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SERVING SOUTHWEST OREGON THROUGH ADAPTIVE RESEARCH AND EDUCATION

fir report

forestry intensified research

JUNE 1980 VOL. 2 NO. 2

"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. McNabb
Watershed 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

NOTE FROM THE EDITOR

The Current Research section of the FIR Report is changing to reflect the addition of the Fundamental Research Phase to the Southwest Oregon Forestry Intensified Research Program. Beginning with this issue, the Current Research section will have separate subheadings for FIR research projects. Information on non-FIR research of local interest will immediately follow the Current Research heading. Subheadings for Adaptive FIR and Fundamental FIR research will then follow to identify projects that are a part of this program.

adaptive fir

BRUSHFIELD ECOLOGY STUDY INITIATED

Medford-based FIR scientists, in cooperation with the Rogue Resource Area of the Medford District BLM, recently initiated an adaptive research project designed to explore sclerophyll brushfield ecology. The study has two important reforestation-related questions of concern to southwest Oregon foresters: (1) What is the impact of various levels of brush removal on soil moisture depletion rates, soil temperature, and internal plant moisture stress, (2) What are the implications of not controlling resprouting brush in terms of these same variables? To answer these questions, a sclerophyll brushfield dominated by canyon live oak and greenleaf manzanita southwest of Medford was selected. Before the treatments were applied to the area, a complete descriptive survey was made of existing vegetation and the soil examined for uniformity over the entire slope. The research area had nearly 100 percent brush coverage with scattered ponderosa pine and Douglas-fir regeneration. A heavy ravel layer covers a 12-inch-thick soil mantle, which overlays fractured rock. The average slope is 66 percent with a west exposure.

Five 0.17-acre rectangular treatment areas were established to include the following treatments:

(1) 100 percent brush removal without resprout control.

(2) 100 percent brush removal with resprout control.

(3) 50 percent brush removal without resprout control.

(4) 50 percent brush removal with resprout control.

(5) Control plot (no brush removal).

Within each treatment area, 10-milacre plots have been established to monitor brush recovery rates. Ten soil moisture/temperature sensors have also been placed on each treatment area at a depth of 8 inches in the mineral soil. Soil moisture and temperature data are collected in the predawn hours between 1:00 and 4:00 a.m. (as is plant moisture stress of selected shrubs and conifers) using a pressure chamber. Air temperature, relative humidity, and precipitation data are collected weekly with a recording hygrothermograph and a rain gauge. Brush was hand slashed with chainsaws and removed from the treatment areas.

Initial measurements taken in late May showed soil temperatures increased with decreasing brush coverage. No difference in soil moisture content was observed between treatments as the soils were still fully charged with water. Greenleaf manzanita exhibited lower plant moisture stress than either canyon live oak or Douglas-fir. These variables will be measured at 3-week intervals through September in order to gain a better understanding of the effect that various intensities of vegetation management have on ecosystem components vital to reforestation.

S.H.

MODIFYING SEEDLING MORPHOLOGY

A large portion of the commercial forest lands in southwest Oregon have shallow, rocky soils, particularly in the Siskiyou Mountains. Reforestation of these areas has traditionally been frustrating because of their droughty character and by the fact that it is difficult to make an adequate planting hole in rocky soils for standard 2-0 planting stock.

To help find a solution to this problem, Adaptive Fir has initiated a research study in cooperation with the U.S. Forest Service Medford Forest Nursery and the Siskiyou National Forest. Two-year-old Douglas-fir and ponderosa pine seedlings were undercut at different depths and at various stages of phenological development. The primary objective of the study is to produce seedlings with decreased shoot-root ratios and shorter, more compact fibrous root systems through the use of undercutting as a nursery cultural practice. By undercutting the experimental nursery stock with a sharp, thin blade, taproots and large downward growing laterals are severed and the soil loosened. Theoretically, this treatment redirects energy into lateral and fine rootlet production while slowing, delaying, or stopping top growth. It is hoped that these trees will not only be more easily planted, but that a better balance can be attained in the shoot-root ratios, thereby enabling seedlings to better withstand the limited moisture conditions and high temperatures associated with droughty sites.

Six treatments have been applied to both 2-year-old Douglas-fir and ponderosa pine seedlings using a randomized, complete-block experimental design repeated four times. These treatments include:

(1) Undercut at 6 inches during root growth initiation.

(2) Undercut at 6 inches just prior to budbreak.

(3) Undercut at 8 inches at the end of needle elongation.

(4) Undercut at 6 inches during root growth initiation and again at 8 inches just prior to budbreak.

(5) Undercut at 6 inches during root growth initiation and again at 8 inches at the end of needle elongation.

(6) Control (no undercutting).

Initial visual observations indicate that height growth in the ponderosa pine seedlings has been reduced considerably. No visible above-ground changes have been noted in the Douglas-fir stock.

This coming winter the trees will be lifted and the treatments compared in terms of shoot-root ratios, dry weight biomass (shoot and root), root-absorptive surface area, height, and caliper.

Trees will be outplanted on harsh sites on the Siskiyou National Forest where their survival and growth will be monitored for several years. On the ponderosa pine outplanting site, 1-year-old seedlings will also be planted for comparison. In the past, 1-0 seedlings have been extremely well balanced in terms of shoot-ratios and a comparison with treated 2-year-old trees is important. This is particularly true when production economics are considered. The results of this study will be published as they become available.

S.H.

fundamental fir

FUNDAMENTAL FIR PROJECTS

The USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, and Oregon State University have initiated research in southwest Oregon under the Fundamental Research Phase of FIR. Final study plans are being completed; and several additional research associates, research assistants, technicians, and graduate assistants have been employed to work in the area.

