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forestry intensified research

DEC. 1980 VOL. 2 NO. 4

"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

VARIABILITY OF FOREST SOILS ON THE ROGUE RIVER NATIONAL FOREST

Bruce P. Wicherski and J. Herbert Huddleston (OSU-Soil Science) recently completed a study of the variability of selected physical, chemical, and morphological soil properties in two landtype mapping units on the Rogue River National Forest. The objectives of the study were: to quantify soil variability in several soil resource inventory mapping units; to explore methods of describing soil variability in order to make soil map information more useful to the map user; and to attempt to identify sources of variability.

Two mapping units, one each in the Siskiyou and Cascade Mountains, were selected to represent extremes of internal variability. Eight delineations of each map unit, as mapped, were sampled with randomly located transects for a total of 40 sites per map unit.

Individual soil properties exhibited several different types of distributions. Approximately half the property-horizon variables measured were normally distributed; the remaining distributions were generally positively skewed or multi-modal. Chemical soil properties were consistently positively skewed or approximately log-normal. Thus, using the arithmetic mean and standard deviation of chemical soil properties for predictive purposes may lead to considerable error.

Chemical properties were more variable than physical or morphological properties, which were about equal in their variability. Extractable bases and organic matter were the most variable chemical properties, and coarse fragment content and thickness of the O horizon were the most variable physical and morphological properties, respectively. The number of samples required to estimate the means of properties varied widely and were often prohibitively large.

Mapping unit 74 in the Siskiyou Mountains was initially considered to be more variable than map unit 33 in the Cascades. The analysis tended to support this hypothesis. For most properties, coefficients of variation were higher, the sample requirements to estimate population means were greater, and the ranges in property-horizon variables were wider in map unit 74 than in map unit 33, but the differences were not great. The differences in variability between the map units in terms of the coefficient of variation were often less than 15 percentage points.

The study found that large or small changes in the values of most properties were as likely to occur at 660-foot separation distances as at 15-foot distances. Significant differences with distance occurred only for percent slope in both mapping units, coarse fragments in the A and B horizons of the generally steeper, mapping unit 74, and organic matter in the A horizon of mapping unit 33.

Between 50 and 75 percent of the total variation in most chemical, physical, and morphological properties of both mapping units occurred within delineations. This result tended to support the validity of the mapping unit description since the delineations could be considered adequately uniform for management purposes. Furthermore, when significant differences in delineation means occurred, the differences in the soil property could often be traced to one particular delineation; many times, these were not of practical significance.

Specifically identifying sources of variation in both mapping units was difficult, especially for mapping unit 74. Possible major sources of variation in mapping unit 74 were the sudden changes in the character of parent material over short distances and the variety of geomorphic surfaces of varying ages and stability present within the unit as mapped. In mapping unit 33, changes in the parent material, especially in the subsoil, and the influence of microrelief may have been important sources of variation.

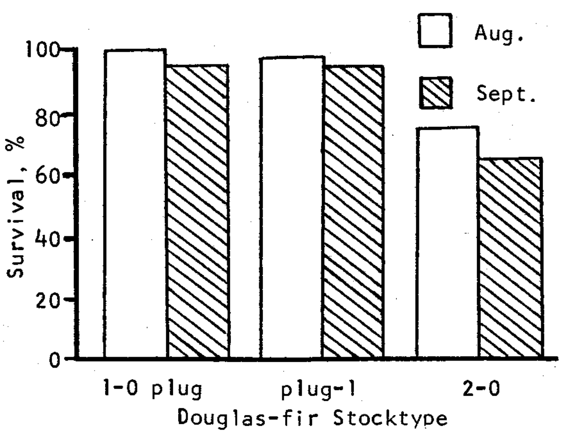
D.M.

adaptive fir

DOUGLAS-FIR STOCKTYPE STUDY

In Spring 1980, Ken Wearstler and I began a two-year study to evaluate the performance of three Douglas-fir stocktypes on a hard-to-regenerate site in the Siskiyou Mountains of Josephine County. The test site is located on land managed by the Medford District, Bureau of Land Management, and is adjacent to Soldier's Camp Saddle on the Galice Access Road. The site has a 75 percent slope with an east-southeast exposure. The soil is a shallow, skeletal loam with surface ravel. The area represents a nonstocked clearcut dominated by tanoak, chinkapin, and manzanita.

The three Douglas-fir stocktypes used were containerized 1-0 plugs, plug-1 bareroot, and 2-0 bareroot seedlings. Two hundred individuals, representing each stocktype, were outplanted in a randomized, complete block experimental design with five replications. All seedlings were Vexar tubed. One hundred seedlings from each stocktype were destructively sampled from May through September for the purpose of collecting plant moisture stress data. Prior to planting, the area was site prepared by handslashing the brush and removing it from the site. Before bud burst, all seedlings were measured for height and caliper. In addition, 30 seedlings from each stocktype were used for dry weight biomass measurements. Soil moisture and temperature as well as precipitation were recorded periodically from May through September. Seedling survival, height and caliper were measured again in late October 1980.



Survival of the 1-0 plug and plug-1 seedlings was particularly encouraging one growing season after outplanting.

Height growth was the greatest for the 1-0 plug seedlings in terms of percent increase. Diameter increase was also greater in the 1-0 plugs, both in absolute terms and on a percent increase basis.

