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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,

Ole T. Helgerson
Reforestation Specialist

Inside

OREGON STATE UNIVERSITY EXTENSION SERVICE

FORESTRY INTENSIFIED RESEARCH

SERVING SOUTHWEST OREGON THROUGH RESEARCH AND EDUCATION

Adaptive FIR

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Because of space limitations, results appear as extended abstracts. Readers who are interested in learning more about an individual study are encouraged to contact the principal investigator or wait for formal publication of more complete results.

HOBBS TO COPE. All puns intended as Steve Hobbs prepares to move to Corvallis this summer to head up COPE, the new OSU-PNW research cooperative that will focus on forest management problems of coastal Oregon. Steve will also remain actively involved in the FIR Program, assisting research on selected studies and directing efforts on the FIR reforestation book.

Its fair to rank Steve as one of FIR's primogenitors. The success of FIR is due in no small part to his hard work and leadership. In his stead, Steve Tesch will take over leadership of Adaptive FIR. This arrangement will give COPE a strong start and permit FIR to continue to fulfill its responsibilities.

Special thanks are due Steve Tesch for editing another excellent volume of the FIR Report. The success of the FIR Report is also in large part due to support and suggestions received from our readers and contributors. As editor of Volume 9, I ask for your continued cooperation and help in maintaining our standards for timely reporting of technological advances and research results useful for southwest Oregon.

OH

Current Research

FERTILIZER BRIQUETS INCREASE FIRST YEAR GROWTH OF PLANTED DOUGLAS-FIR SEEDLINGS IN SOUTHWEST OREGON

In the Pacific Northwest, slow growth of conifer seedlings after planting lengthens rotations by increasing the period of time seedlings are vulnerable to competition from weeds, and to damage by deer and rodents. To boost growth, a variety of slow release fertilizers have been tested (either in the planting hole or in adjacent soil) when seedlings have been planted. Subsequent growth and survival have varied, sometimes seeming to depend on fertilizer type, seedling stocktype, weeds, and soil fertility.

In addition to the previously tested fertilizers, a new product formulated of isobutylidene diurea (IBDU) is now commercially available. IBDU briquets are advertised as weighing 16 g and containing slow-release formulations of either 14-3-3 (N,P,K) with Ca, Mg, Cu, Fe, Mn, and Zn, or 23-2-0 with Mg. Similar briquets have greatly increased growth of planted native conifers in Japan, but do not yet appear to have been tested under conditions of operational reforestation in the Pacific Northwest. This product's characteristics suggest that it may last in the soil longer and damage seedlings less than other types of fertilizers. Fertilizing seedlings at planting has been suggested as an alternative to weed control in allowing conifer seedlings to become established. But other studies show that not all fertilizers enhance seedling survival and growth, and may not help seedlings compete with weeds. This study was established to see whether IBDU briquets applied at planting would enhance survival and growth of 1+0 container-grown Douglas-fir seedlings planted on a clearcut site typical of the Siskiyou Mountains in southwest Oregon. This paper describes first-year results. For a discussion of other types of fertilizer applied to 2+0 Douglas-fir seedlings, see the article by Haas and McNabb in this issue.

The study plots face northwest at the base of a 60 percent slope, in a clearcut at approximately 2400 feet above sea level, (T. 34S., R.9W., S.25). The surrounding forest is within the Mixed Evergreen Forest Zone on lands managed by the Medford District, Bureau of Land Management, in the Siskiyou Mountains. Soils are classsified as intergrading between a loamy-skeletal, mixed, mesic Lithic Xerochrept and a loamy-skeletal, mixed, mesic Typic Xerochrept (Borine 1983), although soil in the study plots appears to be non-skeletal. The area receives approximately 80 inches of precipitation annually and 8 inches between May 1 and September 30. The site was burned in the fall of 1985 after logging, and the test seedlings (1+0 Douglas-fir grown in 10 cubic inch containers) were planted April 17, 1986 during cool (40-50 degree F), rainy weather. The treatments followed a randomized complete block design with four replications. The tree planters scalped and benched each planting spot with their planting hoes, and in fertilizer plots, dropped an IBDU briquet (14-3-3) into the planting hole before emplacing the seedling. The seedlings were protected from deer browsing by 16 inch "Vexar" plastic tubes attached to lath stakes.

