SERVING SOUTHWEST OREGON THROUGH ADAPTIVE RESEARCH AND EDUCATION

# fir report

forestry intensified research

SEPT. 1980 VOL. 2 NO. 3



"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.

Oregon State University EXTENSION SERVICE
Corvallis, Oregon 97331

EXTENSION SERVICE

## FIR SPECIALISTS


STEVE HOBBS, REFORESTATION
DAVE LYSNE, HARVESTING
DAVE MCNABB, WATERSHED
KEN WEARSTLER, SILVICULTURE

FIR
1301 Maple Grove Drive
Medford OR 97501
(503) 776-7371


# current research

### CONTROL OF POCKET GOPHER DAMAGE

U.S. Fish and Wildlife Service scientists Vic Barnes and Mike Anthony are conducting research in the control of pocket gopher damage with Vexar® tubes in conifer plantations. Located with the USDA Forest Service Silviculture Laboratory in Bend, Oregon, they have been evaluating the impact of Vexar tubes on seedling survival and growth since 1976 on three national forests in Idaho and Oregon. A fourth research area was added in 1977. Seedling species used are lodgepole pine on the Deschutes and Targhee National Forests, ponderosa pine on the Boise National Forest, and Shasta red fir on the Klamath National Forest.

Bare root seedlings were prepackaged in 2-inch wide Vexar tubes by first inserting the seedling into a piece of plastic pipe, of slightly smaller diameter than the Vexar tube. Holding the seedling firmly inside the Vexar tube, the plastic pipe was withdrawn, leaving the seedling and its roots inside the Vexar tube. Moistened soil taken from the planting site was then packed around the roots in the Vexar tube. Tubed and unprotected seedlings were then auger planted in areas with established pocket gopher populations.

To date, the results of providing young seedlings with physical protection from pocket gopher damage both above and below ground, have been encouraging. On the Boise, Deschutes, Klamath, and Targhee National Forests, survival was significantly greater for protected seedlings. Height growth was likewise greater for those trees protected with Vexar tubes.

Based on my observations near Bend, Vexar tubes may offer a reasonable degree of protection to young conifers during the plantation establishment phase. There was some initial concern as to whether Vexar tubes would impede lateral root development. This does not appear to have been a factor. While visiting the Silviculture Laboratory, I observed several young trees that had been excavated and had good root development with the laterals breaking through the Vexar tubes.

A more detailed account of this study is contained in a paper titled "'Vexar' Plastic Netting to Reduce Pocket Gopher Depredation of Conifer Seedlings," by Richard M. Anthony, Victor G. Barnes, Jr., and James Evans. 1978. In: Proceedings of the 8th Vertebrate Pest Control Conference. University of California, Davis. pp. 138-144. Copies may be obtained by writing to either Mike or Vic at the:

Silviculture Laboratory
USDA Forest Service
1027 Trenton Avenue
Bend, Oregon 97701

The study has not been completed and final conclusions have not been drawn, but the results are encouraging. Foresters faced with pocket gopher control problems should be looking for future publications.

SH

# fundamental fir

### EFFECTS OF FIRE AND ALLELOPATHY ON MYCORRHIZAE

David Perry (OSU-Forest Science) and Sharon Rose (OSU-Forest Science) have a cooperative research agreement with the Pacific Northwest Forest and Range Experiment Station to study the effects of fire and allelopathic compounds on mycorrhizal fungi and associated soil micro-organisms. Jim Trappe (PNW) is coordinator.

One part of the study will investigate the effects a high intensity wild fire has on soil micro-organisms, particularly the population of Strepomyces species, which are antagonistic to the root pathogen Fomes annosus. The soil will also be checked to determine if there has been a reduction in mycorrhizal fungal inoculum following the fire. A survey of the relative and absolute composition of the microbial species populations will be made immediately following the fire and after one and two years to evaluate recovery potential.