	1-0 Plug	Plug-1	2-0
Mean Height (cm) Spring	14.3	32.9	19.2
Mean Height (cm) Fall	21.0	40.3	23.6
Percent Increase	46.6	22.7	22.7
Mean Diameter (mm) Spring	2.7	6.7	5.6
Mean Diameter (mm) Fall	3.4	7.1	6.0
Percent Increase	25.8	7.1	7.2
Mean Plant Moisture Stress (Bars, May-September)	9.9	12.8	15.4

We were not surprised at the better survival and growth exhibited by the 1-0 plug and plug-1 seedlings because both stocktypes had consistently lower predawn plant moisture stress levels during the period May through September. While we were excavating seedlings for the plant moisture stress work, we noticed that the 1-0 plugs and plug-1 seedlings had more vigorous root systems in terms of the number of actively growing root tips as compared with the 2-0 bareroot seedlings. Root elongation is undoubtedly an important factor affecting first-year survival and growth on droughty sites.

This study will be continued for at least one more year when more definitive results will be published. It is important to realize that survival and growth patterns between stocktypes may change over several years and that survival during the first year does not constitute establishment.

S.H.

NEW PRECIPITATION MAPS TO BE DEVELOPED FOR SOUTHWESTERN OREGON

Adaptive FIR is initiating a research project with Hank Froehlich (OSU-Forest Engineering) to develop new precipitation maps for southwest Oregon. The project will include preparing a new annual precipitation map, preparing a growing season precipitation map, and determining if subregional differences exists in intensity-frequency of short term, high-intensity storm events. This combination of projects will provide the most comprehensive interpretation of existing precipitation data for forest management planning.

A review of existing precipitation maps has found considerable variation in annual rates for mountain sites. In some areas, like the western Siskiyou Mountains, precipitation has been considerably underestimated. Most of these maps have been based on National Weather Service data, which is very good but heavily weighted with lower valley stations. Mountain stations are more limited, with many of the stations located in conjunction with the Cascade Mountain power generation facilities of Pacific Northwest Power.

Since most of the annual precipitation maps available were prepared, several additional reporting stations have been established in southwestern Oregon by organizations other than the National Weather Service. These organizations include the Department of Water Resources (State of Oregon), U.S. Forest Service and U.S. Geological Survey. Most, if not all, of these stations are scattered throughout the mountains of southwestern Oregon. Thus, combining data sources offers the opportunity to obtain a more balanced and accurate record of annual precipitation in southwestern Oregon.

Growing season precipitation maps have never been developed for southwestern Oregon, but they ought to prove useful in characterizing subregional differences among sites when evaluating their reforestation or productivity potential.

Determining if subregional differences exist in intensity of short term, high-intensity storm events is important to evaluating the risk of erosión from intensive site-preparation practices. A precipitation-frequency analysis of precipitation records for several sites will provide information on the probability of large storms occurring. Comparisons between sites will determine if portions of southwestern Oregon are more susceptible to large storm events than others.

We would appreciate receiving additional information about unreported precipitation data so that we may have the most comprehensive data set for preparation of the new maps.

D.M.

SECOND-YEAR SURVIVAL AND GROWTH OF NATURAL AND PLANTED SEEDLINGS

This article is a follow-up report on a cooperative project between adaptive FIR and the Rogue River National Forest presented in the FIR REPORT (1980, Volume 2, Number 1, p. 3-4).

The regeneration cut of a two-stage shelterwood was completed in 1978 on a unit located within the Applegate District of the Rogue River National Forest (Township 40S, Range 2W, Section 23). Broadcast burning was used as the method of site preparation in the same year. The site is characterized by shallow, rocky soils, 3,500 feet in elevation, 50-70 percent slopes, and southwest aspect. The harvest resulted in the stand having relatively large openings (approximately 1.0 acre in size) as well as portions with shelterwood overstory. During the spring of 1979, a portion of the area was planted with bareroot Douglas-fir and ponderosa pine 2-0 nursery stock. In addition, abundant natural regeneration (primarily true fir and Douglas-fir, with some ponderosa pine and incense cedar) germinated during the spring.

These conditions provided a good opportunity to study the survival and growth of natural and planted seedlings in both exposed and sheltered microsites. The microsite in which each seedling was growing was classified into two categories, unshaded and shaded. Seedlings growing in unshaded microsites were directly exposed to all the environmental factors. Seedlings growing in shaded microsites were in some way sheltered from environmental extremes (within the shelter of a large tree, on the shaded side of a stump or log, root-collar shaded by a rock or piece of wood, etc.). Mortality and the probable cause were recorded on a monthly basis from May through Setpember 1979 and April through September 1980. Height growth of the sedlings was recorded at the end of each growing season (September 1979 and October 1980).

Mortality among the planted seedlings was minimal during the winter of 1979-80. Only one ponderosa pine in an unshaded microsite and one Douglas-fir in a shaded microsite died. No mortality occurred among the planted seedlings during the second growing season (April to September 1980).

SURVIVAL OF PLANTED SEEDLINGS

Species	No. of Seedlings Initially Sampled	Survival (%) Unshaded Microsite '79	'80	Shaded Microsite '79	'80
Ponderosa Pine	28	54	50		
Douglas-fir	21	90	90		
Ponderosa Pine	22			68	68
Douglas-fir	29			83	79

Mortality among the natural seedlings continued to be heavy over the winter (1979-80) and during the second-growth season. Of the natural seedlings alive at the end of the first growing season, approximately 25 percent died over the winter, and an additional 25 percent died during August and September of the second growing season. Half the winter mortality could be attributed to animal feeding, and the remaining half was presumed to be the result of environmental stress. Mortality occurring during the later part of the second growing season was presumed to be the result of drought stress. The following table summarizes the survival of the natural seedlings after two growing seasons.

