FIR Report

WINTER 1989

VOL. 10 NO. 4

The Southwest Oregon Forestry Intensified Research Program (FIR) is a cooperative effort between the College of Forestry at Oregon State University and the Pacific Northwest Research Station of the USDA Forest Service. The FIR Program assists foresters and other resource management specialists in solving complex biological and management problems endemic to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and research projects specifically tailored to meet the needs of this area.

Established in October 1978, the FIR Program is supported jointly by Oregon State University, the Bureau of Land Management, USDA Forest Service, O&C Counties, and the southwest Oregon forest products industry. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

The "FIR REPORT" is one of the principal methods of reporting recent technological advances and research results pertinent to southwest Oregon, and alerts area natural resource managers to upcoming continuing education opportunities. Comments and suggestions concerning the content of "FIR REPORT" are welcome and encouraged. This newsletter is prepared quarterly and is mailed free on request by contacting us at this address: FIR REPORT, 1301 Maple Grove Drive, Medford, OR 97501.

For the FIR Staff,

David H. McNabb
Extension Watershed Specialist

Inside

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Because of space limitations, articles appear as extended abstracts. Results and conclusions presented herein may be based on preliminary data or analyses. Readers who are interested in learning more about a study are encouraged to contact the principal investigator or wait for formal publication of more complete results.

Notes from the Editor:

Following approval by the FIR Advisory Council, this will be the last volume of the FIR Report printed four times a year. Beginning with Volume 11, the FIR Report will be printed twice a year. The next issue will be mailed in early summer.

Reducing the number of issues printed annually is in keeping with the wind-down of the Forestry Intensified Research Program over the next 3 years. Fundamental FIR will officially end in September 1989, although a few of the Pacific Northwest Research Station projects will remain active. Adaptive FIR will end in September 1991. The completion of many Fundamental FIR projects reduces the amount of information available for dissemination in the FIR Report. In addition, the focus of Adaptive FIR has shifted to formal publication of research results as studies are completed.

We would also like to remind readers that the FIR Report is a newsletter and does not constitute the formal publication of research results. The articles are abstracts of study results; comprehensive analyses and interpretation of research results will be formally published in refereed journals. It is inappropriate to cite FIR Report articles in publications. FIR Report material should be referenced as unpublished data, with permission of the author. We'd be happy to help you obtain that approval.

Errata:

FIR Report 10(3):3. In Table 2, the diameter of seedlings in the control treatment when vegetation is controlled should be 15.7 mm, not 20.3 mm, and the average in this column is 15.4 mm instead of 16.3 mm.

Current Research

LOW SOIL MOISTURE CAN INCREASE SEEDLING FROST DAMAGE

Frost has been identified as an important factor in seedling damage and death on high elevation sites in southwest Oregon. We cannot control mesoscale frost events, but we can alter the seedling environment and thereby improve the seedling's chances of surviving the frost.

Summer precipitation events are rare, so the amount of stored soil moisture and the rate at which it is lost affect the seedlings in several ways. Seedlings need water to grow efficiently, but water also affects the seedling temperature and heat environment. Water has a higher heat capacity than anything in the seedling environment. Therefore, conservation of soil moisture can be equated with conservation of the ability to store heat in the soil. That can be very important during a frost event.

Radiative heat energy absorbed and stored in soil during the day is reradiated, warming air above the soil during the night. If sufficient heat is stored to last throughout the night, air above the soil will be maintained at relatively high temperatures. Therefore, soil moisture affects the immediate seedling environment and can buffer temperature extremes. Treatments that conserve soil moisture could improve seedling survival during frost events.

We established a study near Mt. Ashland to determine how site preparation treatments affect seedling microclimate. The site is at an elevation of 1600 m and a southwest aspect of 25 percent slope. The soil was shallow and weathered from granite.

Burning and scalping are two common site preparation techniques that have varying effects on soil water conservation. Burning and scalping were combined to create four treatments:

1) burn + scalp,

2) burn (no scalp),

3) scalp (no burn), and

4) control (no burn, no scalp).

Our objectives were: 1) to access the physical characteristics of the four seedling microsites to identify the mechanisms that affect seedling response to frost events; and 2) to determine the effects of treatments on seedling frost damage.

Table 1 outlines the effect we expected the treatments to have on soil water storage and soil heat properties. Plus signs (+) indicate relative treatment enhancement of water loss and surface heat exchange. To properly anticipate treatment effect on water loss, evaporation (E) and transpiration (T) were first considered separately. Then E and T were combined, and the treatments were ranked as high or low in relative water use. If water use is relatively high, then water content is relatively low, resulting in a relatively lower soil heat capacity.

TABLE 1. The expected effects of the four treatments on loss of soil water through evaporation (E) and transpiration (T), and on soil heat capacity and surface heat exchange properties.

	Water Use Enhancement E	Water Use Enhancement T	Relative Water Use	Soil Heat Capacity	Surface Heat Exchange
Burn+Scalp	++	+	low	high	+++
Burn	+	++	low	high	++
Scalp	++	+++	high	low	+++
Control	+	++++	high	low	+

Scalping increases evaporation relative to evaporation through a litter layer. Therefore, scalped areas would be expected to have higher evaporation rates than the unscalped treatments.

Transpiration is reduced by controlling vegetation. Burning often controls vegetation. Therefore, the two burn treatments should have lower transpiration rates than unburned treatments. Scalping also provides some control of vegetation; hence, the two scalp treatments are expected to decrease transpiration. Burning and scalping combined will provide more control of vegetation and decrease transpiration more than either treatment individually.

The effect of these treatments on surface heat exchange - or the ability to gain and lose heat energy - is controlled by the thickness of the litter layer. Surface heat exchange is greatest for the scalped treatments, when the litter layer is removed entirely. Burning will decrease the thickness of the litter layer and will increase surface heat exchange of unscalped soil.

The two burned treatments - burn + scalp and burn - were expected to use less water overall than unburned treatments when the effects of evaporation and transpiration were combined. As a result, they were also expected to have higher heat capacities. The scalped treatments, burn+scalp and scalp, were expected to have the highest rates of surface heat exchange.

The effects of heat storage and heat exchange capabilities are interrelated. The burn treatments were expected to have a greater ability to store heat as well as good ability to exchange heat with the environment. The scalp treatment however, has a limited ability to store heat and a high heat loss potential.

Using data from the site weather station, five potentially damaging frost events were identified during periods of active seedling growth and development. We found no visual evidence of frost damage on seedlings until July 5, the day following the fifth frost event.

Until that frost event, seedlings growing on the two scalp treatments were developing faster than seedlings on the two unscalped treatments. But after that date, condition of seedlings growing on the scalp treatment declined rapidly relative to other treatments. (Figure 1). Seedlings growing on the two burned treatments suffered significantly less damage from frost on that date and throughout the rest of the period of active growth (Figure 2).

