Forest, using timber inventory data. Their data indicates patterns of height-growth similar to both Means and Curtis. Their data bases include both poor and good potential productivity sites from southwest Oregon as identified by aspect, elevation, soils and community type. In light of the above evidence, sketchy as it may be, it appears that support exists to justify reconsidering the "commonly accepted" pattern of height growth for Douglas-fir in southwest Oregon.

What are the management implications of using McArdle's curves in southwest Oregon if they are not appropriate? The height growth patterns represented by these more recent Douglas-fir site studies consistently indicate a pattern of slower height at younger ages, but continued height growth beyond the point at which McArdle's curves flatten. This difference in pattern is evident when Curtis's and McArdle's growth curves for site index 80 (100 year base) are compared (Figure 1). The distance between the two curves increases as age increased beyond about 100 years.

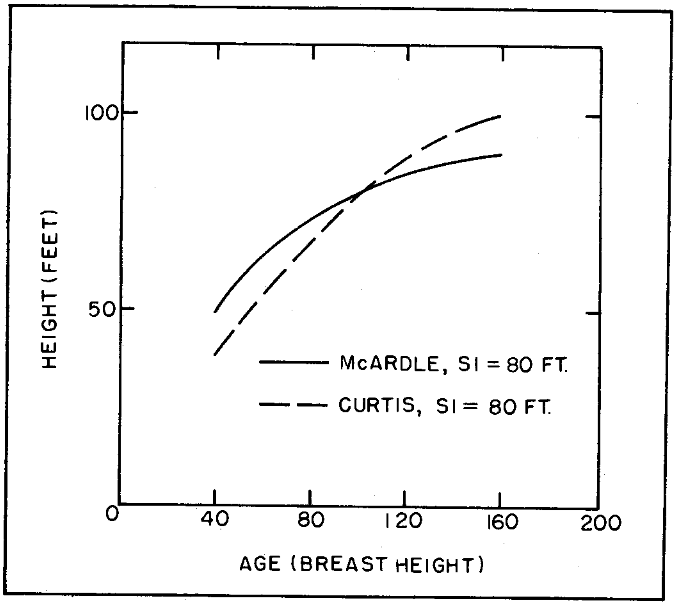


Figure 1. Comparison of height growth patterns predicted by McArdle and Curtis for site index 80 feet, 100 year base.

If McArdle's curves are inappropriate, their use introduces two types of potential error into the estimation of site quality. If old-growth stands are being used to estimate the site potential of future managed stands (in particular, stands which will be managed on rotations less than 100 years) overestimates of site potential are occurring.

McArdle, Curtis, and Galice Ranger District growth curves were compared to illustrate the patterns of growth which lead to trees 100 feet tall at 160 years of age (Figure 2). The point where the curves intersect represents 3 different site indices and it is clear that large differences in height exist

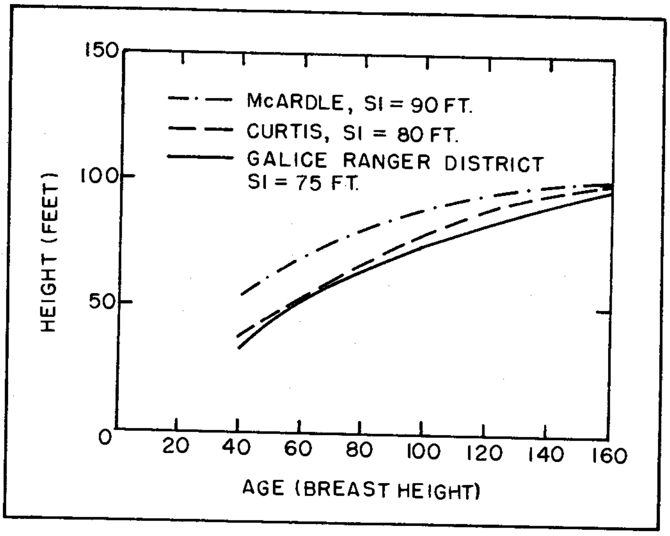


Figure 2. Comparison of predicted height growth patterns leading to a tree 100 feet tall at 160 years old.

between the curves at 40 to 80 years of age. The Curtis and Galice Ranger District curves are nearly 20 feet less than the McArdle curves at 40 years.