SURVIVAL OF NATURAL SEEDLINGS

Species	No. of Seedlings Initially Sampled	Survival (%) Unshaded Microsite '79	'80	Shaded Microsite '79	'80
True Fir	45	11	2		
	27			74	44
Douglas-fir	45	7	4		
	25			52	24
Ponderosa Pine	3	0	0		
	4			100	75
Incense Cedar	1	100	100		
	1			100	100

Given good quality planting stock, artificial planting on this relatively harsh site can be accomplished as evidenced by the planted seedling survival data. However, depending upon natural seeding (even given an adequate supply of seed) or artificial seeding is a high risk proposition. During their first two growing seasons, natural seedlings are very sensitive to environmental stress and appear to be a preferred animal food. Successful seeding of harsh sites will require taking advantage of existing shaded microsites or creating shaded microsites and protection from animal feeding.

The limited size sample for the unshaded microsite prevented drawing meaningful conclusions about the height growth of natural seedlings. The six natural seedlings listed in the table for the unshaded microsite (1980) were the only surviving seedlings that could be found in the study area.

HEIGHT GROWTH OF NATURAL SEEDLINGS

	Mean Height (cm)			
	Unshaded Microsite		Shaded Microsite	
Species	'79	'80	'79	'80
True Fir	5(5)[1]	13(1)	5(26)	10(14)
Douglas-fir	5(5)	15(2)	7(23)	13(14)
Ponderosa Pine	5(2)	8(1)	7(7)	12(5)
Cedar	5(1)	7(2)	7(3)	14(2)

[1]Number of trees sampled.

Height growth differences between the two microsites were becoming more evident for the planted seedlings during the second growing season. Height growth of ponderosa pine and Douglas-fir was better in the unshaded microsites.

HEIGHT GROWTH OF PLANTED SEEDLINGS

	Mean Height (cm)					
	Unshaded Microsite			Shaded Microsite		
Species	'78	'79	'80	'78	'79	'80
Ponderosa Pine	12 (23)[1]	17 (23)	27 (23)	12 (26)	17 (26)	25 (25)
Douglas-fir	21 (22)	32 (22)	51 (21)	21 (29)	30 (29)	47 (28)

[1]Number of trees sampled.

The height growth data for planted seedlings on this site indicates that shading reduces the height growth of seedlings after only two growing seasons. This suggests that shading (whether by a shelterwood or artificial shading) should be eliminated as soon as the regeneration is established if maximum growth of the seedlings is to be obtained.

The results from this study suggest that with good site preparation, well adapted and good quality planting stock, and good planting technique, planting should be favored over natural seeding on this and similar harsh sites.

K.W.

fundamental fir

OUTPLANTING OF MYCORRHIZAL INOCULATION SEEDLINGS

Jim Trappe (PNW-Corvallis) and a host of cooperators have a project underway to evaluate the survival and growth of outplanted 2-0 Douglas-fir, Shasta fir, white fir, and lodgepole pine seedlings inoculated with the mycorrhizal fungi, Pisolithus tinctorius (P.t.). P.t. is one of the most highly regarded mycorrhizal fungi, particularly in the southeastern United States, where it has been used to reforest some very harsh sites, including acid, strip mine spoils.

The ultimate value of operationally planting specified mycorrhizal seedlings is a demonstrated increase in the survival and growth of inoculated seedlings over nonspecified mycorrhizal seedlings. Thus, outplanting research studies are necessary to support the current intensive research effort and to justify developing nursery operations to secure specified mycorrhizal seedlings. P.t. inoculum is currently available from commercial laboratories, but bare-root seedling nurseries are generally unable to guarantee that P.t. inoculated seedlings will have P.t. mycorrhizae when lifted. While this problem has hampered field testing of mycorrhizal seedlings, including this study, outplanting studies are being conducted with the stock available.

Seedlings for the outplanting study were grown as 2-0 bare-root stock at the Medford Forest Nursery under three treatment regimes: an uninoculated control; seedbeds treated with a P.t. inoculum produced locally; and a P.t. inoculum available from a commercial laboratory. P.t. mycorrhizal fungi development on seedlings at the time of lifting was poor. Therefore, mycorrhizal seedlings for the outplanting study had to be individually selected from the inoculated planting stock because of insufficient P.t. development.

Groups of seedlings receiving the three treatments were distributed to cooperators during the spring of 1980 and outplanted at 35 sites throughout southwest Oregon and northern California. Some seedlings were measured last fall, and the remaining seedlings will be measured next spring.

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. Enrollment is limited to 150. FEE: $100. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

MANAGING FOREST LANDS TO MINIMIZE SOIL COMPACTION

March 25-26, 1981. Southwest Oregon Forestry Intensified Research Program, Medford, Oregon. A two-day program to review soil compaction processes, effects of soil compaction on forest productivity, soil compaction and equipment interaction, and harvesting options to minimize soil compaction. Enrollment is limited to 150. CONTACT: Dave McNabb or Dave Lysne, FIR.

FOREST PESTICIDES SHORT COURSE

March 10-12, 1981. Bonneville Power Administration Auditorium, Portland. The first day of the short course is intended for licensed individuals seeking recertification credit and is approved for 7 hours credit. The last two days of the short course are intended as prelicense training. Participants have the option of registering for the first day only, the second and third day, or all three days. CONTACT: Conference Office, Forest Pesticides, Cooperative Extension Service, Washington State University, Pullman, WA 99164.