Cumulative water use near the soil surface was significantly greater in unburned treatments, greatest overall for the scalp treatment (Figure 3). The ranking of treatments for relatively high water use is identical to that for frost damage by July 30, from high to low: scalp, control, burn and burn + scalp.

A comparison of diurnal curves of soil temperature at 20 mm depth and air temperature at 2 m height during two of those frost events shows the effects of decreased water content on soil tem-

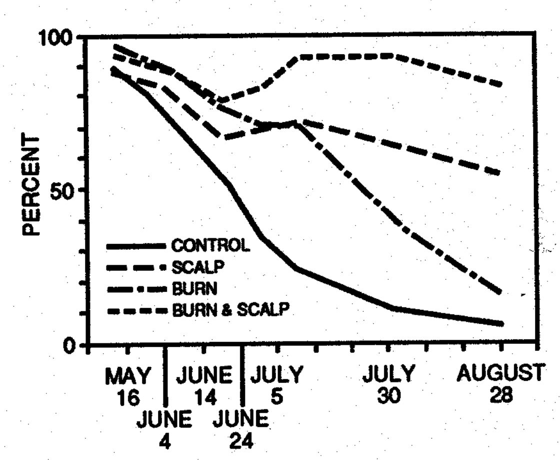

FIGURE 1. Percent of the seedlings in good or fair condition on each treatment as the growing season progressed.

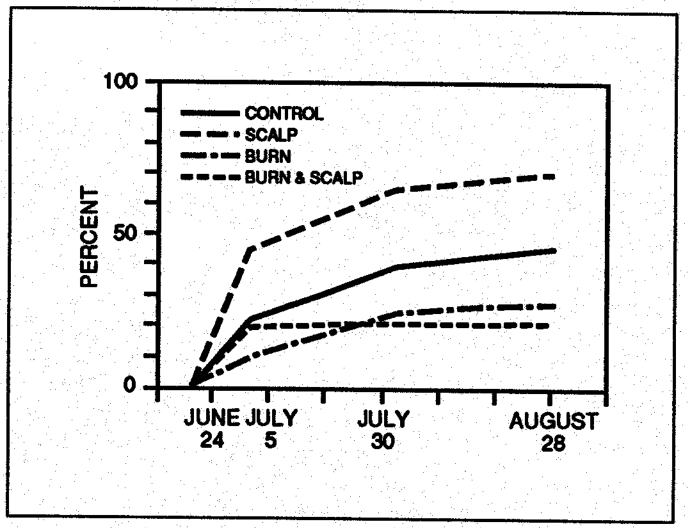

FIGURE 2. Percent seedlings damaged by frost on each treatment as the season progressed.

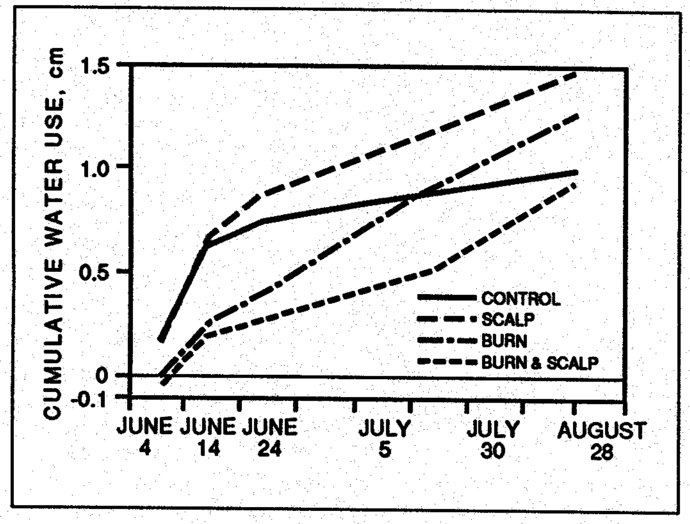

FIGURE 3. Cumulative water use for each treatment as the season progressed (0-25 cm soil depth).

perature changes during a frost event. A frost event recorded on June 6 did not result in any apparent seedling damage, but a frost event of similar intensity and duration on July 4 did (Figure 4:a,b).

Soil temperature on June 6 was warmer than air temperature for all four treatments during the predawn frost event, indicating that the soil had sufficient heat stored to maintain soil temperature throughout the night despite loss of radiative heat. On July 4 however, soil temperature on all four treatments was colder than air temperature for varying amounts of time during the predawn hours. The scalp treatment had the lowest minimum temperature and the highest maximum temperature during the 24 hour period. It also remained below air temperature longer than any other treatment, five hours as compared to two hours for the burn and the burn + scalp treatments and three hours for the control treatment. Rapid soil temperature changes in response to changes in air temperature are indications of decreased soil heat capacity.

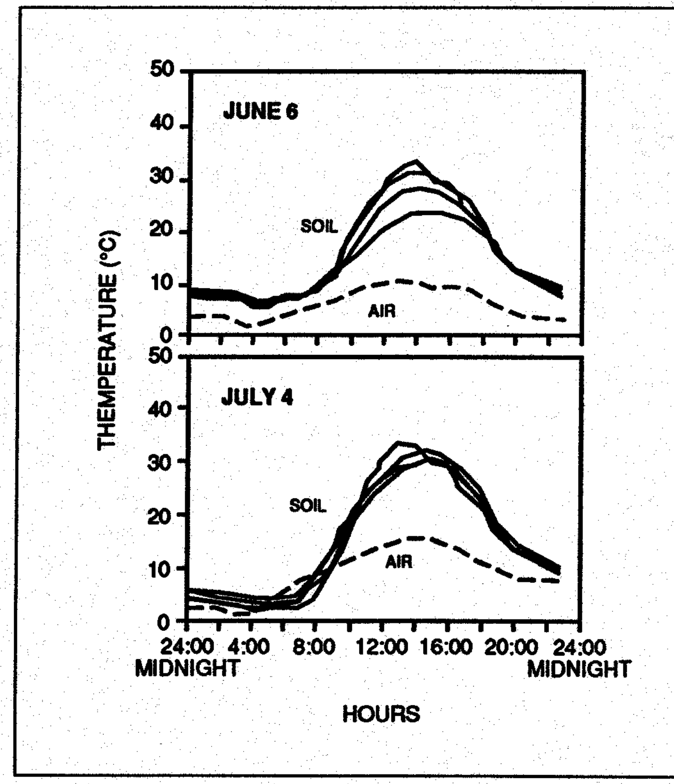

FIGURE 4. Soil temperature response to changes in air temperature during two different frost events. Soil temperature differences among treatments are not significantly different.