More than 25 separate research studies have been formulated for the current fiscal year. The studies fall within the five general problem areas identified during the initial establishment of the FIR program. These include reforestation, site-specific silvicultural systems, stand management techniques, conifer genetics, and the economics of forest management. The majority of the projects and resources are supporting reforestation research.

The numerous reforestation projects underway will provide a broad base from which to attack the general, as well as more localized, reforestation problems in southwest Oregon. These studies include: determining reasons for periodicity and quality variations of seed crops from mixed conifer and Douglas-fir forest types; investigating site-specific soil temperature and soil and plant moisture relationships and their effects on seedling establishment; evaluating alternative methods of site preparation and brushfield reclamation, including sclerophyll brush types; pathogenesis of Fusarium on sugar pine at the Medford Nursery; a survey of forest-animal damage; type and intensity of competition between shrubs and conifer seedlings; estimating soil water holding capacity of the seedling root zone; determining if allelopathy is a factor affecting seedling survival; and developing site-specific reforestation systems for southwest Oregon. In addition to these projects, three other studies involve the inoculation and spread of mycorrhizae important to the survival and growth of seedlings, including development of mycorrhizal inoculum for use in bare-root and container nurseries, selection of mycorrhizal fungi adapted to hot, dry sites, and the role of small mammals in mycorrhizal inoculation of clearcuts. Another study important to reforestation is determining the genetic validity of current seed zones.

Projects related to stand management, genetics and economics include: development of a geographical stratification and ecological site classification for interior southwest Oregon; development of stand growth models for the major commercial species; evaluating methods of ameliorating soils compacted during logging and site preparation; identification of regeneration problem areas utilizing environmental and biological indicators; synthesis of available information on ecology and management of Port Orford-cedar; growth of conifer stands after thinning and/or fertilizing; comparing genetic responses in growth and survival characteristics of mixed species; and delineating breeding zones and developing provisional seed transfer rules for the commercial tree species.

Fundamental FIR research projects will be reviewed in this and future issues of the FIR Report and their results summarized as they become available.

D.M.

GROWTH AND YIELD STUDY

Sound forest management depends on being able to accurately predict and forecast forest growth. Good growth and yield information is the essential ingredient in making both biological and economic evaluations of forest management alternatives. Growth and yield data suitable for making sound forest management decisions are virtually nonexistent for southwestern Oregon. The major reasons why such data have not been developed are the age and diversity of the forests in the region, and the harshness and diversity of the physical environment. As a consequence of these conditions, a satisfactory system for categorizing the forest lands by productivity classes has not been developed.

The limited growth data that exist for the forests of this region are either inadequate or of poor quality. The U.S. Forest Service Forest Survey is the largest source of information. However, the data from the Forest Survey are inadequate for the development of growth models because the objective of the Forest Survey is to provide a "status quo" condition of the forests as they exist today. Only a limited amount of short term past-growth data is collected. Long term data on the growth of forests for an array of ages, stocking, and productivity classes are needed to develop valid growth and yield models.

Because of the immediate impact good growth and yield data can have on evaluating forest management alternatives and timber harvest levels, it was originally identified as a major area of emphasis for the FIR Program.

The problem of a productivity classification system for the forests of southwestern Oregon should be overcome in the near future. With the recent, current, and planned efforts to develop a productivity classification system through vegetation typing and soil surveys, enough information is available to stratify the forests of the region for the purposes of collecting growth and yield data.

David Hann (Forest Management Department, Oregon State University) is the principal investigator for a growth and yield study funded under Fundamental FIR. The objective of the study is to develop growth and yield models for the major species of southwestern Oregon. The project began July 1, 1980 and will be completed in 1984.

Two research assistants who will be supervising the field portion of the project arrived in Medford in mid-June: Dave Larsen, forest mensurationist, and Steve Stearns-Smith, soil scientist. They will spend the summer familiarizing themselves with southwestern Oregon and developing field procedures. During the fall and winter over the next 3 years, they will be responsible for locating stands suitable for measurement plots. During the summers of 1981-83, a 20-person field crew will collect data from approximately 600 plots throughout the region. Data from these plots will be used to build the growth and yield models.

Dave and Steve will be calling on the majority of forest land owners and managers in southwestern Oregon to assist them in locating suitable stands for sampling. The success of this study will depend upon the assistance and cooperation provided by private organizations and public agencies.

K.W.

FOREST SEEDLING MICROCLIMATE

A study titled "Harvesting and silvicultural controls of forest seedling microclimate" by Richard Holbo (OSU For. Engr.), Stewart Childs (OSU Soil Sci.) and Dave McNabb (FIR) is now underway in southwest Oregon; recently reforested sites have been selected for field study during July and August. The objectives of this study are twofold: (1) to evaluate the nature and amount of seedling microclimate environmental modification provided by harvesting and silvicultural prescriptions; and (2) to assess the relative effectiveness of these treatments in ameliorating seedling environment, thereby increasing their survival and growth.

The first harvesting and silvicultural prescriptions to be evaluated are the use of the shelterwood harvesting system and shade cards to provide seedlings with some type of shade. Both systems are widely used but have met with varying amounts of success. Information as to how effective they are at modifying seedling microclimate is seriously lacking, so thus foresters have not been able to objectively determine the cause of their failure or the opportunity to improve upon current methods.

Several recently harvested and planted sites are being evaluated. Criteria for selection are that the sites be on southerly exposures with shallow, gravelly soils, and that reforestation has been a reoccurring problem on similar sites.

Douglas-fir seedlings will be the target species to test the relative effectiveness of the treatments.