SMALL WOOD HARVESTING UPDATE

April 14-15, 1981. Oregon State University, Corvallis. A review of seven years (1972-80) of small wood harvesting research at Oregon State University by present and former faculty. The research will be used to answer questions most commonly asked by logging engineers about small wood harvesting. Enrollment is limited to 150. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

REGENERATION SYSTEMS WORKSHOP

June 8-11, 1981. FIR, southwest Oregon. The objective of the workshop is to bring foresters from southwest Oregon together so they can view and discuss successful regeneration practices and regeneration problems. Since there is a tremendous amount of regeneration expertise and experience among foresters in the region, we want to provide a mechanism by which foresters can learn from one another. The majority of time will be spent in the field with one day spent in each of the Roseburg, Grants Pass, and Medford areas. The program will begin in Roseburg and end in Medford. A program announcement will be distributed in February. CONTACT: Ken Wearstler or Steve Hobbs, FIR.

VARIABLE PLOT SAMPLING

June 15-19, 1981. Oregon State University, Corvallis. Program to cover variable plot and three-p sampling. Enrollment is limited to 50. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, 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.

PLANT IDENTIFICATION SHORT COURSE

June 21-26, 1981. Oregon State University, H. J. Andrews Experimental Forest, Blue River. Program covers the visual identification of families and the use of Hitchcock and Cronquist's key, Flora of the Pacific Northwest, to identify genus and species of tree, shrub and herbaceous plants. Enrollment is limited to 40. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

AERIAL PHOTO/REMOTE SENSING

June 22-26, 1981. Oregon State University, Corvallis. Program to be similar to ones presented in past years. Enrollment is limited to 40. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

HABITAT TYPE WORKSHOP

July, 1981. Oregon State University, H. J. Andrews Experimental Forest, Blue River. Enrollment is limited to 40. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

STRUCTURE AND FUNCTION OF ECOSYSTEMS

July, 1981. Oregon State University, H. J. Andrews Experimental Forest, Blue River. Enrollment is limited to 40. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-3709.

# of interest

THE LOG DRIVE

This article initiates a continuing column in the FIR REPORT dealing with logging engineering developments in southwest Oregon. Under the premise that experience gained by one agency or company may benefit everyone if the experience is shared, "The Log Drive" will present a short description of logging engineering innovations being explored locally. Subject matter may include road design, construction, and maintenance; new logging systems and logging system applications; logging and transportation planning; and logging engineering economics. In order to make "The Log Drive" a success, cooperation from FIR REPORT readers is required. Suggestions for future topics should be directed to the FIR Harvesting Specialist. Additional information on any of the topics covered in "The Log Drive" may be obtained directly from the agency or company involved or the FIR Harvesting Specialist.

Commercial Thinning with a Koller Yarder - The Medford District of the Bureau of Land Management is negotiating a trial timber sale for logging with a Koller K300 yarder with a Koller carriage. The Koller system is capable of using intermediate supports to increase yarding distances and the efficiency of the system's small size lines. The Koller system's low initial cost and low manpower requirements make the system particularly suited to the harvesting of small material on reaches up to 1,000 feet.

The timber sale is a commercial thinning located approximately 7 miles west of Medford. The timber sale is expected to be in the logging phase by the end of January or the first part of February 1981. Further information on the planned sale may be obtained by contacting Ivend Holen, Rogue Resource Area, Medford District, BLM (503)776-4315.

Road Construction Slash Utilization - Hanscom Brothers, Incorporated, of Eagle Point, Oregon, has been attempting to use road construction slash that would ordinarily be endhauled to a disposal site for later burning or burying. Hanscom Brothers, Incorporated, has been hauling the road construction slash in 40-foot chunk trailers. The trailers are Navy surplus open-top boxes with a large hydraulic ram in the front to push out the slash during unloading.

The operation, to date, has not been very successful because the forest roads were not designed to accommodate the long trailers. To be successful, the operation would need road designs similar to those required for lowboy access for logging equipment move-in and move-out. Design considerations would have to include reasonably good alignment, adequate curve widening, room for the vehicle to turn around, and room for the vehicle to be loaded.

Multispan Timber Sales - Two timber sales that have been sold on the Siskiyou National Forest require multispan yarding. The Lazy Bluff Timber Sale on the Galice Ranger District was sold in June 1980, and the Left Timber Sale on the Illinois Valley Ranger District was sold in September 1980. Both sales were planned for multispan logging because the existing roads provided inadequate deflection for single-span yarding and new road construction was precluded by sensitive soils. Logging has not begun on either sale.

The Lazy Bluff sale contains 8.080 million board feet of timber, 7.5 million board feet of which is Douglas-fir. The average tree is 30 inches d.b.h. and contains 730 gross board feet. Slopes are over 65 percent. Approximately 10 percent of the sale is planned for uphill multispan logging over one intermediate support per span. The logging plan calls for both single tree and double tree intermediate supports. Maximum slope yarding distance is 1,800 feet with a skyline rigging length of 2,800 feet. The sale is planned to be yarded with the Madill 071 with a 1-inch skyline and a 3/4-inch mainline. The carriage is a Danebo MSP.