The scalp treatment had the lowest relative water content and therefore the lowest heat capacity of the four treatments. It also had a high heat loss potential due to the removal of the duff layer. Therefore, seedlings growing on the scalp treatment suffered the greatest frost damage. The water conservative burn and burn+scalp treatments suffered least.

Since the scalp and burn+scalp treatments were at opposite ends of the scale in water use (Figure 3) we conclude that for this specific site, evaporation was not as important a factor in loss of soil moisture as transpiration. Evaporation may have been more important if scalps were larger than the 45 cm diameter scalps used in this study or the litter had been removed by machine piling.

In conclusion, high soil moisture content can ameliorate the impact of frost on seedlings grown on high elevation sites. Moisture and the rate at which it is lost greatly affect the seedling environment in several ways. The seedlings need water to grow efficiently, but water also affects the seedling temperature and heat environment due to its high specific heat capacity and high thermal conductivity. Increased soil moisture affects the immediate seedling environment by buffering the environment against temperature extremes.

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Adaptive FIR

COARSE FRAGMENTS REDUCE WATER HOLDING CAPACITY OF SURFACE SOIL

Soil coarse fragments - gravels between 2 mm and 7.5 cm in diameter and cobbles between 7.5 and 30 cm in diameter - traditionally are considered inert material that reduces the available water holding capacity of the soil. Recent studies have found that weathered coarse fragments are not necessarily inert, but do provide water for sustaining tree growth. In a study of 40 soils in southwest Oregon, Flint and Childs found 15 percent of the available water in soil horizons was stored in coarse fragments. The coarse fragment volume, however, averaged 25 percent, indicating that the coarse fragments were less effective at storing water than the soil (FIR Report 5(2):5). In the last issue of the FIR Report (10(3):4-5), Mike Newton and associates demonstrated that seedlings and brush were able to extract water from the saprolitic rock below the soil profile (FIR Report 10(3):4-5).

How coarse fragments affect soil water holding capacity depends on several factors, including the density of rock, size of pores within the rocks, the fraction of the soil volume occupied by coarse fragments, and the effect that coarse fragments may have on the fine earth portion of the soil (soil particles less than 2 mm in diameter).

The amount of available soil water in coarse fragments increases as their bulk density decreases. Unweathered rock generally has a bulk density of at least 2.65 Mg/m^3, but weathered rock, particularly rock that can be broken with a hammer, may have a bulk density of less than 2.0 Mg/m^3 (Bulk density of soils in southwest Oregon typically ranges between 0.7 and 1.2 Mg/m^3).

As bulk density decreases, the voids within rocks increase and become another reservoir for soil water. Smaller coarse fragments (less than about 5 mm) typically hold the most water because larger fragments are generally more dense.

Recent analyses of soil cores collected from regeneration potential study sites to estimate the amount of soil moisture available to seedlings suggest coarse fragments may have a more adverse impact on soil water holding capacity of soil than previously anticipated. The effect is two-fold: bulk density of most coarse fragments is high; and the bulk density of the fine earth fraction (soil <2 mm) decreases as the coarse fragment content increases.

Three to seven pairs of soil cores, 7.5 cm in height and 7.5 cm in diameter, were collected from 37 of the regeneration potential study sites; samples were not collected from 2 sites because size and concentration of coarse fragments prevented removal of cores. Cores were hand-carved from the center of the 0-15, 15-30, and 30-60 cm depths. At least 140 pairs of soil cores were collected for each depth across all sites.

Bulk density of coarse fragments ranged between 1.88 and 2.78 Mg/m^3 with an average of 2.47 Mg/m^3. The high average bulk density suggests that water holding capacity of rocks was low on most sites. Two factors probably contribute to the high densities: samples included coarse fragments larger than 5 mm in diameter which are more dense; and many of the soils are relatively young Inceptisols that are less likely to contain coarse fragments of low density, weathered saprolite.

The bulk density of the fine earth decreases in direct portion to the mass fraction of the whole soil that is coarse fragments (Figure 1). The simple, linear regression equation is highly significant, accounting for 78 percent of the variation (n=142). A similar relationship occurs at the other depths but for a specific ratio of coarse fragment to total soil mass, the lowest fine earth bulk densities occur in the upper horizons.

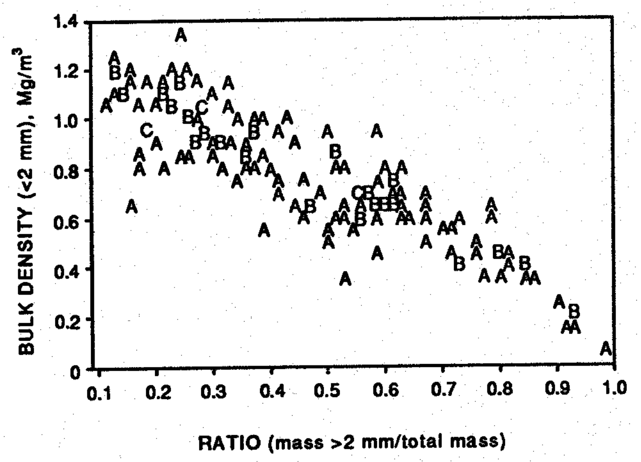

FIGURE 1. Bulk density of fine earth (soil <2mm) versus the ratio of the mass of coarse fragments to the total soil mass at the 0-15 cm depth. Letters represent the number of samples at each position: A=1; B=2; and C=3.

Decreasing fine earth bulk density with increasing coarse fragment content of the whole soil has important implications regarding soil water holding capacity. Increasing coarse fragment content not only lowers the available water holding capacity because of the smaller amount of water they contain, but the available water holding capacity of the fine earth surrounding the coarse fragments is also reduced. The water holding capacity of fine earth is reduced because it does not occupy all the pore space among coarse fragments. The remaining pore spaces are large macropores that are unable to retain water.

The implication of these findings is that loss of available soil water holding capacity will become progressively greater as the coarse fragment content increases. In addition, excessive disturbance of soils with a higher fraction of coarse fragments during planting is more likely to result in the greater separation of fine earth and coarse fragment fractions of the soil that will further lower the water holding capacity of soil near roots of planted seedlings.

In conclusion, the amount, bulk density, and size distribution of coarse fragments limit soil water holding capacity. On the regeneration potential study sites, the water holding capacity of coarse fragments is low because many sites have young soils with large, dense coarse fragments. Thus, the coarse fragments in soils at these sites are essentially inert materials. Equally important, however, is the effect that high coarse fragment contents have on reducing the bulk density of the fine earth which further reduces soil water holding capacity.

Additional analyses are planned to estimate the water holding capacity of these soils and relate it to survival of seedlings in the regeneration potential study.