The aerial and seedbed microclimates, and seedling response, will be monitored continuously for 2-day periods with battery-powered digital recorders during the summer, winter, and early and late spring. Aerial microclimate monitoring, including measurement of solar radiation, net radiation, windspeed, and air and dewpoint temperatures will be done on each site so that the different sites can be compared. To correct for steep slopes, solar radiation, and reflected solar radiation will also be measured with the sensors aligned parallel to the slope. Seedbed microclimate monitoring will include measuring soil temperature at five locations near the seedlings. Each thermometer will be capable of reporting soil temperatures at five depths. Soil moisture will be determined, and its relative availability evaluated, as part of a companion study. Needle temperature will be monitored continuously with extremely small thermocouples to determine the ability of the seedling to respond to changing soil, plant, and atmospheric moisture conditions. The seedling leaf resistance will be measured to supplement the leaf temperature data and aid in its interpretation.

While seedling growth response has been extensively examined in controlled laboratory environments, these studies can seldom be directly related to the natural environment. Only recently has some basis been provided by experiment to develop the necessary micrometeorological relationships for microclimate analysis in complex terrain. Thus this study will provide much needed information on how harvesting and silvicultural prescriptions modify microclimate and affect seedling growth and survival.

D.M.

continuing education

JOINT MEETING OF THE NORTH AMERICAN QUANTITATIVE FOREST GENETICS GROUPS AND THE WESTERN FOREST GENETICS ASSOCIATION

August 4-8. Coeur d'Alene, Idaho. The 2-day NAQFGG meeting will feature invited speakers from tree improvement cooperatives in various regions of the U.S. and Canada. The WFGA meeting will consist of a half-day of papers and one-and-a-half days of field trips to view current projects. CONTACT: Dr. Robert Gall, College of Forestry, University of Idaho, Moscow, ID 83843 (208)855-6444; or Dr. Ray Steinhoff, Forestry Sciences Lab, 1221 South Main, Moscow, ID 83843 (208)772-3357.

SIXTH NORTH AMERICAN FOREST BIOLOGY WORKSHOP

August 11-13. University of Alberta, Edmonton, Alberta, Canada. Sponsored by the Society of American Foresters' Physiology and Tree Genetics and Improvement working groups. The workshop theme is: "Directions of Forest Biology in the 1980's." CONTACT: Professors Kenneth O. Higginbotham or B. P. Dancik, Department of Forest Science, University of Alberta, Edmonton, Alberta, Canada T6G 2G6.

FOREST INVENTORY WORKSHOP

September 3-5. Oregon State University, Corvallis. A forest inventory workshop making extensive use of panel presentations to cover all aspects of forest inventories from establishing objectives to integrating the results into management operations. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503) 754-3709.

OREGON-WASHINGTON SILVICULTURAL COUNCIL FIELD TRIP

September 10-11. Grants Pass and Medford, Oregon. The objective of the 2-day field trip is to provide a general overview of the forest management practices and problems of southwestern Oregon. A banquet is planned the evening of September 10. Enrollment will be limited. CONTACT: Joe Stancar, Industrial Forestry Association, 135 Nisqually Cut-off Road, S.E., Olympia, WA 98503 (206)491-6920.

INTERNATIONAL SYMPOSIUM ON FOREST SEED STORAGE

September 18-October 2. Petawawa National Forestry Institute, Chalk River, Ontario, Canada. Sponsored by IUFRO Working Party on Seed Problems. CONTACT: B. S. P. Wang, National Tree Seed Centre, Petawawa National Forestry Institute, Canadian Forestry Service, Chalk River, Ontario, Canada KOJ 1JO.

FERTILIZING DOUGLAS-FIR FORESTS

September 30 and October 3. FIR, Southwest Oregon. A half-day meeting in Roseburg (September 30) and Medford (October 3) to provide foresters interested in or planning fertilizer operations with a general review of forest fertilization in the Pacific Northwest. The program will include the slide-tape, "Fertilizing Douglas-fir Forests," and expand on the topics of fertilizer response, stocking control, and site selection. CONTACT: Dave McNabb or Ken Wearstler, FIR.

SOCIETY OF AMERICAN FORESTERS NATIONAL CONVENTION

October 5-8, 1980. Spokane, Washington. The theme of this year's SAF meeting is Land-Use Allocation: Processes, People, Politics, Professionals. CONTACT: Society of American Foresters, 5400 Grosvenor Lane, Washington, D.C. 20014 (301)897-8720.

REFORESTATION: SEEDLING HANDLING

October 14-16, 1980. Oregon State University, Eugene. Workshop emphasizing seedling handling and protection of stock from time of lifting until outplanted. The program will include the demonstration and use of tools to monitor seedling condition. Enrollment is limited to 150. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

VEGETATION MANAGEMENT

February 1981. Oregon State University, Corvallis. Program is in the planning stage. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

# of interest

ERRATA

Reconnaissance Survey Underestimates Natural Landslide Frequency (March 1980, Vol. 2, No. 1). Table p. 8, Ketcheson and Froehlich's mass soil movement study: Line 1, land slides less than 10 yd^3; and Line 2, land slides 10 yd^3 and larger.

HARVESTING SPECIALIST JOINS ADAPTIVE FIR TEAM

Dave Lysne, forest engineer, has recently joined the Adaptive FIR team. He has several years of forest engineering experience with the Forest Service in Regions 1 and 6 and has recently completed a Master of Forestry degree in Forest Engineering at OSU. Dave will be working with other team members on Adaptive FIR research projects and programs as well as contacting industry and agency foresters to determine what specific harvesting programs will be most beneficial to them.

D.M.