A greenhouse study will also be conducted to determine if the fire affects the inoculum potential of ectomycorrhizal fungi of Douglas-fir. Sterile Douglas-fir seedlings will be grown in sterile and untreated containers of burned and unburned soil. The degree of mycorrhizal inoculum potential will be determined by the relative number of mycorrhizal root tips to total root tips and the frequency of mycorrhizal colonization.

The second part of the study will determine if there are sufficient allelopathic compounds in the litters of snowbrush, tan oak, madrone, bracken fern, and mixed conifers to affect mycorrhizal fungi (see allelopathy review paper, page ). The impedance of mycorrhizal fungi can affect seedling nutrition and plant water relations and, indirectly, seedling survival and growth.

Water soluble extracts of each litter type will be mixed with a nutrient solution. Four species of mycorrhizal fungi from southwest Oregon will be grown in the solution to determine if any changes in weight or gross morphological characteristics occur.

A greenhouse study will also evaluate the effect different litters and litter extracts have on the growth of sterilized Douglas-fir and western hemlock seedlings and mycorrhizae formation when planted in burned and unburned soil. This portion of the study will be repeated with seedlings preinoculated with mycorrhizal fungi.

DM

# continuing education

## FOREST VEGETATION MANAGEMENT

March 3-5, 1981. Oregon State University, Corvallis. A workshop for foresters engaged in vegetation management activities. Topics to be covered include: silvicultural impacts of competing vegetation; wildlife considerations; update on current vegetation management practices; field survey techniques for setting priorities; and health considerations. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

## MANAGING FOREST LANDS TO MINIMIZE SOIL COMPACTION

March, 1981. Southwest Oregon Forestry Intensified Research Program. A two-day program is being planned to review the effects of soil compaction on forest productivity, soil compaction and equipment interaction, and harvesting options to minimize soil compaction. CONTACT: Dave McNabb or Dave Lysne, FIR.

## SMALL WOOD HARVESTING UPDATE

March or April, 1981. Oregon State University, Corvalis. Program in the planning stage. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Coravallis, OR 97331 (503)-754-3709.

## YOUNG PLANTATION MANAGEMENT

June 16-19, 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

## FRICTIONAL RESISTANCE TO LOG SKIDDING

Matching the proper logging equipment to a particular logging operation is becoming increasingly important and, often, increasingly difficult. Logging equipment is expensive, environmental concerns are becoming more important, and the "easy" terrain has often been logged. Timber sale planners need to consider terrain, land management constraints, and the physical capability of the logging equipment when planning a logging operation. When analyzing the physical capability of a piece of logging equipment, the logging engineer needs to understand the forces required to move the larger logs within the harvesting area.

One of the important factors determining the force required to move a log is the coefficient of friction between the log and the soil. As the coefficient of friction increases for a constant log weight, the energy required to move the log increases. An understanding of the energy required to move the larger logs within the harvesting area is necessary to understand required machine horsepower, cable size, bucking length, etc.

The force required to overcome the frictional resistance of a log to movement is found by multiplying the normal component of the log weight--the weight of the log perpendicular to the soil surface--by the soil-log coefficient of friction. Thus, if you have a 1,000-pound log on a 20-degree hillside and a soil-log coefficient of friction of 0.6, the frictional resistance to movement of the log is 564 pounds.

$$1{,}000 \text{ lbs} \times 0.6 \times \cos 20° = 564 \text{ lbs.}$$

Because the normal component of the log weight remains constant whether the log is being skidded uphill or downhill, the frictional resistance to skidding remains constant. Of course, gravity will help overcome the frictional resistance to skidding if the log is being skidded downhill.