DM

1988 SEEDLING SURVIVAL FOR REGENERATION POTENTIAL STUDY

This study addresses the potential for artificially reforesting lands within the Medford District BLM that were perceived to be difficult to reforest. The potential for artificial reforestation is being measured by planting two stocktypes of Douglas-fir on sites that have been selected to represent the range in environmental characteristics of these lands. In addition, ponderosa pine has been planted on sites below 2700 feet in elevation. Sugar pine has been planted on three sites and plug-1 Douglas-fir has been planted on one site.

Sites were clearcut harvested and most broadcast burned. Following planting, weeds were controlled by mulching, and clipping and grubbing with hand and power tools so that seedling survival and growth would reflect the potential of the site. Douglas-fir seedlings have been protected from deer browsing by Vexar® plastic mesh tubes.

Most of the seedlings have now been planted for 3- to 5 years. Survival averages over 70 percent for all age species, or stocktype (Table 1). Maximum survival among all sites, however, averages 82 percent, reflecting better adaptation of certain species and stocktypes to specific sites. Low survival is generally attributable to heat damage, poor planting, and weeds; porcupines also damaged the ponderosa pine. Ponderosa pine survival averages about 7 percent higher than the Douglas-fir; survival of 2-0 bareroot Douglas-fir seedlings across all sites averages only 1 percent higher than the 1-0 plugs.

At the end of the 1988 growing season, seedlings on 12 study sites, approximately one-third of the sites, were at least 5 years old. Within this group, mortality for each stocktype was low in 1988 despite the drought and any carryover effects of the previous summer's drought. Survival of 1-0 plug Douglas-fir decreased by 4 percent while the 2-0 bareroot Douglas-fir and 1-0 plug ponderosa pine decreased 2 percent; 2-0 bareroot ponderosa pine remained unchanged.

For sites completing four growing seasons, declines in survival for each stocktype were slightly greater. Survival dropped 8- and 4

TABLE 1. Seedling surival at the end of 1988 for study sites in the regeneration potential study.

Site (Years of observation)	Aspect	Stocktype and Species* 1-0 Plug DF	2-0 Bare-root DF	Plug-1 DF	1-0 Plug PP	2-0 Bare-root PP	1-0 Plug Sugar Pine
Tin Pan Peak(5)	W	88	98		90	97	
Salt Creek(5)**	S	66	85			92	
Dutch Herman #1(5)	N	74	84				
Hog Remains(5)	N	60	88				
Julie Creek(5)	S	40	77				
Negro Ben(5)	S	71	69		98		
Forest (Oregon) Belle(5)	S						82
Peggler Butte(5)	S	41	45				
Rock Creek(5)	S	38	40		68		
Steven's Creek(5)	S	35	51	90	86		
Texter Gulch(5)	W	86	82		90	94	
Walker Return(5)	S	61	82				
Blue Gulch(4)	N				99		
Brandt Crossing(4)	S	82	60		95		
Buckhorn #1(4)	S	73	70		59		
Burton Butte(4)	N	70	74		95		
Chrome Umbrella(4)	S	97	93				
Dutch Herman #2(4)	N	89	77				
West Left Fielder(4)	W	77	83		49		
Limp Hog(4)	S	22	11		44		
Marial Ridge(4)	S	58	82				
Millcat(4)	N	84	82		67		
Miller Gulch(4)	S				23		
Myrne Return(4)	N	69	82				
Pickett Again(4)	S	85	67		88		
Rocky Ravel(4)	N	72	83				
Wolf Gap(4)	S	70	83				
South Left Fielder(3)	S	85	77		71		
Buckhorn #2(3)	S	71	55				81
China Ridge(3)	S	89	77		93		
Dutch Herman #3(3)	N	82	79				
Hayes Creek(3)	S	93	74				
Howard Quick(3)	N	46	59				
Low Crow(3)	N	82	48			85	59
Missouri Blowdown(3)	N	98	94				
Old Ben(3)	S	89	89		73		
Totten Creek(3)	S	85	67				83
Flume Descent(2)	SW	92	86		89		
Lower Grave Creek(2)	S	86	88		86		

*DF = Douglas-fir, PP = ponderosa pine.
**Douglas-fir data are averages of shaded and unshaded seedlings.

percent for 1-0 plugs and 2-0 bareroot Douglas-fir, respectively. Survival of ponderosa pine decreased by 6 percent, primarily as a result of porcupine depredation at the West Left Fielder site.

For sites completing two or three growing seasons at the end of 1988, survival declines from the previous year were 6 percent for 1-0 plug Douglas-fir, 5 percent for 2-0 bareroot Douglas-fir, 8 percent for ponderosa pine, and 11 percent for sugar pine.

The trend is for changes in survival to decrease as plantation age increases despite the occurrence of drought. This trend is also evident in the plot of survival versus seedling age for sites with 5 years of data (Figure 1). The greatest drop in survival is in the year of planting.

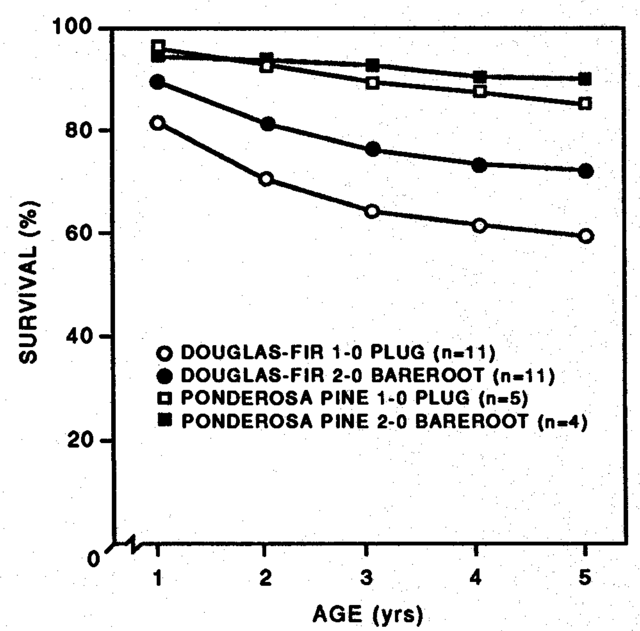

FIGURE 1. Survival of Douglas-fir and ponderosa pine over time. Data is from regeneration potential study sites which are at least 5 years old.

For background material on this study, see FIR Reports 3(3):4, 4(1):1, 4(4):4, 5(2):6-7, 5(4):4, 6(4):4, 8(4):2-3, 9(2):2, and 10(1):3-4.