MISSING THE BOAT

Those of us who devote most of our time to reforestation and artificial regeneration technology like to refer to the reforestation process as a three-legged stool. The three legs are good site preparation, high quality planting stock, and sound planting technique. The obvious point of this simplistic model is that should any one of these legs fail, then successful reforestation, which they support, will not be realized. There is another very important component of the reforestation process which I feel deserves equal stature--"timing." Although the timing of operations is certainly considered as part of the reforestation process, I think we need to pay more attention to it during both the planning and execution phases of reforestation.

Professional foresters charged with reforestation responsibilities are for the most part acutely aware of lifting and planting window guidelines in terms of root growth potential, weather, and soil moisture conditions as well as in the length of time trees remain in storage. Usually these temporal considerations span only a few months, and occasionally late plantings at relatively low elevations will succeed if the weather cooperates such as it has this year. Weather conditions in southwest Oregon have been atypical with an unusually high number of cool, cloudy days with scattered showers. Those planting below 3,000 feet on south- to west-facing slopes in April and May may have been lucky. A little luck is always helpful but it no substitute for good planning and execution. The odds are against those that rely on luck in reforestation operations.

These thoughts are obvious to most, but there is one aspect of timing that falls through the floor boards more often than it should. The time that elapses between site preparation and planting should preferably not exceed 12 months, and certainly not 18 months. Competing vegetation is dynamic, and the degree of control we exert over it only decreases with time unless multiple treatments are used.

In southwest Oregon, the competition is in many cases for moisture, and the shrub and grass species found in this region are superbly adapted to survival on the same sites where Douglas-fir is planted. If competing vegetation is allowed to become established on a planting site before the trees are actually planted, then the chances of plantation failure are greatly enhanced. In most cases when this happens, the best that can be hoped for is eventual domination of the site by the planted stock, but over a much longer period of time than would have been the case had the trees been planted with little or no competition.

I was disturbed this spring to find several areas that had been well site-prepared within the last year, but had not been planted. With each growing season that passes without planting the site, successful regeneration will become more and more difficult. The vegetation of this region is aggressive and will not remain static. Reforestation is a complicated process that requires considerable planning and coordination. You may have all the parts worked out nicely, but if they don't come together at the right time, then chances are you have failed.

S.H.

1980 CONE CROP FOR SOUTHWESTERN OREGON

A vital element in the reforestation process is seed collection. The 1980 cone crop for southwestern Oregon should enable many to create or fatten their seed banks and make a number of candidate plus-tree selections.

The Douglas-fir cone crop is generally good (ranging from fair to excellent compared with the 1978 crop) throughout Douglas, Jackson, and Josephine Counties up to 4,500 feet in elevation. The sugar pine crop is rated fair to good throughout most of the region. Ponderosa pine is fair in some areas and poor in others. The true firs as a group, and species occurring above 5,000 feet in elevation, are reported to have poor crops, with only widely scattered trees producing cones.

Because cone crops will vary a great deal from location to location, anyone in need of seed should be making surveys on specific areas within their districts, areas, or ownerships and planning for a cone harvest.

K.W.

CABLE-OPERATED SLASH RAKE

Pepiot Forest Contractors of Sutherlin, Oregon, have been using a cable-operated slash rake to clear the pool area at the Applegate Dam Project. The rake, somewhat similar to a small tractor slash rake but with all rear supports closing into a "tail," is currently operated by a Linkbelt 98 loader. The loader uses a 3/4-inch mainline for pulling the rake across the slope and a 1/2-inch haulback line. The system has a span of about 500 feet and a lateral reach, with the long boom of the loader of 40 to 50 feet either side of the machine. The lateral reach decreases away from the loader. The system was most efficiently operated from parallel skid roads using a mobile tailhold.

Looking for new site preparation tools to use on steep slopes, the Applegate Ranger District of the Rogue River National Forest contracted to use the rake on several slash and site preparation projects to test its utility in forest stands. The rake was effective in clearing wide fire lines around slash piled over the edge of landings and building fire lines 10-12 feet wide around units where road access was available. The rake was also used to pull slash away from trees left in a shelterwood and concentrate it in piles. As a result, underburning of shelterwoods went much more quickly. They also evaluated the rake for reclaiming old brushfields, either by preparing planting spots in a checkerboard fashion across the site or clearing the entire area.

Bob Livingston and Marty Main, contracting officer representatives, found the rake an effective tool for fuels management. The effectiveness was even greater if the associated benefits derived from scarification, brush control, and protection of residual stems were considered. However, they were less optimistic about its use in reclaiming old brushfields because the cost was generally prohibitive, and it did not uproot the vegetation as well as expected. The rake was not effective at uprooting slender, flexible-stemmed species like dogwood and vine maple because the rake tended to ride over the plants. They speculated the rake would be much more effective on brushfields of scattered plants or low-growing plants with stiff stems like manzanita and canyon live oak. It was also important to plant the area immediately to take maximum advantage of any disruption of the brush root systems that did occur.

Pat Pepiot, designer, and Livingston and Main agree the rake has rigid site requirements for cost-effective operation; so the rake cannot be used on all cable-logged lands. Two major requirements are line-of-sight operation and adequate deflection. The rake cannot operate across convex slopes. A certain amount of deflection is necessary to lift the rake over obstacles, but too much deflection does not allow for adequate ground contact. Steep roads make it difficult to level the machine, and the number and location of tailholds determine how efficient and uniform its application will be.

The rake is most efficient in clearcut situations when operated downhill; however, it may remove more fuels than necessary (if the objective is fuels abatement) and increase the erosion hazard on steep slopes because of excess soil disturbance. The rake is more prone to roll over during side-hill operation although design changes are making it more stable. Operation in shelterwood is much less efficient because standing trees required a new tailhold every two to four passes.