The Left Timber sale contains 7.560 million board feet of sawtimber, approximately 6.2 million board feet of which is Douglas-fir. The average d.b.h. is again 30 inches, but the average tree contains approximately 1,290 gross board feet. Slopes average 50 percent. Approximately 20 percent of the sale is planned for multispan logging uphill over one intermediate support per span. Single tree intermediate supports are planned due to the scattered nature of suitable intermediate support trees. Two cable-logging systems are planned to log the sale. A PSY-200 yarder rigged with 7/8-inch lines and a Danebo S40 carriage is planned to log the areas of good multispan deflection. The PSY-200 will yard a maximum of 1,370 feet slope distance with a haulback rigging length of 3,400 feet. In areas of lesser multispan deflection, a Washington Model 137 yarder with a 90-foot tower rigged with a 1-3/8-inch skyline, 1-inch mainline, 7/8-inch haulback, and a fourth drum used for the slack-pulling mainline for the Danebo S40 carriage is planned. This machine will yard a slope distance of 2,400 feet, which is also the maximum reach. Smaller size lines may be suitable if the logger chooses to rig two intermediate supports per span.

LOW-INTENSITY FOREST MANAGEMENT LANDS - MEDFORD DISTRICT BLM

Low-intensity land is one of three management categories used by the Medford District BLM to stratify commercial forest lands. Low-intensity lands are commercial forest land by definition since they are capable of growing in excess of 20 cubic feet of commercial coniferous species per acre per year. They are not included in the timber production base for allowable cut determination because the regeneration period is expected to be in excess of 5 years after clearcutting or after the regeneration cut of a shelterwood regime.

In 1977-78, 99,755 acres were classified low-intensity lands and excluded from the 418,578 acres of high-intensity lands for the purpose of allowable cut calculations. Because this land has significant management potential, the Medford District BLM proposed a trial management program for the low-intensity lands in the 10-year management plans for the Josephine and Jackson-Klamath Sustained Yield Units. The purpose of the program is to determine what practices may be effective in achieving successful regeneration within 5 years on all or part of the low-intensity lands. If successful regeneration practices are developed, the addition of low-intensity lands to the timber production base could lead to significant increases in the allowable harvest levels in the next planning period.

For the current 10-year planning period, approximately 1,000 acres of low-intensity land will be treated each year. Annual harvest for the trial program is approximately 14 million board feet, but it will depend upon the stand characteristics of the areas selected for timber sales. For each timber sale, an experimental objective will be developed. Various site preparation practices, stocktypes, planting techniques, harvesting techniques, etc., will be evaluated through the timber sales. Adaptive FIR will assist the Medford District BLM in developing hypotheses to test and experimental designs.

The information developed on these lands will have broad applicability to similar lands throughout southwestern Oregon. As these timber sales are completed over the next few years, experimental results will be reported in the FIR REPORT.

THE EFFECTS OF LOG DRAG ON SKYLINE PAYLOAD CALCULATIONS

The last issue of the FIR REPORT (Volume 2, Number 3) included an article on the effects of log drag on the energy required to skid logs if the log is fully supported by the soil and the effects of soil gouging are assumed to be small. This article applies the concepts of log drag to skyline yarding payload analysis. An accurate analysis of skyline payloads is necessary to match skyline yarder horsepower and cable sizes to maximum log bucking lengths for the larger logs within a harvest unit.

The concepts presented in this article were developed by Allen Tobey for his Master of Forestry paper in Forest Engineering at Oregon State University. A copy of Allen's paper, Skyline Analysis With Log Drag, 1980, is on file in the Forest Research Laboratory, Oregon State University. Allen developed a computer program to test the effects of log drag on skyline payloads. Actual log and ground geometry were used to test the effects of log drag on running, standing, and live skylines.

The Skyline Analysis Program (SAP) and the Multispan Program (MSAP), the popular computer programs for skyline payload analysis, do not include the effects of log drag. Only the MSAP program gives a printout of mainline tension, but the mainline is assumed to be tensioned sufficiently to overcome the downslope horizontal component of the skyline resultant. The effects of log drag are not included. Unless the logs being yarded are fully suspended, the indicated mainline tension will be insufficient to move the turn.

If a log is being yarded with one-end suspension, the log is partially supported by the soil. The effect of the partial support is to reduce the vertical load on the skyline, reducing the skyline tension. However, the frictional resistance to skidding from the dragging log increases the mainline tension. Frequently, the mainline can become the limiting line in a skyline system if log drag is considered. A multipler of 1.5 is sometimes applied to the indicated SAP, MSAP, and bead chain payloads to account for the effects of one-end suspension. However, the multiplier applies only to the skyline and does not include the effects of mainline tension. Tobey suggests that the effect of log drag on payload would actually vary with ground slope, log clearance, choker length, point of choker attachment, center of gravity of the log, and the soil-log coefficient of friction. The payloads obtained by applying the multiplier may be in error by as much as plus or minus 50 percent at any given terrain point if the effects of log drag and mainline tension are considered.

Logging engineers should not increase the fully suspended skyline payload if the mainline is likely to be the limiting line when log drag is included. While the exact force required to overcome log drag for a partially suspended log is not easy to determine, the mainline is most apt to be the limiting line on steep uphill skids.

VOLATILIZATION OF AMMONIA AFTER UREA FERTILIZATION

During the recent FIR programs on Douglas-fir fertilization, several questions were raised about the magnitude of volatilization losses of ammonia following urea fertilization. Minimal volatilization of ammonia was assumed to occur if urea was applied during the cool, wet season of the year. Sometimes, because of planning or contracting delays or unusual weather patterns, fertilizer is applied under less than optimum conditions for maximum effectiveness. Therefore, the magnitude of ammonia losses after urea is applied to soils under different environmental conditions is important for evaluating fertilizer operations.