OH

Fundamental FIR

BASELINE CONCENTRATION MEASUREMENTS OF HERBICIDES IN THE AIR OF SOUTHWEST OREGON

This study samples known volumes of air over approximately one week intervals continuously from April until October, and then approximately one week during each month from September through March to determine the baseline concentration of three herbicides in air. Data has been collected for three years, 1985 to 1987. There are some data gaps due to cooperators being on fires, slow delivery of sample containers by mail, and other problems; but these problems have not impacted the study greatly. Data is reported through September 1, 1987. Data over the past year is in the process of being interpreted and calculated.

Six stations were initially established, however, one station has been dropped from the program because of difficulties in sample handling. The stations are located at 1) the Star Ranger Station in Applegate Valley, 2) the Takilma People's Clinic in the Illinois Valley, 3) the Harbor Community Water District pumping station on the Chetco River, 4) the Agness Guard Station near the confluence of the Rogue and Illinois Rivers, 5) just south of Powers, and 6) the station with discontinued sampling is the Rand BLM Station.

Residues filtered from the atmosphere were analyzed for picloram (Tordon), 2,4-D, and triclopyr (Garlon). These herbicides were chosen because they could be analyzed simultaneously, they are among the most commonly used herbicides in forestry, and while of generally low to moderate mammalian toxicity, they are among the more effective herbicides. Sources of the residues are not restricted to forest applications, since these same herbicides are used in agriculture, road and powerline right-of-way maintenance, and certain industrial sites. These results do not imply that the sources are from forestry operations. The station locations sample airsheds with a high proportion of private and public forest land. Most are midway between commercial forest lands and population centers.

Residues were captured with a polystyrene resin with small pores called Amberlite XAD-4. Separation and quantification of samples were accomplished with a high pressure liquid chromatograph. The detection limit averages about 1 nanogram (1×10^{-9} gram) of herbicide per cubic meter of air. The detection limit is sometimes greater, because of 1) smoke from forest fires in the late summer, 2) smoke from wood burning at homes in the winter at some locations, and 3) random interferences untraceable to any particular source. Residues reported as detections are based on a limited number of chemical parameters, but they have a high probability of being the stated compound. Because they could possibly be interferences, we are preparing analytical techniques with a mass spectrometer to positively identify the residues in sample extracts we have saved.

The concentrations of the herbicides detected in air is low, averaging 1.67 parts per trillion, or 2 ng of herbicide per cubic meter in dry air at 71.6°F (Table 1). The U.S. Environmental Protection Agency threshold limit value for the concentration of 2,4-D in air is 8.3 parts per million. The levels of the herbicides we detected averaged over a million times less than this level. The sampling procedure averages the residue concentrations over a week's volume of air (350 cubic meters). This means that the herbicides we detected may 1) have arrived at the samplers as high concentration but short duration pulses; 2) arrived as several lower concentration and longer duration pulses; 3) or have been present throughout the

TABLE 1. Average weekly concentration of herbicides in those samples which contained detectable residue levels (about 10% of all samples).

		ng m^{-3}		
STATION	PERIOD	PICLORAM	2,4-D	TRICLOPYR
Applegate	4/13 - 4/20/87	2.41		
	6/2 - 6/9/87			2.00
	7/13 - 7/20/87	2.60		1.42
	8/3 - 8/10/87	2.01		
Rand	No residues detected, through 7/15/86			
Chetco	9/19 - 9/26/85		1.32	
	6/19 - 6/26/87	2.30		
	6/26 - 7/7/87	1.52		
	7/10 - 7/17/87	1.96	4.55	
	7/17 - 8/3/87	1.10		
Agness	9/9 - 9/16/85			1.24
	9/18 - 9/26/85		22.95	
	9/26 - 10/2/85		1.38	
	6/5 - 6/12/86			5.29
	5/19 - 5/26/87	1.43		
	7/8 - 7/15/87			1.78
	7/15 - 7/22/87			1.47
	7/22 - 7/30/87	1.08		1.00
	7/30 - 8/7/87	1.30		
	8/7 - 8/14/87	1.53		
	8/14 - 8/21/87	2.32	2.12	
Powers	8/22 - 9/9/85		2.32	
	6/4 - 6/17/86			1.40
	6/20 - 6/27/86			1.38
	7/9 - 7/16/87		1.05	6.38
	7/23 - 7/30/87		1.67	3.20
	7/30 - 8/6/87	1.62		
Takilma	5/15 - 5/22/87			2.10
	5/29 - 6/5/87	1.27		
	6/29 - 7/6/87	1.63		
	8/1 - 8/9/87	1.27		

sampling period at low concentrations. Most air samples (about 90%) do not contain detectable residues, while about 10% contain residues of one or more herbicides.

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Continuing Education

OLD-GROWTH DOUGLAS-FIR FORESTS: WILDLIFE COMMUNITIES AND HABITAT RELATIONSHIPS

March 29-31, 1989. Portland, Oregon. A symposium based on the results of the research conducted by the USDA Forest Service Old-Growth Forest Wildlife Habitat Research Program and cooperators. Topics include the ecological definition and classification of old-growth Douglas-fir forests, characteristics of forest development, and vertebrate abundance along environmental, habitat association, and landscape gradients. CONTACT: Continuing Education Office, College of Forest Resources, AR-10, University of Washington, Seattle, WA 98195. (206) 543-0867.

REFORESTATION OF HIGH ELEVATION SITES IN SOUTHWEST OREGON AND NORTHERN CALIFORNIA

May 16, 1989. Grants Pass, OR. Program will address the general problems of reforestation of high elevation sites including the climate, soil physical, chemical, biological environment and pests, of granitic and nongranitic sites, and natural reforestation strategies. Workshop director: Ole Helgerson. CONTACT: Lenore Lantzsch, Adaptive FIR, (503) 776-7116.

MANAGING FOREST SOILS IN SOUTHWEST OREGON

SOIL PHYSICS

June 13, 1989, Nendel's Inn, Medford, and June 15, 1989, Umpqua Community College, Roseburg. Program will discuss the soil physical environment as it relates to forest management in southwest Oregon. Emphasis will be on interpreting the knowledge obtained by various FIR studies over the past decade. Topics to be addressed include the compactability of soil, soil temperature, effects of fire on water repellency, water holding capacity of soil, plantability of soil, and effect of soil on seedling survival.

SOIL NUTRIENTS/BIOLOGY

July 6, 1989, Nendel's Inn, Medford, and July 12, 1989, Umpqua Community College, Roseburg. Objective of program is similar to earlier session but will cover soil nutrients and biology. Topics to be addressed include using soil tests to predict fertilizer response, nutrient loss during prescribed burning, seedling fertilization, nutrient management, soil biology, and long-term forest productivity.