The gravitational effect on the log is found by solving for the upslope or downslope component of the log weight. Thus, if the log in the example were being skidded uphill, the gravitational resistance to skidding is 342 pounds.

$$1{,}000 \text{ lbs.} \times \sin 20° = 342 \text{ lbs.}$$

Therefore, if the log were being skidded uphill, the total resistance to movement would be the sum of the frictional resistance and the gravitational resistance, or 906 pounds. If the log were being skidded downhill, gravity would assist movement of the log and the gravitational resistance would be -342 pounds, a negative number, indicating gravity would assist movement.

$$1{,}000 \text{ lbs.} \times \sin (-20°) = -342 \text{ lbs.}$$

The total resistance to movement if the log were being skidded downhill is the algebraic sum of the two resistances to movement, or 222 pounds. If, while solving for total resistance to skidding, the sin convention that considers slopes downhill in the direction of skidding to be negative and the resistances are added algebraically, the correct total skidding resistance is obtained. It is important to remember that the soil-log coefficient of friction does not include the effects of soil gouging. If the leading end of the log plows through the soil, the resistance to skidding is increased.

Theoretically, two soil-log coefficients of friction exist. The static coefficient of friction is used to obtain the frictional force resisting movement before the log actually begins to move. The kinetic coefficient of friction yields the frictional force resisting movement of the log after the initial movement occurs. The static coefficient of friction is greater than the kinetic coefficient of friction. In other words, the force required to initiate movement is greater than the force required to sustain movement. The uneven slopes and approximate log weights used in logging planning make separating the two coefficients impractical, and one coefficient is used. It is sufficient to remember that breaking a log out of its bed requires more effort than keeping the log moving, as any logger knows.

Past studies conducted to obtain estimates of the soil-log coefficient of friction have resulted in a wide range of values, but most studies found a soil-log coefficient of friction between 0.6 and 0.7 for gravel to fine sand soils. John Henshaw, in a study conducted at Oregon State University during 1976 and 1977, found a soil-log coefficient of friction of 0.62 for loam to clay soils. Gary Falk, in another OSU study, obtained an estimate of the soil-log coefficient of friction of 0.64 for soils similar to those in Henshaw's study. If site-specific soils information is not known, the value 0.6 is frequently used to estimate the soil-log coefficient of friction.

The soil-log coefficient of friction is not affected by skidding speed, log dimensions, or number of stems being skidded. The coefficient is reduced by increased soil moisture content and well-developed sod. The coefficient does not include the effects of plowing of the leading end of the log or tree-length skidding with tops attached.

Future articles in the FIR Report will expand the importance of the coefficient with respect to gound-based logging vehicles capability and track pressure distributions.

DL

## REFORESTATION OF HIGH ELEVATIONAL CLEARCUTS

Recently Steve Hanna of the Tiller Ranger District, on the Umpqua National Forest, provided me with the first-year results of an administrative field study he established in 1979. The study objective was to determine what combination of treatments would result in the highest seedling survival percentage on four different clearcuts on the west slope of the Cascades at the 5,000-foot elevation level. Aspects vary from south to west and the slopes from 20 to 40 percent. The soils are of the Snowline-Hummington association. All four units were clearcut in the early 1960's and broadcast burned. Repeated attempts at reforestation with bare-root Douglas-fir and noble fir as well as seeding, met with failure.

On the first three units, one half of each sample area was cleared of competing vegetation with hand tools. Douglas-fir was the only species planted. No vegetation control was applied to the fourth unit, where a species comparison was made between Douglas-fir and noble fir. The treatments evaluated were (1) vegetation control; (2) artificial shading with shadeboards; and (3) browse protection with rigid Vexar® tubes. On the fourth unit, a species comparison between Douglas-fir and noble fir was substituted for the vegetation control vs. no vegetation control treatments used on the other three. Two hundred seedlings were planted on each unit with equal numbers in each combination of treatments listed in the table below. A $2^3$ factorial experimental design was used.