First of all, volatilization losses of ammonia are an important concern to southwest Oregon foresters. Precipitation is generally less and temperatures warmer than other areas of western Oregon and Washington, resulting in a less than optimum climate for urea fertilization. This climate has also produced soils and forest litters that commonly will have a higher pH than more northerly sites. Urea fertilization of initially high pH soil and litter will increase the values into the range where volatilization losses will also be higher. Application of 200 kg-N/ha can temporarily increase soil and litter pH from 1 to 2 units. Thus, slightly acid soils will become alkaline, preventing hydrolysis from changing ammonia to the more stable ammonium cation. In a controlled environment study, Crown Zellerbach scientists found ammonia losses doubled as initial litter pH increased from 5 to 6.

Recently, Joseph Craig and Art Wollum of North Carolina State University studied the effects of climate on ammonia volatilization from an urea-fertilized loblolly pine forest site in the southern Piedmont of North Carolina. Litter and soil (0-6 cm) pHs were extremely to very strongly acid, averaging 4.1 and 4.6, respectively. From 2 to 24 percent of the nitrogen added in the urea treatment was lost to the atmosphere. The majority of the loss occurred during the first two weeks after fertilizer application. Ambient air and soil temperatures appeared to effect ammonia volatilization losses with the lowest rates occurring during a winter treatment, but amounts of precipitation and timing of precipitation after fertilizer application seemed to be the factors controlling the daily loss of ammonia to the atmosphere.

The North Carolina study found precipitation could either minimize or accelerate ammonia losses depending on the timing and amount of precipitation occurring immediately before and several days after the fertilizer application. Daily ammonia losses were highest when fertilizer was applied to a moist forest floor following recent rainfall or whenever the site received 5 mm or more precipitation during the days following the fertilization. Ammonia losses from individual plots were as high as 10 kg-N/ha/day and could average one half that amount for all plots. As the moist forest floor started to dry, ammonia losses decreased rapidly.

Two to three cm of precipitation was the minimum necessary to move the urea and/or ammonium deeper into the soil and reduce ammonia losses to near zero. More precipitation was required to dissolve the pellets and move the fertilizer deeper into the soil the first few days following treatment. Otherwise, once the precipitation stopped, the moist forest floor contributed to increased ammonia losses until the forest floor dried again.

Because the North Carolina study was conducted in the field, the results were dependent on the sequence of natural climatological events, and concise statements relating quantitative losses to specific climatic conditions could not always be made. Crown Zellerbach scientists have found ammonia losses from urea applied to forest litter increased approximately 33 percent when the temperature was increased from 7 to 18°C under controlled laboratory conditions.

A review of local climatological records can identify the optimum time for applying urea fertilization to minimize ammonia losses in southwest Oregon. Average mean daily temperatures are lowest throughout the region during the months of December and January. January averages are slightly lower (0.8°C). February is the next coolest month with temperatures averaging about 1.4°C warmer than December-January temperatures. The differences may be even less in the mountains. November and March temperatures are similar, ranging 2° to 5°C above the coolest temperatures. October, April, and May are considerably warmer.

Frank Lambrecht (NOAA-National Weather Service, Medford) has recently summarized precipitation records for Medford (1911-79) which provide some important insights into precipitation patterns typical of southwestern Oregon. The probability of precipitation (0.03 inches or more) occurring for a specific day is approximately constant from mid-November through the end of January-mid February. The probability of precipitation occurring earlier increases rapidly during October and early November but declines slowly after mid-February for several months.

A more dramatic seasonal distribution of larger storm amounts (0.5 inches and greater in 24 hours) occurs in the Medford area than is apparent from the probability of precipitation occurring. The median daily precipitation amounts received in the larger storms are highest between mid-November and the end of January. Near the end of January, there is a definite drop in the median daily storm precipitation amounts. Thus, while the probability of precipitation occurring declines only slightly, the decrease in storm precipitation amounts lowers the monthly precipitation average below December and January amounts. This decrease in storm size apparently signals the shift from the winter storm season to a spring shower regime that tapers off as summer approaches.

From the above temperature and precipitation summary, December and January are the best months to apply urea fertilizer to forests in southwest Oregon. Even then, we can still experience several days of warm, often dry, weather that would be optimum for volatilization of ammonia. Thus, when operating with the best planning and schedules, we will have to accept some losses of ammonia from the forest floor. However, the volatilized ammonia may not be totally lost from the site. There is a possibility that some of the ammonia lost from the forest floor may be absorbed by the canopy foliage.

If high ammonia losses are anticipated because of climatic or soil and litter pH, we may want to consider switching to another nitrogen fertilizer, such as ammonium nitrate. While its transportation and application costs are higher, a lower amount of nitrogen may be applied to achieve the same results as adding 200 kg-N/ha as urea and losing a significant amount of ammonia from the site by volatilization.

recent publications

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SOIL COMPACTION FROM LOGGING EQUIPMENT: EFFECTS ON GROWTH OF YOUNG PONDEROSA PINE, by H. A. Froehlich. J. Soil Water Cons. 34:276-278. Compacted soils in tractor skid trails produced by harvesting old-growth ponderosa pine on the Ochoco National Forest, central Oregon, proved to be long lasting. Soil densities in skid trails at 3- and 6-inches and 9- and 12-inches were 18 and 9 percent greater, respectively, than those of adjacent undisturbed soils 16 years after logging. Skid trail soil densities at an active logging operation nearby showed essentially the same densities at each depth as did the 16-year-old trails. Thus, little recovery had occurred since logging. Growth of residual pine trees (average age of 64 years at d.b.h. and 39 feet tall) related negatively to the area and intensity of soil compaction in the root zone. Moderately impacted trees (11 to 40 percent of the root zone impacted with a soil density increase of more than 10 percent) showed a 6 percent reduction in growth rate. Heavily impacted trees (more than 40 percent of the root zone impacted with a soil density increase of at least 10 percent) showed a 12 percent reduction over the 16-year period.
1