Both programs will be one day in length and repeated at each location. Registration will be for either or both programs. Workshop director: Dave McNabb. CONTACT: Lenore Lantzsch, Adaptive FIR (503) 776-7116.

FUTURE PROGRAMS AT OSU

April 3-7, 1989. Variable probability sampling: Variable plot & three-P.

May 24-26, 1989. Data base management systems for foresters.

CONTACT: Conference Assistant, Oregon State University, (503) 754-2004.

Of Interest

LEARNING MATERIALS AVAILABLE FROM FOREST MEDIA CENTER

The Forestry Media Center has just published its 1989 catalog of learning materials. The catalog describes over 100 slide-tapes, video tapes, and other learning resources available from the FMC for rental or purchase. Many new programs have been added, among them:

Forest Vegetation Management (slide-tape 932)

The Behavior of Pesticides in the Forest Environment (video tape series 911.1 & 911.2)

Logging Road Construction (slide-tape 909)

Designated Skid Trails (slide-tape 903)

Trees of North America (slide-tape series)

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Copies of the following publications are available from the source noted in parentheses at the end of each abstract. Addresses for sources are listed below:

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Portland, OR 97208-3890

(IRS) -Intermountain Research Station
324 25th Street
Ogden, Utah 84401

NATURAL VEGETATION OF OREGON AND WASHINGTON, reprinted edition by J.F. Franklin and C.T. Dyrness. Oregon State University Press, Corvallis. 452 p. This is a reprint of the book on regional ecology that was first issued in 1973 as General Technical Report PNW-8 by the USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. The publication contains information on unusual habitats, physiography, geology, and soils, and is illustrated with over 200 photographs. Appendixes define soil types, list scientific and common names of plants, and provide a general subject index. The reprint edition also contains a commentary and supplement by J.F. Franklin and T. Blinn. The supplement identifies the major advances in research and understanding of the vegetation of the Pacific Northwest since 1973. It also includes more than 500 citations, updating through 1987 the bibliography in the 1973 publication. (The supplement is also available from the Pacific Northwest Research Station for those wanting to update the original edition. See listing elsewhere in this section.)

The reprinted edition is available from Oregon State University Press, 101 Waldo Hall, Corvallis, OR 97331. Price: $22.95, plus $2.00 for shipping.

TIMBER-DERIVED REVENUES: IMPORTANCE TO LOCAL GOVERNMENTS IN OREGON (FISCAL YEARS 1982-83 THROUGH 1986-87) by K. Hackworth and B. Greber. 1988. Forest Research Laboratory, Oregon State Univ., Corvallis. Special Publication 17. 20 p. The forestry sector contributes significant revenues to local governments in Oregon. This paper briefly describes public and private forestry contributions and the relative importance of these payments to five forms of local governments — county governments, schools, education service districts, rural fire protection districts, and road districts — in fiscal years 1982-1983 to 1985-86. The contribution of property tax payments from the forestry sector to statewide property taxes in 1986-87 is also analyzed. (OSU)

MOUNTAIN LOGGING NEAR STREAMS: OPPORTUNITIES AND CHALLENGES by P. W. Adams, R.L. Beschta and H. A. Froehlich. 1988. p. 153-162. Proc., Int'l Mountain Logging and Pacific Northwest Skyline Symp., Dec. 1988, Portland, Oregon, College of Forestry, Oregon State Univ., Corvallis. Mountain logging near streams has come under increasing scrutiny and control in the Pacific Northwest as the unique functions and benefits of streamside areas have become more apparent. These characteristics include diverse and productive plant cover and forest stands, heavy shade, abundant large and fine organic debris, control of erosion and sedimentation, and significant fish and wildlife habitat. Logging near streams can alter many of these characteristics and produce a variety of resource effects. Among the key challenges related to logging near streams are habitat improvement, integrated resource and operations planning, the development of site-specific and prioritized streamside management practices, and evaluations of logging feasibility and environmental trade-offs. Skills and abilities in communicating and applying appropriate technologies and approaches to meet these challenges will become increasingly important. (OSU)

SPECIES COMPOSITION AND DIVERSITY DURING SECONDARY SUCCESSION OF CONIFEROUS FORESTS IN THE WESTERN CASCADE MOUNTAINS OF OREGON by P. Schoonmaker and A. McKee. 1988. For. Sci. 34:960-979. Species diversity and community composition were studied at 23 sites on similar western hemlock/Douglas-fir forest habitats, in undisturbed old-growth stands and stands at 2, 5, 10, 15, 20, 30, and 40 years after clearcutting, broadcast burning, and planting with Douglas-fir. Vegetation was sampled with three 5 x 60 m transects at each site. Invading herbs, then invading and residual shrubs, and finally conifers dominated through the first 30 years. Late seral species, which account for 99% of cover in old-growth stands, are nearly eliminated immediately following disturbance, species diversity trends weakly upward with heterogeneity peaking at 15 years and richness at 20 years. This initially high diversity (higher than that of old-growth stands) is short-lived. After the tree canopy closes, species diversity declines reaching its lowest values at 40 years. Only two species were eradicated after disturbance, both mycotrophs. Pacific Northwest old-growth forests are relatively poor in species, but moderately high in heterogeneity values. (OSU)

ALTERNATIVE SUPPLY SPECIFICATIONS AND ESTIMATES OF REGIONAL SUPPLY AND DEMAND FOR STUMPAGE by K.P. Connaughton, D.H. Jackson and G.A. Majerus. 1988. Pacific Northwest Research Station Res. Pap. PNW-RP-399, Portland, OR. 19 p. Four plausible sets of stumpage supply and demand equations were developed and estimated; the demand equation was the same for each set, although the supply equation differed. The supply specifications varied from the model of regional excess demand in which National Forest harvest levels were assumed fixed to a more realistic model in which the harvest on the National Forests depended on current Federal timber sales, uncut-volume-under-contract, and stumpage price. Each set of equations was estimated with annual time-series data for Montana to test the effect of changing supply specification on stumpage demand. Each of the four sets of equations was estimated with two different proxies for the price of stumpage to test the effect of changing the definition of private stumpage price on demand. The slope of the demand curve — the coefficient measuring the change in stumpage price per unit change in quantity demanded — varied, sometimes dramatically, by supply specifications and by the proxy used to measure stumpage price. (PNW)

PRICE PROJECTS FOR SELECTED GRADES OF DOUGLAS-FIR LUMBER by R.W. Haynes, T.D. Fahey and R.D. Fight. 1988. Pacific Northwest Research Station Res. Note PNW-RN-473, Portland, OR. 10 p. Grade-specific price projections were developed for Douglas-fir produced in the Douglas-fir region. These grade-specific price projections can be used as an aid in evaluating management practices that will affect the quality of saw logs that are produced. (PNW)