Pat Pepiot and the Applegate District believe the rake is not a panacea for site preparation on steep slopes. At present its use is limited to cost-effective areas. Pat is continuing to make improvements in the rake design and does not believe it is ready to be specified for site preparation in timber sale contracts. Further field testing of the rake is needed to determine its capabilities and limitations.

D.M.

BRUSH CONTROL REPORT

Catherine Roberts, Reforestation Consultant, has released the second-year report of her Cooperative Brush Control Study, March 1980. Initiated in 1978, the study was designed to examine the effectiveness of manually controlling brush species and releasing Douglas-fir on five sites in northwest Oregon and southwest Washington. Brush was cleared from 2-acre plots during the dormant, early foliar, and late foliar seasons of 1978. Control plots were established and left untreated.

A year and a half after treatment, the brush had nearly recovered by resprouting with from 2-11 times the number of original stems per individual brush clump. Released Douglas-fir showed negligible height growth after 2 years.

The report is thorough and includes a survey of worker attitudes concerning manual brush release operations with chainsaws. Given the current level of interest in manual brush control, the report offers a comprehensive evaluation of its effectiveness. Copies may be obtained by writing to: Catherine Roberts, Reforestation Consultant, 8007 N.W. Siskin Drive, Corvallis, Oregon 97330.

S.H.

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 Publications
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

3 Forest Research Laboratory
Oregon State University
Corvallis, OR 97331

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

5 Forest Engineering Research Institute of Canada
2112 West Broadway
Vancouver, B.C., Canada V6K 2C8

6 Soil Conservation Service
National Soil Survey Laboratory
P.O. Box 82503
Lincoln, NB 68508

7 Department of Botany and Plant Pathology
Oregon State University
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8 Department of Soil Science
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FIFTY-YEAR DEVELOPMENT OF DOUGLAS-FIR STANDS PLANTED AT VARIOUS SPACINGS, by D. L. Reukema. 1979. USDA Forest Research Paper PNW-253. Pacific Northwest Forest and Range Experiment Station, Portland. 21 pp. A 51-year record of observations in Douglas-fir stands planted on site IV land at six different spacings--ranging from 4 to 12 feet --illustrates very clearly the beneficial effects of wide initial spacing. It also illustrates the detrimental effects of carrying too many trees relative to the size to which they will be grown. Primarily as a result of initial spacing, average site index is currently 50 percent higher at the widest spacing than at the closest spacings. Differences between wide and close spacings by all measures of production are closely related to these differences in site index; thus not only are trees larger, but yield per acre is greater at wide spacings. Furthermore, most of this volume is contained in merchantable-size trees at wide spacings, whereas much of it is in submerchantable trees at closer spacings. The 100 largest trees per acre are about 75 percent larger in d.b.h. and 60 percent taller at 12-feet than at 4-feet spacing. Corresponding diameters and heights are 13.6 vs. 7.8 inches and 95 vs. 60 feet. Gross volume production of the total stand ranges from about 4,230 to 6,680 cubic feet per acre, at 4- and 10-feet spacings; corresponding volumes in live trees are 3,550 and 6,420 cubic feet per acre. Volumes of the 100 largest trees per acre range from about 850 to 3,840 cubic feet per acre, at 4- and 12-feet spacings. Total yield is nearly as great at 12- as at 10-feet spacing; merchantable yield is greater at the 12-feet spacing. Whereas current annual volume increment (c.a.i.) of the total stand has declined with increasing age, c.a.i. of the 100 largest trees per acre has tended to remain nearly constant over the past 24 years. Mean annual increment (m.a.i.) is near culmination at close spacings but is still far short of culmination at wide spacings. The impact of mortality has been minor at wide spacings. These trends indicate that differences--in favor of wide spacings--will continue to increase.

1

STEM GROWTH PER UNIT OF LEAF AREA: A MEASURE OF TREE VIGOR, by R. H. Waring, W. G. Thies, and D. Muscato. 1980. Forest Science 26:112-117. The utilization of carbon produced by trees for stemwood production is a lower priority use than carbon used for root and shoot growth. Therefore, the amount of stemwood produced per square meter of foliage may be used to determine the proportion of carbon allocated to stemwood production, i.e., tree vigor. Estimating leaf area from previously developed equations based on sapwood basal area, they found the ratio of basal area growth to sapwood basal area (tree vigor index) was consistent for all dominance classes except suppressed trees: suppressed trees were less efficient in utilizing their foliage to produce wood. In comparing several stands representing different site classes and stocking levels, tree vigor index was 2.5 times higher on good sites than on poor sites at equivalent leaf areas. The tree vigor index of stands with relatively high leaf areas was reduced to about 40 percent of that calculated at moderate leaf areas on both good and poor sites. Stand growth will peak when both the tree vigor index and leaf area are optimized.

3

SEALED BIDDING AND ACTIVITY OF OUTSIDE BIDDERS FOR NATIONAL FOREST TIMBER, by R. W. Haynes. 1980. Journal of Forestry 78:344-346. Activity of outside bidders increased significantly in western Oregon during the first 9 months of 1977 over the previous 2 years when the National Forest Management Act made sealed bidding the prevalent form of timber sale. The significant increase also applied to timber sold by the Rogue River and Umpqua National Forests but not the Siskiyou National Forest. When outside bidders participated in sales, the number of bidders and the overbid increased significantly; however, participation of outside bidders in oral bid sales increased the overbid more than sales sold by sealed bids. Thus, outsiders had less influence on sealed bid sales than on oral bid sales because there was less opportunity for preclusive bidding.