THINNING YOUNG TIMBER STANDS IN MOUNTAIN TERRAIN, by L. D. Kellogg. 1980. Forest Research Laboratory Research Bulletin 34, Oregon State University, Corvallis, 18 pp. Since 1972, the Forest Engineering Department of Oregon State University has been engaged in research projects to evaluate alternative methods of economically harvesting young timber in commercial thinning operations. Eleven studies conducted from 1972 to 1979 specifically addressed thinning techniques and harvesting production. This paper presents a concise summary of the eleven studies, organized into five areas: (1) felling and bucking; (2) tractor versus skyline yarding; (3) prebunch and swing yarding; (4) multispan yarding; and (5) the Igland-Jones Trailer Alp. Major conclusions presented are that felling and bucking production increased with thinning intensity, tractor yarding production decreased with increasing slope, total skyline logging cost was at least 1.5 times as expensive as tractor logging on slopes up to 40 percent; prebunching logs in the skyline corridor increased production for the machine used to skid logs to the landing; and intermediate supports can extend yarding distances on convex slopes. The paper presents valuable information elaborating each of the main conclusions. As an example, prebunching was economically feasible if a mobile single-drum prebuncher preceded yarding with a Schield-Bantam yarder but was not economically feasible if an Igland-Jones Trailer Alp was used to prebunch for a Madill 071 yarder. However, production for the machine used to skid logs to the landing was increased in both cases.
1

DUFF REDUCTION BY PRESCRIBED UNDERBURNING IN DOUGLAS-FIR, by David Sandberg. 1980. USDA Forest Service Research Paper PNW-272. Pacific Northwest Forest and Range Experiment Station, Portland. 18 pp. Consumption of duff from the forest floor is often the most important effect of prescribed fire, affecting the degree of air pollutant emission, chemical change in the soil, and site preparation achieved. Measurements of duff reduction are reported from a series of underburning experiments in partial cut stands of (predominately) Douglas-fir in western Washington and Oregon, including three in southwest Oregon. The effects of fire on duff were found to be predictable from preburn estimates of duff moisture content, calculated fuel moistures, and/or an inventory of fuel and duff loadings. Thousand-hour timelag fuel moisture estimates from the National Fire-Danger Rating System (NFDR-Th) were the most useful inputs for predicting duff reduction. Approximately 0.06 inches (0.14 cm) additional duff is consumed for each 1 percent decrease in NFDR-Th (approximately 1 ton per acre). As a consequence, an average 2.5 percent additional duff is consumed, and 2.3 percent additional soil is bared by the 1 percent change. A tentative theory to account for the amount of duff consumed is presented: Below about 30 percent moisture content, duff burns independently of woody fuels, so that nearly all duff is burned; very little combustion takes place in duff layers exceeding about 120 percent moisture content; and between these values, duff burns only under the influence of external heat supplied by the burning of fine surface fuels.

NUTRIENT CHANGES AFTER PRESCRIBED SURFACE BURNING OF OREGON PONDEROSA PINE STAND, by S. D. Nissley, R. J. Zasoski, and R. E. Martin. 1980. Proc. Sixth Conf. on Fire and Forest Meteorology, April 22-24, 1980. Washington, D.C. p. 214-220. The nutrient losses and redistribution following prescribed burns on three sites in central Oregon ponderosa pine stands are reported. Fuel loading rates varied between 24 and 32 t/ha with duff being the major weight fraction. Precipitation (3.7 cm) five or eight days prior to burning kept litter and duff reduction percentages low (8 to 38 percent). Nutrient losses from burning were related to the amount of material combusted, its nutrient content, and the volatility of the individual element. After burning, the concentration of many elements in the duff increased significantly. Nitrogen concentrations did not increase, indicating its loss from the site by volatilization. Normalization of unburned control nutrient contents with the burned values showed nitrogen losses ranging from 20 to 260 kg/ha. Average nitrogen loss from the forest floor was 35 percent of the total. Nitrogen losses were well correlated with increases in forest floor pH's after burning, indicating that pH increase could be an easily measured indicator of fuel consumption. Sulfur losses from the forest floor of normalized data from one site were estimated at 17 kg/ha, although precipitation prior to burning may have been responsible for some of the loss. **2**