SPORT FISHING: A COMPARISON OF THREE INDIRECT METHODS FOR ESTIMATING BENEFITS, D.L. Hueth, E.J. Strong and R.D. Fight, tech. eds. 1988. Pacific Northwest Research Station Res. Pap. PNW-RP-395, Portland, OR. 99 p. Three market-based methods for estimating values of sport fishing were compared by using a common database. The three approaches were travel-cost method, the hedonic travel-cost method, and the household-production method. A theoretical comparison of the resulting values showed that the results were not fully comparable in several ways. The comparison of empirical results showed differences in values not easily accounted for on theoretical grounds. The database was not designed to provide data for all three methods, and some of the resulting models explain only a small proportion of the variation. (PNW)

BACTERIAL WATER QUALITY RESPONSES TO FOUR GRAZING STRATEGIES —COMPARISONS WITH OREGON STANDARDS by A.R. Tiedemann, D.A. Higgins, T.M. Quigley, H.R. Sanderson and C.C. Bohn. 1988. J. Environ. Quality 17:492-498. Levels of fecal coliform (FC) and fecal streptococcus (FS) were measured weekly during summer 1984 in streamwater of 13 wildland watersheds under four range management strategies. Strategies included (A) no grazing; (B) grazing without management for livestock distribution; (C) grazing with management for livestock distribution; and (D) grazing with management for livestock distribution and with cultural practices to increase forage. Counts of FC were compared to Oregon State water quality standards. Data for FS were used for determining the FC/FS ratio to assess origin of FC organisms. Counts of FC were significantly lower (p<05) with strategies A and C than with Strategy D, but there were no significant differences among other strategy comparisons. Two of the strategy D watersheds violated the Oregon State water quality 30 day log 10 standard of no more than 200 FC/100 miles. One of these was in violation for the major part of the sampling period. Ratios of FC/FS indicated that wildlife were the major source of FC bacteria in strategy A, Strategy B, and all but one of the strategy C watersheds. Cattle were the primary source in one strategy C watershed and in all strategy D watersheds. (PNW)

GROWTH OF DOUGLAS-FIR IN SOUTHWESTERN OREGON AFTER REMOVAL OF COMPETING VEGETATION by A.E. Jaramillo. 1988. Pacific Northwest Research Station Res. Note PNW-RN-470, Portland, OR. 10 p. After three growing seasons, young Douglas-fir trees in plots of various sizes that had been totally cleared of nonconifer vegetation were larger than trees in plots that had been partially cleared or not cleared at all. On the Bybee unit (Illinois Valley Ranger District, Siskiyou National Forest), height and diameter differences were highly significant between treatments. Diameter differences between the treatments were highly significant on the Squaw unit (Illinois Valley Ranger District, Siskiyou National Forest). (PNW)

YARDING-METHOD AND SLASH-TREATMENT EFFECTS ON COMPACTION, HUMUS, AND VARIATION IN PLANTATION SOILS by D. Minore and H.G. Weatherly. 1988. Pacific Northwest Research Station Res. Note PNW-RN-476, Portland, OR. 6 p. Soil penetration-resistance and soil-humus frequency were measured on 86 progeny-test plantations in southwestern Oregon to determine the effects of yarding method and slash treatment on soil compaction and humus, and a disturbance index was calculated for each plantation. Compaction and humus loss were more severe on tractor-yarded, machine-piled plantations than on cable-yarded, broadcast-burned plantations. Machine piling and burning of slash did not increase compaction or humus loss significantly more than broadcast burning on tractor-yarded plantations. Within-plantations variation in soil compaction was greater on tractor-yarded, broadcast-burned plantations than on tractor-yarded plantations from where stumps were removed. (PNW)

GROWTH AND YIELD OF A MANAGED 30-YEAR-OLD NOBLE FIR PLANTATION by M.D. Murray. 1988. Pacific Northwest Research Station Res. Note PNW-RN-475, Portland, OR. 8 p. A thinned and fertilized noble fir plantation produced 3,450 cubic feet per acre 30 years after it was planted in western Washington. More than half of this volume was in trees with diameter at breast height of 10 inches and larger. Current annual increment the last 6 years was 295 cubic feet per acre. Ornamental boughs have been harvested annually for about a 15-year period within the 30 years of the plantation's existence. The measured yield of the noble fir plantation was compared with the estimated yield of a Douglas-fir plantation of the same age; total noble fir volume was about 5 percent less than the estimated volume of Douglas-fir. The estimated value of the noble fir, including saw logs and boughs, could exceed the value of Douglas-fir growth on the same site 48 years after plantation establishment. (PNW)

CLINOMETER VERSUS POLE MEASUREMENT OF TREE HEIGHTS IN YOUNG DOUGLAS-FIR PROGENY TESTS by G.T. Howe and W.T. Adams. 1988. West. J. Appl. For. 3:86-88. Measurement of 8 m tall Douglas-fir saplings in progeny test plantations resulted in slightly smaller estimates of tree height than estimates with a height-pole; however, measurement of height with a clinometer took considerably less time and had only a minor affect on the family height rankings. (OSU)

PROTECTING PEOPLE AND HOMES FROM WILDFIRE IN THE INTERIOR WEST: PROCEEDINGS OF THE SYMPOSIUM AND WORKSHOP. W.C. Fischer and S.F. Arno, compilers. 1988. Gen. Tech. Rep. INT-251, USDA Forest Serv. Intermountain Res. Sta., Utah. 213 p. Includes 25 invited papers and panel discussions, 6 workshop reports, and 15 poster papers that focus on the escalating problem of wildfire in wildland residential areas throughout the western United States and Canada. 1987 October 6-8. (IRS)

A FIELD GUIDE FOR PREDICTING SNOW DAMAGE TO PONDEROSA PINE PLANTATIONS by W.F. Megahan and R. Steele. 1988. Res. Note INT-385, USDA For. Serv. Intermountain Res. Sta., Utah. 9 p. Describes a procedure for predicting potential damage to ponderosa pine plantings due to weight and movement of snowpack. Provides an example of the procedure for field use and discusses management implications of planting ponderosa pine in areas with high potential for snow damage. Current area of application covers the Weiser and Payette River drainages in central Idaho. (IRS)

PROCEEDINGS OF THE ALASKA FOREST SOIL PRODUCTIVITY WORKSHOP by C.W. Slaughter, T. Gasbarro, eds.; T. Lawson, tech. ed. 1988. USDA Forest Serv., Pacific Northwest Research Station, Fairbanks, AK. 120 p. The Alaska forest soil productivity workshop addressed (1) the role of soil information for forest management in Alaska; (2) assessment, monitoring, and enhancement of soil productivity; and (3) Alaska research projects involved in studies of productivity of forests and soils. This proceedings includes 27 papers in five categories: agency objectives in monitoring and enhancing long-term forest productivity; practical approaches to assessing soil productivity and tree growth measurements; soil productivity monitoring for project assessment, implementation, and compliance; soil productivity and tree growth in coastal spruce and hemlock forests; soil productivity and tree growth in interior spruce and hardwood forests; and tree improvement and its role in overcoming site limitations. (PNW)