| Treatment Combination* | Douglas-fir Percent Survival | Douglas-fir Percent Browsed | Noble fir Percent Survival |
|---|---|---|---|
| Units 1-3 - With a vegetation treatment | | | |
| $A_1$ $B_1$ $C_1$ | 97 | | |
| $A_1$ $B_1$ $C_2$ | 91 | 10 | |
| $A_1$ $B_2$ $C_1$ | 88 | | |
| $A_1$ $B_2$ $C_2$ | 79 | 20 | |
| $A_2$ $B_1$ $C_1$ | 81 | | |
| $A_2$ $B_1$ $C_2$ | 77 | 16 | |
| $A_2$ $B_2$ $C_1$ | 65 | | |
| $A_2$ $B_2$ $C_2$ | 52 | 11 | |

(continues)

(table continued)

| | Douglas-fir | | Noble fir |
|---|---|---|---|
| Treatment Combination* | Percent Survival | Percent Browsed | Percent Survival |
| Unit 4 - No vegetation treatment | | | |
| $B_1$ $C_1$ | 80 | | 100 |
| $B_1$ $C_2$ | 80 | 12 | 92 |
| $B_2$ $C_1$ | 88 | | 88 |
| $B_2$ $C_2$ | 67 | 8 | 71 |

*$A_1$ = vegetation control
$A_2$ = no vegetation control
$B_1$ = shaded
$B_2$ = unshaded
$C_1$ = tubed
$C_2$ = not tubed

These preliminary results indicate that the highest survival percentages are associated with the more intensive reforestation procedures and that noble fir survival was somewhat better than that of Douglas-fir. Clearly the control of competing vegetation was a major factor in Douglas-fir survival on the first three units.

SH

RIPPING BOULDERY SOILS

Extensive areas of the High Cascades from the Dead Indian Plateau east and north have soils with boulders from less than one foot in diameter to several feet. These boulders are often randomly located throughout the soil profile. Because this area contains some of the more productive forest land in southwest Oregon and the soils have often been compacted from several harvest entries, the land is in need of some type of site restoration practice. Ripping skid trails or entire units, if compaction is widespread, with tractors with rear-mounted rock rippers, is becoming an increasingly common treatment of these areas. However, ripping can create additional management problems.

The deep ripping of these soils with large tractors has the greatest potential to increase future management problems. The reduction in the number of planting spots because of the deep holes left after boulders are turned up or air spaces are left in the bottom of the rip tracks is generally of greatest immediate concern; however, the impact on the future harvest is probably a more serious problem. The ripping of these soils can bring a large number of boulders to the surface where they will remain until the next harvest entry. The felling of trees across these exposed boulders will result in increased breakage and require skid trails to be cleared of boulders prior to skidding, thereby increasing logging costs and decreasing net volume.

Two options are available to minimize the negative impacts of ripping. The less effective option would be to require ripper teeth to be hinged so that they may swing laterally. This will allow the teeth to move around some boulders but will probably still bring the larger, more hazardous boulders to the surface. The second option is to do the ripping with less powerful equipment. The potential exists to select machine horsepower, depth of ripping, and number of ripper teeth so that the tractors can efficiently rip through soil and small boulders but will have insufficient power to move large boulders. If the operator allows the rippers to ride up and over large boulders as the machine proceeds forward and re-enter the soil when less resistance is encountered, most of the large boulders will remain below ground.

DM

# 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 97401

**3** Forest Research Laboratory
Oregon State University
Corvallis, OR 97331

**4** Publications
Rocky Mountain Forest and Range Experiment Station
240 West Prospect Street
Ft. Collins, CO 80526

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

**6** USDA Forest Service
Missoula Equipment Development Center
Missoula, MT 59801

7 Route 1
Box 265A
Sorrento, FL 32776

8 School of Forest Resources and Conservation
University f Florida
Gainsville, FL 32611

TANOAK...A BIBLIOGRAPHY FOR PROMISING SPECIES, by P. M. McDonald. 1977. USDA Forest Service General Technical Report PSW-22. Pacific Southwest Forest and Range Experiment Station, Berkeley. 8 pp. Tanoak represents a hardwood species of little recognized worth until recently. It was estimated in 1968 that there were 1.52 billion board feet of tanoak sawtimber in southwest Oregon alone. The development of new processing technology has greatly increased utilization diversity. Tanoak can now be used in production of duplication and offset printing papers, pallets, flooring, baseball bats, paneling, veneer, plywood, and other products. The author has assembled a comprehensive bibliography with 177 publications spanning the period 1882-1976.