DAMAGE FROM LOGGING AND PRESCRIBED BURNING IN PARTIALLY CUT DOUGLAS-FIR STANDS, by Robert E. Benson. 1980. USDA Forest Service Research Note INT-294. Intermountain Forest and Range Experiment Station, Ogden. 6 pp. Logging damage to a residual stand resulting from tractor logging a mixed-coniferous forest on gently rolling terrain and damage to the residual stand from prescribed burning is discussed. Three silvicultural treatments were applied to the forest: (1) selection cutting with approximately half of the sawtimber and poles removed followed by tractor slash piling and burning; (2) understory removal entailing removal of all trees exhibiting poor vigor and all trees under five inches d.b.h. slashed; and (3) overstory removal with all trees over 9 inches d.b.h. removed and Douglas-fir removed down to 5 inches d.b.h. Logging residues in the understory and overstory removal units were given three treatments: (1) residue left; (2) residue broadcast underburned; and (3) residue bundled and removed by logging vehicle. The understory removal unit was broadcast underburned under moist conditions, and only the fine fuels were consumed. The overstory removal unit was broadcast underburned under moderate-to-hot burning conditions, and fuel volumes were reduced greatly. Logging damage to the residual stand was greatest in the overstory removal unit and least in the understory removal unit, but logging damage did not appear to severely impair future stand development in any harvest unit. The broadcast burning killed 67 percent of the leave trees in the overstory removal unit and 5 percent of the trees in the understory removal unit, possibly as a result of the difference in burning conditions and the significantly greater number of trees left per acre in the overstory removal unit. The treatment of the fuels in the overstory removal unit did not leave a manageable stand. **4**

EARLY RESPONSE OF PONDEROSA PINE TO SPACING AND BRUSH: OBSERVATIONS ON A 12-YEAR-OLD PLANTATION, by W. W. Oliver. 1979. USDA Forest Service Research Note PSW-341. Pacific Southwest Forest and Range Experiment Station, Berkeley. 7 pp. Ponderosa pine was planted at five different spacings, from 6 by 6 to 18 by 18 feet, on a productive site in northern California. Spacing and brush effects on tree growth were evaluated both on plots where brush was allowed to develop and on plots kept free of brush. Competition between trees in brush-free plots began during the eighth year for trees spaced 6 by 6 feet and during the tenth year for trees spaced 9 by 9 feet. On several plots brush competition reduced tree diameters by the equivalent of nearly 3 years' growth. The following summarizes average diameter and height data by spacing 12 years after planting.

Square Spacing	With Brush		Without Brush	
	D.B.H.	Height	D.B.H.	Height
feet	inches	feet	inches	feet
6	2.9	13.1	3.5	14.4
9	4.2	14.9	4.7	17.0
12	3.9	13.1	5.4	18.4
15	3.4	13.1	5.5	17.4
18	4.4	16.2	6.2	18.9

These results forecast the strong influence of spacing and brush on tree growth. **3**

CONE AND SEED INSECTS OF NORTH AMERICAN CONIFERS, by A. F. Hedlin, H. O. Yates III, D. C. Tovar, B. H. Ebel, T. W. Koerbear, and E. P. Merkel. 1980. Joint publication of the Canadian Forestry Service, U.S. Forest Service, and Secretaria de Agricultura y Recursos Hidraulicos, Mexico. 122 pp. This publication is a comprehensive guide summarizing information on the recognition, biology, and importance of cone- and seed-destroying insects of Canada, the United States, and Mexico. Consideration is given to the conifer hosts. Emphasis is placed on the economically important tree species in four genera: Abies, Picea, Pinus, and Pseudotsuga. The fruiting habits of these genera are discussed briefly. Keys are included that aid in identifying insect pests of the flower and conelet, cone, and seed. Each insect of economic importance is discussed under the following headings: host, description, damage, life history and habits, and importance. Illustrations consist of color photographs, life-cycle diagrams, and distribution maps. Two additional topics are briefly discussed: insect detection and damage appraisal in seed orchards; and prevention and control. This excellent publication is highly recommended for regeneration foresters responsible for cone collection and seed processing, and for seed orchard managers. 5

EQUATION AND GUIDELINES FOR MEASURING SKYLINE DEFLECTION, by Leo K. Cummins. 1980. Journal of Forestry 78:632-633. A single equation is presented to compute midspan skyline deflection given readily available slope percent, tower height, and observer location information plus the frequently unknown horizontal span length. The single equation is intended to replace the two-part equation developed by Sessions and Binkley. The equation is most useful for determining loaded deflection of in-place skylines. A discussion of potential sources of error is also included. 6

TIMBER SITUATION IN THE UNITED STATES - 1952-2030, by D. Hair. 1980. Journal of Forestry 78:683-686. In response to projected increases in population, economic activity, and income, future demands for timber from domestic forests will grow rapidly. If timber owners continue to respond to price and inventory changes and manage their lands much as they have in the recent past, supplies show much slower increases. This means that large increases in relative prices of stumpage and most timber products will be necessary to balance demands and supplies. The rise in relative prices may have substantial and adverse effects on the timber processing industries, timber-based employment and income, consumers of wood products, and the environment. Softwood sawtimber supplies in the Pacific Coast section are projected to drop substantially, from 25.2 to 19.6 billion board feet between 1976 and 2030, with much of the decline occurring by 1990. The major cause is the physical incapacity of industry lands to maintain current rates of cutting. The old-growth inventory in this ownership class is rapidly being depleted, and supplies from merchantable second-growth stands cannot offset the decline. In contrast to the trends on the Pacific Coast, softwood sawtimber supplies in the South are projected to increase from 18.0 to 27.3 billion board feet over the same period, mostly on the farmer and other private ownerships that predominate in that section. Changes in timber supplies of the magnitudes in prospect in the Pacific Coast and South are certain to have major and long-lasting effects on the economies of the two sections. For the Pacific Coast, declining supplies will mean closed mills and reduced timber-based employment and income. These impacts are likely to be most severe in rural areas where timber is the chief source of economic activity. In the South, on the other hand, the projected supply situation suggests new timber-based economic activity and associated growth in employment and income. Such impacts are not inevitable--there are many opportunities to greatly increase and extend timber supplies, and the investments in these opportunities promise to be profitable from the standpoint of society and the economy. 7

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