EFFICACY OF IMAZAPYR AND METSULFURON METHYL FOR SITE PREPARATION AND CONIFER RELEASE IN THE OREGON COAST RANGE by E.C. Cole, M. Newton and D.E. White. 1988. Forest Research Laboratory Res. Note 81, Oregon State University, Corvallis, OR. 7 p. Efficacy of imazapyr and metsulfuron methyl, two new chemicals with potential for forestry applications, was evaluated on several Oregon Coast Range shrub species, including red alder, bigleaf maple, salmonberry, and evergreen and Himalaya blackberry. Injury to Douglas-fir seedlings also was assessed. Imazapyr was highly effective on red alder and bigleaf maple, but less effective on salmonberry and both blackberry species. Metsulfuron methyl was ineffective on red alder and bigleaf maple, but gave excellent control of salmonberry and both blackberry species. Both chemicals caused severe injury to Douglas-fir seedlings, especially when applied during the growing season. Imazapyr (currently registered for limited forestry use in Oregon and Washington) and metsulfuron methyl (currently registered for rights-of-way and roadsides) are promising for site preparation in the Coast Range but are limited as broadcast applications for Douglas-fir release. (OSU)

DETERMINING COSTS OF LOGGING-CREW LABOR AND EQUIPMENT by S.P. Bushman and E.D. Olsen. 1987. Forest Research Laboratory Res. Bull. 63, Oregon State University, Corvallis. 22 p. Small, independent logging contractors can benefit from the established procedures of cost control and cost planning compiled in this report. Ways of tracking labor and equipment costs of a logging crew and the production records available for determining the volume removed from an area for a given time are described. Example costs are from Oregon contractors, but the principles can apply to logging companies elsewhere. Cost and production for a given time period can be used to determine the unit cost of production. (OSU)

CREATING LANDSCAPE PATTERNS BY FOREST CUTTING: ECOLOGICAL CONSEQUENCES AND PRINCIPLES by J.F. Franklin and R.T.T. Forman. 1987. Landscape Ecology 1:5-18. Landscape structural characteristics, such as patch size, edge length, and configuration, are altered markedly when management regimes are imposed on primeval landscapes. The ecological consequences of clearcutting patterns were explored by using a model of the dispersed patch or checkerboard system currently practiced on federal forest lands in the western United States. Thresholds in landscape structure were observed on a gradient of percentages of landscape cutover. Probability of disturbance, e.g., wildfire and windthrow, and biotic components, e.g., species diversity and game populations, are highly sensitive to these structural changes. Altering the spatial configuration and size of clearcuts provides an opportunity to create alternative landscapes that differ significantly in their ecological characteristics. Both ecosystem and heterogeneous landscape perspectives are critical in resource management. (PNW)

PONDEROSA PINE MANAGED-YIELD SIMULATOR: PPSIM USERS GUIDE by D.J. DeMars and J.W. Barrett. 1987. Gen. Tech. Rep. PNW-GTR-203, USDA Forest Serv., Pacific Northwest Research Station, Portland, OR. 36 p. PPSIM simulates yields of natural and managed ponderosa pine stands. Management practices and effects that can be simulated include commercial thinning, fertilization, genetic improvement, and presence of dwarf mistletoe. An option is available that adjusts growth to simulate local conditions. Equations used in PPSIM describe growth of natural stands, estimate the volume increment of thinned stands, and predict the amount and timing of mortality in natural stands. The Fortran IV program is available from the authors on request. (PNW)

OLD-GROWTH DOUGLAS-FIR AND WESTERN HEMLOCK: A 36-YEAR RECORD OF GROWTH AND MORTALITY by D.S. DeBell and J.F. Franklin. 1987. West. J. Appl. For. 2:111-114. Growth and mortality were measured at 6-year intervals in a 1,180-acre old-growth stand in southwestern Washington. Principal tree species were Douglas-fir (Pseudotsuga menziesii), western hemlock (Tsuga heterophylla), Pacific silver fir (Abies amabilis), western red cedar (Thuja plicata), and western white pine (Pinus monticola). They composed 59, 27, 6, 6, and 1%, respectively, of the total cubic volume (13,290 ft^3) in 1947. Gross volume growth averaged 94 ft^3 per acre per year, and mortality averaged 86 ft^3 per acre per year. Net growth was therefore minimal, and total stand volume remained nearly constant for 36 years. Douglas-fir, which accounted for only one-third of the gross growth and nearly one-half of the mortality, is losing dominance to western hemlock, which provided nearly one-half the gross growth and only 28% of the mortality. Pacific silver fir increased in importance in the lower canopy and composed 60% of the in-growth. Thus, although net gain in timber volume was nil, substantial changes occurred in stand characteristics during the 1947-1983 period. (PNW)

SEVEN CHEMICALS FAIL TO PROTECT PONDEROSA PINE FROM ARMILLARIA ROOT DISEASE IN CENTRAL WASHINGTON by G.M. Filip and L.F. Roth. 1987. USDA For. Serv. Pacific Northwest Research Station Res. Note PNW-RN-460, Portland, OR. 8 p. Chemicals were applied once to the root collars of small-diameter ponderosa pine (Pinus ponderosa Dougl. ex Laws.) to prevent mortality caused by Armillaria obscura (Pers.) Herink Roll-Hansen (=A mellea sensu lato). After 10 years, none of the 15 treatments appeared to reduce mortality in treated trees vs. untreated trees. Diameter growth of surviving trees averaged 3.0 millimeters per year, and the spread rate of the fungus averaged 0.6 meter per year. (PNW)

ILLUSTRATING HARVEST EFFECTS ON SITE MICROCLIMATE IN A HIGH-ELEVATION FOREST STAND by W.G. Fowler and T.D. Anderson. 1987. USDA For. Serv. Pacific Northwest Research Station Res. Note PNW-RN-466, Portland, OR. 10 p. Three-dimensional contour surfaces were drawn for physiologically active radiation (PAR) and air and soil temperatures from measurements taken at a high-elevation site (1450 m) near the crest of the Cascade Range in central Washington. Measurements in a clearcut were compared with measurements from an adjacent uncut stand. Data for 31 days in July and August 1985 illustrated the rapid changes as storms off the Pacific Ocean displaced the dominant high pressure of summer. (PNW)

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