**2**

SCHEDULING REPLACEMENT OF LOGGING EQUIPMENT: SOME QUANTITATIVE GUIDELINES, by D. A. Butler and C. B. LeDoux. 1980. Forest Research Laboratory Research Bulletin 32. Oregon State University, Corvallis, 22 pp. The authors describe a new, theoretical methodology for evaluating the replacement of a single piece of logging equipment with a predetermined new model. The example is for a specific piece of equipment and gives results unique to the data-base analyzed, but the application typifies procedures, required data, and results of the method. The model is coded in the BASIC programming language and may be adapted to other situations simply by altering the code.

**3**

PACIFIC CROWN WEIGHT ESTIMATES FOR TANOAK, BLACK OAK, AND PACIFIC MADRONE, by J. A. Kendall Snell. 1979. USDA Forest Service Research Note PNW-340. Pacific Northwest Forest and Range Experiment Station, Portland. 4 pp. Preliminary tables for estimating dry weights of whole trees and of crown components are presented for California black oak and tanoak; only total tree weight tables are available for Pacific madrone. Crown component weights were generated from data of two earlier studies, one from the Appalachians and one from the Pacific Northwest.

**1**

SILVICULTURE OF PONDEROSA PINE IN THE PACIFIC NORTHWEST: THE STATE OF OUR KNOWLEDGE, by J. W. Barrett. 1979. USDA Forest Service General Technical Report PNW-97. Pacific Northwest Forest and Range Experiment Station, Portland. 106 pp. The silviculture of ponderosa pine in the Pacific Northwest States of Washington and Oregon is described. The timber resource, growth, and value are discussed first, followed by damaging agents, management, and silviculture. Relevant literature is presented along with observations, experience, and results of unpublished work. Research needs for the future are also proposed.

**1**

ALLELOPATHY: A POTENTIAL CAUSE OF REGENERATION FAILURE, by R. F. Fisher. 1980. Journal of Forestry 78:346-348, 350. Allelopathy is the inference of one plant with another through substances produced by the plant and released into the environment. It has the potential to cause reforestation failures or delays. Therefore, this paper reviews the forest and ecological literature on allelopathy to make silviculturalists aware of the phenomenon. Black walnut (Juglano nigra) is the classic example of an allelopathic tree. Several plants are suspect of being allelopathic to Douglas-fir, including Pacific madrone, rhodedendron, sumac, elderberry, and bracken fern. Most of the allelopathic chemicals are phenolics and terpenoids that act in a variety of ways. They can interfere with respiration and other energy transfer processes or inhibit nutrient absorption and translocation. The chemicals may not be effective under all site conditions. Thus, it is difficult to characterize and quantify the impact of allelopathic chemicals. Foresters often inadvertently control potential allelopathic plants with site preparation and weed control.

**8**

STREAM DYNAMICS: AN OVERVIEW FOR LAND MANAGERS, by B. H. Heede. 1980. USDA Forest Service General Technical Report RM-72. Rocky Mountain Forest and Range Experiment Station, Ft. Collins. 26 pp. This report focuses on the major processes of stream dynamics and shows how the complexity of stream behavior forces the user to consider the individual components of each case. Concepts of stream dynamics are demonstrated through discussion of processes and process indicators; theory is included only where helpful to explain concepts. While the science of fluvial hydraulics has not been developed to a level that permits accurate prediction of stream behavior, some qualitative predictions are possible since conceptual relationships have been developed for most hydraulic interactions. If streamflow records are available, the investigator can predict at least the trend of future stream behavior. Judgment is still required in addition to mathematical-statistical analyses. Above all, stream restraining measures must be applied with great caution so that treatment of one critical location will not simply lead to the formation of another, or that future treatment "side effects" will not be more detrimental to the attainment of a new equilibrium condition than no treatment.