The apparently poor height growth of 20-60 year old stands, based on McArdle's curves, may result in some relatively good sites being classified as poorer sites (Figure 3). Using the comparison of the three curves again, this time to illustrate a tree 55 feet tall at 40 years old, it is clear that the long-term growth potential of a stand may be underestimated. Again, as Figure 1 showed, stands may grow more slowly initially, but will achieve greater height growth at rotations beyond 100 years, than that predicted by McArdle for the same site index.

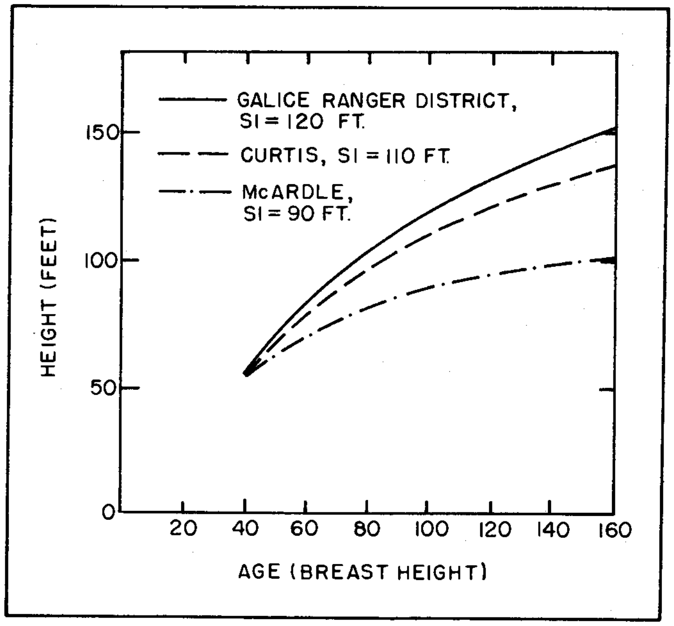


Figure 3. Comparison of predicted height growth patterns describing future growth of a 55-foot tall tree, 40 years old.

One important question should be asked relative to any currently used height-growth information for predicting managed-stand growth: will future managed stands which are carefully cultured with site preparation, vegetative management, and early stocking control behave differently from the naturally-developing stands used to produce existing height growth curves? Is the slower rate of height growth at younger ages indicated by this new information a product of competition with brush and/or partial shading by overstory trees, or is it a result of environmental limitations?

At this point no one can really answer those questions, but Means and Curtis both suggest that, in fact, environmental limitations are restricting growth at young ages, regardless of the other competition. Certainly, "free to grow" status of trees in managed plantations may increase young tree height-growth somewhat, but to what extent is open to speculation.

As foresters in southwest Oregon, we need to continually refine and improve our analytical resources. Phil Tedder, Oregon State University economist, concluded at the recent "Reforestation of Skeletal Soils Workshop" in Medford, that limited growth and yield information really precluded meaningful economic analysis of forest management opportunities in southwest Oregon. One may suggest that while advances in reforestation technology are extremely critical to the future of forestry in southwest Oregon, the implementation of this new technology cannot realistically take place in an economic vacuum.