1

SEASONAL TOLERANCE OF SIX CONIFEROUS SPECIES TO EIGHT FOLIAGE-ACTIVE HERBICIDES, by S. R. Radosevich, E. J. Roncoroni, S. G. Conard, and W. B. McHenry. 1980. Forest Science 26(1):3-9. Eight foliage-active herbicides were applied to seedlings of six conifer species during three different stages of phenological development on the University of California Blodgett Research Forest in 1977. The herbicides tested included 2,4-D, 2,4,5-T, silvex, dichlorprop, triclopyr, fosamine, glyphosate, and asulam. The conifer treated were ponderosa pine, Jeffrey pine, sugar pine, Douglas-fir, white fir, and red fir. Seedlings were generally more tolerant of the fall application as compared with the spring and summer treatments. Herbicide application rates in the study were intended to create higher levels of conifer exposure than might occur operationally. Plant moisture stress, phenology, photosynthesis, and herbicide tolerance were observed to be related.

9

ROLE OF FOREST FUELS IN THE BIOLOGY AND MANAGEMENT OF SOIL, by A. E. Harvey, M. F. Jurgensen, and M. J. Larsen. 1979. USDA Forest Service General Technical Report INT-65. Intermountain Forest and Range Experiment Station, Ogden, Utah. 8 pp. This paper reviews the current understanding of the relationships between forest fuels (organic matter accumulations), forest soil biology, and forest productivity with emphasis on the forests of the Rocky Mountain region. Soil organic matter (fuels) are the energy source or substrate for most microbial activity. Microbial activities most critical to site quality are nitrification, dinitrogen fixation, decay, ectomycorrhizal symbiosis, and pathogensis. Nitrification is increased by forest disturbance, although in most cases the loss of the nitrate produced is small and short lived. Symbiotic nitrogen-fixing associations in the region are rare; soil humus, decaying and decayed wood are important sites for nonsymbiotic nitrogen fixation, particularly during dry periods or on dry sites. Soil humus and decayed wood are also the principal substrates for ectomycorrhizal symbionts during dry seasons and on dry sites. Removing or burning forest fuels can lead to increased feeder root disease or create wound entry sites for decay in living trees. Adequate quantities of wood residue, and other soil organic matter sources, are critical to optimal forest growth. Except where wood constitutes potential for disease or intense wildlife or where it is replaced in relatively short time spans (warm, moist sites), it should be conserved. This is particularly true of marginal (dry or cold) sites.

4

MANAGING LOGGING RESIDUE UNDER THE TIMBER SALE CONTRACT, by T. C. Adams. 1980. USDA Forest Service Research Note PNW-348. Pacific Northwest Forest and Range Experiment Station, Portland. 12 pp. An interdisciplinary team approach was used in planning the management of logging residue under a timber sale contract on the Wind River Experimental Forest near Carson, Washington. Residue was categorized by three size classes: 1/4 to 3, 3.1 to 9, and over 9 inches in diameter. The interdisciplinary team specified a desired residue level by size class for one clearcut unit. For comparison, another unit was given a specified residual level approximately 30 percent greater, and another unit 30 percent lower. A high-lead cable system was used for yarding. Conclusions: (1) Yarding of small residue was very inefficient with standard high-lead equipment not designed for this type of service. Operations were slowed by the need for hand piling of broken tops, chunks, and limbs in preparation for yarding, and by such material breaking up as it traveled along the ground during yarding. (2) Residue management had an important role in planning and operation of this timber sale. It focused attention on soil protection, seedling protection, nutrient recycling, provision of cover for wildlife, and reduction of the need for burning. (3) An interdisciplinary team gave an important input to timber sale planning. Their value was in helping to accomplish land management objectives in a positive way rather than just being concerned with planning treatment after a timber harvest job is done. (4) More trials are needed, especially on steeper ground. Different logging methods and equipment more suitable for handling small material could result in less breakage and less costly yarding.

1

LOGGING COSTS FOR A TRIAL OF INTENSIVE RESIDUE REMOVAL, by T. C. Adams. 1980. USDA Forest Service Research Note PNW-347. Pacific Northwest Forest and Range Experiment Station, Portland. 11 pp. This note summarizes a time and cost study of intensive residue removal on the Wind River Experimental Forest near Carson, Washington. Residue was categorized by three size classes: 1/4 to 3, 3.1 to 9, and over 9 inches in diameter. Different residue levels were specified for three clearcut units. A high-lead cable system was used for yarding. Conclusions: (1) This trial of intensive residue removal by high-lead system in an old-growth forest was a rather costly procedure in relation to management goals. Additional site preparation was judged necessary for replanting on this site. (2) High costs of yarding small residue by standard high-lead equipment suggests that such equipment is not suitable for such small material. (3) In absence of a market for small-residue material, some form of slash burning on this site will continue to be the favored treatment on old-growth clearcut units to reduce small residue to acceptable levels.

1

SHELTERWOOD CUTTING IN A YOUNG-GROWTH, MIXED-CONIFER STAND IN NORTH CENTRAL CALIFORNIA, by P. M. McDonald. 1976. USDA Forest Service Research Paper PSW-117. Pacific Southwest Forest and Range Experiment Station, Berkeley. 16 pp. In 1958 a young-growth, mixed-conifer stand was harvested using a two-stage shelterwood system on the Challenge Experimental Forest. Located on the west slope of the Sierra Nevada Mountains in north central California, the stand was dominated by ponderosa pine with lesser amounts of Douglas-fir, sugar pine, white fir, and incense cedar. A hardwood component consisting of California black oak, tanoak, and Pacific madrone was also scattered throughout the stand. Seventy percent of the merchantable volume was removed leaving 12 trees per acre to constitute the shelterwood. Three intensities of site preparation/slash-disposal were applied: (1) Pile with bulldozer immediately after logging and burn piles later; (2) delay piling until late summer of an obviously good seed year and burn piles later; and (3) lop and hand scatter. On prepared ground, regeneration was excellent with 3,700 ponderosa pine seedlings and 600 tolerant conifer seedlings per acre after 50 months. Seedling survival was best in those areas where the slash was piled just before seedfall.