**4**

TREE-FALLING MECHANICS, by D. Y. Guimier. 1980. Forest Engineering Research Institute of Canada, Technical Report No. TR-42. 28 pp. A computer-assisted, theoretical approach was undertaken to study the mechanics of freely-falling trees, a tree restricted in its fall by the action of a faller-buncher, and a tree kicked off the stump while falling by a faller-buncher. The mechanics of freely-falling trees are developed in detail and are readily applicable to tree-falling practices involving chainsaws and wedges. Five trees were characterized for free-falling computer simulations. The trees covered a diameter range of 9.8 inches d.b.h. to 31.9 inches d.b.h. and heights from 59 to 141 feet. An initial lean of 6 degrees was assumed to start the tree falling. Conclusions from the free-falling simulations follow: (1) small trees take less time to fall than big trees because small trees have less inertia and often smaller crowns to offer less wind resistance; (2) small trees fall at a faster speed than big trees; (3) the vertical reaction on the stump is least when the tree has fallen approximately 70 degrees from the vertical. The vertical reaction (downwind force) on the stump may be negligible at this point; (4) the horizontal reaction (sideways force) on the stump is zero when the tree has fallen approximately 50°. As the tree continues to fall, the centrifugal force of the falling tree tends to pull the tree away from the stump in the direction of falling; (5) the amount of kinetic energy developed as the tree falls determines how hard the tree hits the ground. Kinetic energy increases with the square of the angular speed. If a tree is felled downhill on a 60% slope, the energy of impact is 32% greater than if the tree were felled on a level lay. If the tree is felled uphill on a 60% slope, the energy of impact is reduced by 43%. The energy of impact relates to falling breakage; and (6) the influence of initial lean on speed of falling is negligible.

**5**

VISUAL QUALITY AND THE COST OF GROWING TIMBER, by R. D. Fight and R. M. Randall. 1980. Journal of Forestry 78:546-548. The cost of enhancing the visual quality of forest lands under multiple-use management can be determined by comparing the cost of managing under alternative regimes with different degrees of visual enhancement. Assuming volumes and timing of harvesting is unaffected by classifying lands into units for visual enhancement, the costs that need to be considered are those for logging, slash disposal, road maintenance, and treatment and timber sale preparation and administration. The results of such an analysis on the Mt. Hood National Forest for managing Douglas-fir land to meet middle-ground partial retention visual standards was that benefits would have to be approximately $2 per acre per year to cover costs or about a 14 percent rise in timber value, at roadside, over standard management practices. Middle-ground partial retention refers to a distance zone extending from the foreground to 3 to 5 miles from the observer with a visual quality objective meaning that human activity may be evident but must remain subordinate to the characteristic landscape.

**1**

EVOLUTION OF LARGE, ORGANIC DEBRIS AFTER TIMBER HARVESTING: MAYBESCO CREEK. 1949 TO 1978, by M. D. Bryant, USDA Forest Service, General Technical Report PNW-101. Pacific Northwest Forest and Range Experiment Station, Portland. 30 pp. Stream maps showing large accumulations of debris and stream channel features were made of Maybesco Creek, in southeastern Alaska in 1949. The valley was logged between 1953 and 1960 and stream maps updated. The maps were supplemented with a ground survey in 1978. Natural conditions before logging revealed sparse accumulations of large debris scattered throughout the stream. During logging, the natural accumulations acted as sieves, collecting large amounts of logging debris. As these debris dams increased in size, they became unstable and washed out. The absence of old-growth forest along the streambank effectively eliminated new accumulations. Thus, there were fewer accumulations in 1978 than 1949, before the start of logging. As a consequence, stream channel morphology will become more dependent on rock formations and streambanks, and the amount of area in riffles will increase.