S. T.

recent publications

For copies of the publications cited, mail your requests to the appropriate address as indicated by the number following each summary. Requests should be sent to:

1 Publications
Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141
Portland, OR 97208

2 Forest Research Laboratory
Oregon State University
Corvallis, OR 97331

3 American Society of Agricultural Engineers
P.O. Box 410
St. Joseph, MI 49085

4 Publications
Intermountain Forest and Range Experiment Station
507 25th Street
Ogden, UT 84401

SEASONAL VARIATION OF INFILTRATION CAPACITIES OF SOILS IN WESTERN OREGON, by M. G. Johnson and R. L. Beschta. 1981. USDA Forest Service Research Note PNW-373. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 8 p. Infiltration capacities were 50 percent greater during fall than during summer for forest soils of the western Cascades of Oregon. These results contrast with those measured in other studies. In forested areas, investigators should be aware of potentially large seasonal changes in infiltration capacities. Such seasonal changes may exceed effects due to applied treatments (logging, slash disposal, burning, etc.) and can confound study results.

1

DESIGNATED SKID TRAIL SYSTEMS TO REDUCE SOIL IMPACTS FROM TRACTIVE LOGGING MACHINES, by H. A. Froehlich, D. E. Aulerich, and R. Curtis. 1981. Forest Research Laboratory Research Paper 44. Oregon State University, Corvallis. 15 p. The efficiency of skidding logs from skid trails 100, 150 and 250 feet apart--11, 7, and 4 percent of the ground covered, respectively--was compared to logs skidded from a conventional skid trail system with 20 percent of the ground covered. The logs were skidded from a Douglas-fir stand averaging 10 inches d.b.h. that was being thinned. Trees were directionally felled toward the designated skid trails; therefore, the average winching distance for trail spacings up to 150 feet was essentially the same as that for the conventionally harvested unit. Overall productivity of logs per hour was similar for both trail systems. The designated system required a greater winching time than did the conventional system but the time was offset by less time spent in skidder positioning and hooking and travel time on designated trails. Skidding to designated trails also resulted in less damage to residual trees than did conventional tractor yarding.

2

FOREST REGENERATION - The Proceedings of the Symposium on Engineering Systems for Forest Regeneration. 1981. ASAE Publication 10-81. American Society of Agricultural Engineers, St. Joseph, Michigan. 376 p. The main thrust of this symposium was to address mechanization in regeneration in the broadest sense of the term. Papers address equipment used for collecting cones, innoculating nursery soil with mycorrhizae, planting seedlings, removing overstories and preparing sites. Subject matter can be summarized under the broad headings of soil erosion control, seedling production, soil compaction-machine systems, site preparation and natural regeneration, forest economics, intermittent tree planting machines, and forest utilization and improvement. Specific papers address mechanization in regeneration in conceptual terms, provide some specification and production information, and discuss results in terms of regeneration success and environmental impacts.

3

FISH PASSAGE AT ROAD CROSSINGS: AN ANNOTATED BIBLIOGRAPHY, by L. Anderson and M. Bryant. 1980. USDA Forest Service General Technical Report PNW-117. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 10 p. This publication lists 45 publications pertinent to road crossings of salmon and trout streams. Topics include bridge and culvert installation, design criteria, mechanics, hydraulics, and economics, as well as their biological effects.

1

EFFECT OF PRESCRIBED FIRE ON SOIL NITROGEN LEVELS IN A CUTOVER DOUGLAS-FIR/WESTERN LARCH FOREST, by M. F. Jurgenson, P. E. Harvey, and M. J. Larsen. 1981. USDA Forest Service Research Paper INT-275, Intermountain Forest and Range Experiment Station, Ogden, Utah. 6 p. The effects of a prescribed broadcast fire on soil nitrogen (N) levels and related soil properties were determined following the clearcutting of a 250-year-old Douglas-fir/western larch stand in northwestern Montana. Larger slash (> 3-inch diameter and 8-ft in length) was removed prior to burning, and burning occurred when fuels were relatively moist. Soil N losses from burning amounted to slightly over 90 lb/ac, all from the surface organic layers. This was 6 percent of the total N originally present in the surface 12 inches of litter and soil. Soil ammonium concentration increased within 2 days following the fire, and rapid nitrification occurred after a 3-week lag period; both returned to preburn levels by the following summer. Soil acidity decreased after the burn and remained lower 4 years later. No long-term site depletion of soil N was expected to result from the effects of the prescribed burn.