2

PREDICTION OF SOIL NITROGEN AVAILABILITY IN FOREST ECOSYSTEMS: A LITERATURE REVIEW, by D. R. Keeney. 1980. Forest Science 26:159-171. The increased interest in the use of nitrogen fertilizers to stimulate forest growth has generated interest in laboratory soil-testing methods to predict the probability of N response. However, development of a reliable test for forest ecosystems will be even more difficult than for agriculture, where such testing has met with limited acceptance, because many additional factors have to be considered. These additional factors include: the sources and sinks of N and the internal cycling inherent to forest trees; the importance of the forest floor as a reservoir of N; the probability that soil test values will be an insignificant part of the total N mass balance and calibrating the empirical results with field response will be difficult; the reliability of laboratory tests to predict in situ biological processes; and the collection of valid soil samples for analysis. Soil sampling problems include the depth to sample and spatial variability. Within-site soil differences are complex but are partially related to soil moisture gradients, soil gravel content, slope steepness and litter distribution, including rotted logs. While the problems with developing a reliable soil N test for predicting fertilizer response for forest ecosystems are many and complex, a preliminary study has found Douglas-fir response to fertilization to be related to soil N values obtained by an anaerobic incubation method.

8

ORGANIZATIONAL FACTORS AFFECTING TRIALS OF NEW LOGGING MACHINES, by H. I. Winer and M. Ryans. 1980. Forest Engineering Research Institute of Canada, Special Report No. SR-10. pp. 18. Operational tests of new logging equipment are often easier to plan than to execute, given the real world situation. Thus, decisions regarding acceptance of new machines are only as reliable as the operational tests themselves. This report is intended as an aid and reminder to help those planning machine trials to recognize and avoid potentially troublesome situations, in which (for whatever reasons) a machine is not evaluated effectively. Several examples of poor operating procedures from FERIC's own machine tests are included as examples.

5

LOGGING, INFILTRATION CAPACITY, AND SURFACE ERODIBILITY IN WESTERN OREGON, by M. G. Johnson and R. L. Beschta. 1980. Journal of Forestry 78:334-337. Infiltration capacity and erodibility were measured 3 years after portions of the Hi-15 watersheds at the H. J. Andrews Experimental Forest and 6 years after portions of the Coyote Creek watersheds at the South Umpqua Experimental Forest were harvested. Infiltration capacity of soil was assessed with a rainfall simulator infiltrometer and surface soil erodibility by the concentration of suspended sediment in infiltrometer runoff water. Average infiltration capacities for logged watersheds were generally similar to those for undisturbed watersheds, except where reduced because of tractor logging, tractor windrowing of slash, and burning slash on high-clay-content soils. Areas that had been heavily disturbed still had reduced infiltration capacity and increased surface erodibility but had partially recovered to pre-logging conditions.

3

VEGETATION AND FIRE HISTORY OF A PONDEROSA PINE-WHITE FIR FOREST IN CRATER LAKE NATIONAL PARK, by R. C. McNeil and D. B. Zobel. 1980. Northwest Science 54:30-46. This paper describes the structure and composition of the vegetation of the area adjacent to the south entrance to Crater Lake National Park and the approximate dates and locations of most fires that burned in the area between 1750 and 1902. Eight communities occur in the four recognized habitat types. Fires occurred at sampling spots within the area at intervals of 3 or less to more than 50 years, with the mean interval at a location ranging from 9 to 42 years. The mean interval between fires was generally longer at higher elevations. Fire years were not related to drought years by dendrochronological studies. Most trees now present on the study area started growing during the first 40 years after the last fire in 1902; compositional change in overstory and understory, apparently due to fire exclusion, is obvious in several communities.

7

VARIABILITY OF MEASURED PROPERTIES IN MORPHOLOGICALLY MATCHED PEDONS, by M. J. Mausbach, B. R. Brasher, R. D. Yeck, and W. D. Nettleton. 1980. Soil Science Society of Amer. J. 44:358-363. Variability in data from morphologically matched pairs of pedons was assessed to establish operational norms in sampling and to consider alternative sampling procedures. Data were stratified by parent material, major horizon, soil order, and clay content. Coefficients of variation were computed for the physical properties (percent sand, silt, and clay, and 1,500 kPa moisture) and chemical properties (extractable acidity, sum of bases, cation exchange capacity, base saturation, pH, and organic carbon). Estimating physical properties of alluvial and residual soils takes many more samples for a specified confidence level than for loess and glacial drift soils. The paired sampling and laboratory analysis process used could distinguish between textural phases only if they differed by more than half the range of a texture class. Because variability in field determination of clay content is greater than variability in laboratory determinations, field variability is responsible for most of the differences among matched samples. Vertical distribution of properties and properties of important horizons are efficiently evaluated by sampling one complete pedon plus satellite samples of important horizons from other pedons. To assess a single horizon efficiently, sample only that horizon in several pedons.

6

COMPARATIVE AUTECOLOGICAL CHARACTERISTICS OF NORTHWESTERN TREE SPECIES---A LITERATURE REVIEW, by D. Minore. 1979. USDA Forest Service General Technical Report PNW-87. Pacific Northwest Forest and Range Experiment Station, Portland. 72 pp. This important publication summarizes existing autecological information on a relative basis for important Pacific Northwest forest tree species. The author cites over 340 separate publications written from 1908 through 1977. Many of these papers are difficult to find, and the author has done an admirable job of synthesizing the information. The species are ranked with respect to 69 environmental factors, phenotypic characteristics, and physical variables. This general technical report provides a useful guide to the autecology of numerous forest species and should prove to be a valuable reference.