**1**

GROWTH OF PLANTED PONDEROSA PINE THINNED TO DIFFERENT STOCKING LEVELS IN NORTHERN CALIFORNIA, by W. W. Oliver. 1979. USDA Forest Service Research Paper PSW-147. Pacific Southwest Forest and Range Experiment Station, Berkeley. 11 pp. Growth of planted ponderosa pine was strongly related to growing stock level (GSL) for 5 years after thinning 20-year old poles on Site $Index_{50}$ 115 land at the Elliott Ranch Plantation in northern California. Five GSLs--basal area anticipated with trees average 10 inches d.b.h. or more--ranging from 40 to 160 square feet per acre were tested. Periodic annual increment (PAI) in diameter decreased curvilinearly from 0.51 to 0.21 inch, with increasing GSLs from 40 to 160. Only trees in plots heavily thinned to GSL 40 (and briefly in GSL 70) grew faster in diameter after thinning than these same trees grew before thinning. PAI in basal area and net volume rose steadily with increasing GSLs, reaching 9.0 square feet and 255 cubic feet per acre, respectively, at GSL 160. Apparently, even light thinning reduced volume production, but thinning still is recommended to shorten time until first commercial entry and to promote stand health.

**2**

INFLUENCE OF FOREST AND RANGELAND MANAGEMENT ON ANADROMOUS FISH HABITAT IN WESTERN NORTH AMERICA. 2. IMPACTS OF NATURAL EVENTS, by D. N. Swanston. 1980. USDA Forest Service General Technical Report PNW-104. Pacific Northwest Forest and Range Experiment Station, Portland. 27 pp. The second in a series of publications summarizing knowledge about the influences of forest and rangeland management on anadromous fish habitat in western North America, this paper addresses the effects on fish habitat of naturally occurring watershed disturbances. The basic hydrologic process and characteristics of minimum and maximum stream flows are reviewed. The detrimental as well as beneficial effects of sediment and organic debris loading on anadromous fish, particularly landslide events, are summarized. The impacts of several other natural phenomenon are discussed including wind, insects and disease, freezing and ice formation, and fire. A firm understanding of the natural processes operating separately or in combination to create limiting habitat characteristics in a particular stream section or system is essential for a clear understanding of the effects forest and rangeland management has on the habitat of anadromous salmonids.

**1**

MOUNTAIN TOPOGRAPHY AND VEGETATION PATTERNS, by R. Daubenmire. 1980. Northwest Science 54:146-152. In the northern Rocky Mountains, topographic control over microclimates allows vegetation that is characteristic of subalpine environments to descend locally to very low altitudes, whereas steppe vegetation can be found locally at rather high elevations. Therefore, the significance of elevation above sea level has very little ecologic significance in the area.

**1**

SIGNS MAINTENANCE GUIDE, by Tom Nettleton. 1979. USDA Forest Service, Equipment Development Center, Missoula, MT. The 250,000 miles of National Forest Systems roads rely on modern traffic engineering measures to make the roads as safe as possible. High quality, well maintained signs are a necessary part of the program. This document is a guide to good maintenance practices. It presents methods for inspection, repairing, refurbishing, cleaning, and replacing traffic control devices and their mountings in the field.

**6**

A GUIDE FOR COMPARING HEIGHT GROWTH OF ADVANCE REPRODUCTION AND PLANTED SEEDLINGS, by K. W. Siedel. 1980. USDA Forest Service Research Note PNW-360. Pacific Northwest Forest and Range Experiment Station, Portland. 6 pp. This guide provides a method for evaluating whether clearcutting and planting will result in a plantation of taller trees at some time in the future versus carefully removing the overstory and saving the advanced reproduction. An equation to calculate the annual growth rate required of planted seedlings to equal the height of the advanced reproduction at the end of a given period is presented. An example and tables giving average annual height growth for a range of height and height growth rate of advanced reproduction, length of growth period, and two planted seedling heights are also included.

**1**



FIR
1301 Maple Grove Drive
Medford OR 97501