4

WATERSHED CLASSIFICATION BASED ON SOIL STABILITY CRITERIA, by D. N. Swanston. 1981. In D. M. Baumgartner et al. (eds.), Interior West Watershed Management, Washington State University, Pullman. p. 43-58. Judging the natural stability of a watershed and assessing soil mass movement hazards related to harvest activities is possible by combining subjective evaluation of factors controlling stability of an area and a limited strength-stress analysis based on available or easily generated field data. Six environmental qualities that should be considered include landform features, soil characteristics, bedrock lithology and structure, vegetative cover, hydrologic characteristics of site, and climate. A hazard index, based on a subjective ranking of these factors, is proposed to index a watershed in terms of relative hazard, location of problem areas, probable failure mechanisms and factors which may be amenable to specific control or correction procedures.

1

EFFECTS OF NITROGEN AND PHOSPHORUS FERTILIZERS ON DEER BROWSING AND GROWTH OF YOUNG DOUGLAS-FIR, by G. L. Crouch and M. A. Radwan. 1981. USDA Forest Service Research Note PNW-368. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 15 p. Nitrogen (N) and phosphorus (P) were applied to young Douglas-fir trees in two stands in the Coast Range of Oregon and Washington to determine their effects on deer browsing and tree growth. Nitrogen increased browsing of terminal shoots and height growth of trees the first year, but effects were mostly negligible two years after treatments. No response to P was detected. Nitrogen and N + P treatments increased the concentration of N in tree foliage the first year. Although N was taken up by the trees, the small growth response suggests that the availability of nutrients was not limiting growth. On the other hand, stimulating the competing vegetation with fertilizer could also explain the response observed.

1

RISK OF LANDSLIDES IN SHALLOW SOILS AND ITS RELATION TO CLEARCUTTING IN SOUTHEASTERN ALASKA, by T. H. Wu and D. N. Swanston. 1980. Forest Science 26:495-510. The frequency of landslides classified as debris avalanches increases significantly a few years after clearcutting in southeastern Alaska. These slides usually occur during periods of heavy autumn rain on uniform or planar slopes with shallow soils underlain by impervious bedrock. Fluctuations in the depth of groundwater as affected by precipitation and evapotranspiration, and root strength are the variables most likely to determine the stability of a given slope. Using an estimate of evapotranspiration, past precipitation records and soil hydrologic properties, an infiltration and seepage model was developed to predict fluctuations in groundwater level with time. The model was empirically calibrated against observed fluctuations of the groundwater level. Probability theory and local precipitation records were then used in the model to estimate the probability of a groundwater level exceeding the level necessary for failure to occur during a unit of time. The probability of failure coupled with the cost of failure (such as volume of soil per unit area lost from a site), could then be used to estimate the costs of landslides resulting from clearcutting other areas. Applications to other regions will require developing an infiltration/seepage model from local data or calibrating the theoretical model with measured porewater pressure.

1

PREPLANT SOIL FUMIGANT INCREASES SURVIVAL AND GROWTH OF FIELD PLANTED CONIFER SEEDLINGS, by G. O. Klock. 1980. Forest Science 26:400-402. After five growing seasons, the survival of Douglas-fir 2-0 seedlings in an experimental planting on the Wenatchee National Forest was 90 percent following preplant soil fumigation with methyl biomide as compared to 22.5 percent in the control planting. The increase in ponderosa pine survival was not significant. Incremental height growth was nearly 2.5 times greater on the preplant fumigated experimental plots than on control plots after five growing seasons. While preplant soil treatment is not recommended for operational use, research into the biotic factors affected by fumigation may provide needed insight into improving regeneration success and accelerating conifer growth.

1

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