1

STAND-ORIENTED INVENTORY AND GROWTH PROJECTION METHODS IMPROVE HARVEST SCHEDULING ON BITTERROOT NATIONAL FOREST, by A. R. Stage, R. K. Babcock, and W. R. Wykoff. 1980. Journal of Forestry 78: 265-267, 278. New, stand-oriented inventory and growth projection methods are helping to improve long-range timber harvesting plans on the Bitterroot National Forest in Montana. The forest is stratified into primary sampling units based on stand conditions. A systematic grid of sample points is located in a unit with a ground-sampling rate of approximately one point per 5 acres. At each point, small trees (less than 5 inches d.b.h.) are sampled on a fixed-area plot of 1/300-acre; a factor 40 angle gage is used to sample larger trees in proportion to their basal area. For each sample tree species, diameter, height, crown ratio, past growth rate, damage or defect, and competitive status within the stand are recorded. The growth projection methods are based on an individual tree growth model (Prognosis, Stage 1973). Because the model predicts growth of individual trees in relation to their crown development, size, stand density, and relation to other trees in the stand, it has the ability to project growth for both managed and unmanaged stands. The condition of each sample stand and its neighbors, together with their nontimber resource values, influences the array of silvicultural schemes available for each stand. For each of the alternatives, yields for every sample stand are calculated. Prospective yields are then combined into groups for processing by linear programming (i.e., Timber RAM) to select the optimum mix of treatments and calculate the harvest schedule for the entire forest. Because growth is estimated for each sample stand before any aggregation of data, errors of aggregation are avoided, and the treatments selected agree fully with plans for nontimber uses.

4

IMPACTS OF FOREST PRACTICES ON SURFACE EROSION, by R. C. Sidle. 1980. Pacific Northwest Extension Publication PNW-195. Oregon State University, Corvallis. 15 pp. An unreferenced Extension publication that summarizes the general impacts forest practices such as timber harvest, road construction, and site preparation, have on increasing surface erosion from forest lands. Soil under native forests are generally not subject to surface erosion; however, surface erosion can be generated by soil and operational conditions that are conducive to, or cause, disturbance and compaction. By using good operational and management techniques to minimize the extent to which disturbance and compaction occur, the amount of surface erosion from managed forest lands can be controlled.

10

A WATERSHED'S RESPONSE TO LOGGING AND ROADS: SOUTH FORK OF CASPER CREEK, CALIFORNIA, 1967-1976, by R. M. Rice, F. B. Tilley, and P. A. Datzman. 1979. USDA Forest Service Research Paper PSW-146. Pacific Southwest Forest and Range Experiment Station, Berkeley. 12 pp. This paper summarizes the early results of the effects of logging and road building on stream flow and sedimentation underway in a 95-year-old second-growth forest near Fort Bragg, California. Erosion rates were measured as the sum of the suspended sediment load, estimated each year by multiplying the volume of flow by discharge classes by mean suspended sediment concentrations and summing, and annual debris basin accumulation. Following construction of 4.9 miles of roads (4.5 percent of the watershed), 1,304 cu. yd./sq. mi. of excess sedimentation occurred during the 4-year period after construction but before logging was started. A total of 4,787 cu. yd./sq. mi. of excess sediment was produced during the 5-year period after logging was initiated. The disturbances from road building and logging changed the sediment/discharge relationship of the harvested watershed from one that was supply dependent to one that was stream-power dependent. High flows (occurring approximately 1 percent of the year) carried 26 percent of the total flow volume and 81 percent of the suspended sediment that was transported annually by the stream. If turbidity changes (not measured) were to parallel suspended sediment changes, turbidity during 8 of the 9 postcalibration years would exceed the standards of the North Coast Regional Water Quality Control Board (no increases greater than 20 percent above background).

2

SKIDDING WITH SMALL CRAWLER-TRACTORS, by B. McMorland. 1980. Forest Engineering Research Institute of Canada, Tech. Report No. TR-37. 89 pp. The study shows that small crawler-tractors, ranging between 63 and 78 hp, have been successfully introduced for ground-skidding in logging operations in the interior of British Columbia. A fleet of seven contractor-owned tractors averaged 19.9 cunits (56.3 m^3) per shift at a cost of \$23.16/cunit (\$8.19/m^3) for decked logs during the 1977-78 logging season. Under similar terrain and stand conditions, the same company had a cost of \$25.10/cunit (\$8.86/m^3) with a rubber-tired skidder and under dissimilar operating conditions, costs were \$27.52/cunit (\$9.73/m^3) for an FMC bunk-grapple skidder and \$58.95/cunit (\$20.87/m^3) for a 3-drum cable yarder. Nonproductive time (all sources) accounted for 21 percent of the scheduled time for small crawler-tractors. A site disturbance study showed that small tractor logged areas had approximately one-third less disturbance than areas logged by larger tractors, summer or winter. Almost all the reduction resulted from narrower skid trails and wider trail spacing, but site disturbance levels were still higher than those measured on cable-logged sites.

5

INCREASED GROWTH OF WHITE FIR AFTER A DOUGLAS-FIR TUSSOCK MOTH OUTBREAK, by B. E. Wickman. 1980. Journal of Forestry 78:31-33. For 36 years after an outbreak of Douglas-fir tussock moth, radial growth of defoliated white fir trees was significantly greater than that of nondefoliated host trees. The increased growth was probably due to the thinning effect of mortality and increased nutrient cycling.

1

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