The test seedlings broke bud uniformly with little mortality. Their needle length and color appeared normal, whereas on adjoining operationally planted 2+0 bareroot Douglas-fir, new needles on unbrowsed shoots were shorter and slightly chlorotic.

At planting, control and fertilized seedlings did not differ significantly in size. At the end of the first growing season, new needles on fertilized and unfertilized seedlings were non-chlorotic, but fertilized seedlings were significantly ($p<.05$) greater in diameter, height and volume, with approximately twice the growth increment of unfertilized seedlings. Because needles were also non-chlorotic at planting, this suggests that seedling growth after planting responds to additional nutrient levels beyond those that eliminate chlorosis in the first flush of growth. Seedling survival for both seedling treatments was good. Survival of unfertilized seedlings was lower, but not significantly so (Table 1). One seedling was browsed by deer. The IBDU briquets (14-3-3) thus appear to increase first-year seedling growth without decreasing survival.

Table 1. Growth and survival of 1+0 container-grown Douglas-fir seedlings planted at Julie Creek fertilizer study site. [1]

	Controls	Fertilized
Diameter (mm)		
Planting	3.1	3.1
Fall 1986	4.3a	5.7b
Increment[2]	1.2a	2.6b
% Change[2]	38a	87b
Height (mm)		
Planting	220	212
Fall 1986	295a	344b
Increment	74a	130b
% Change	34a	63b
Volume (cubic cm)[3]		
Planting	2.26	2.12
Fall 1986	6.97a	13.28b
Increment	4.74a	11.15b
% Change	213a	550b
Survival	88	95

[1]Means in a row with different letters differ at the $p < .05$ level.

[2]Size increment and % change calculated on a per-seedling basis with % change = (increment/size at planting)100.

[3]Volume = Diameter squared times height.

The IBDU briquets cost $0.040 each (1986); however, available data are not adequate to determine whether they will remain biologically effective or become cost effective. If fertilized seedlings maintain their growth advantage and capture enough site resources to ensure survival before weed competition occupies space opened by site preparation, then they should have a competitive advantage over non-fertilized seedlings. Because the test site contained clumps of sprouting tanoak (Lithocarpus densiflorus Rehd.) and approximately 30 percent cover of Senecio vulgaris (L.) at the end of the first growing season, subsequent measurements should indicate whether increasing competition from these species suppresses the positive growth response to fertilizer, or whether increased growth from fertilization gives newly planted seedlings a competitive advantage.

OH
Nabil Atalla, Medford District, BLM

NEWLY PLANTED SEEDLINGS RESPOND TO SEVERAL FERTILIZERS

Fertilizing newly planted seedlings may hasten establishment of plantations by producing faster growing seedlings better able to compete with weeds. Numerous studies in Australia have determined that fertilizers placed in the soil near a seedling result in the best response and should minimize nutrient uptake by weeds. Other studies in Oregon indicate that fertilization with commercially available tablets can increase seedling growth.

Selection of the correct fertilizer and proper emplacement is necessary to increase growth and not damage seedlings. Although seedling fertilization has been tried elsewhere, little information exists for southwest Oregon conditions. Commercially available tablets placed in the planting hole during planting can increase survival and growth, but are expensive, contain a small amount of essential plant nutrients, and have a limited number of formulations. Granulated fertilizers and other materials are available that can be blended into site-specific formulations that could be placed in the soil near a seedling; however, these materials have not been tested.

In 1985, we initiated a study to determine how different types of fertilizers affected the performance of 2-0 bareroot Douglas-fir seedlings. Ten different combinations of fertilizer, dosage, and date of application were randomly installed on a recently harvested site. Because of the exploratory nature of the study, each treatment contained only 10 seedlings. The growth of individual seedlings within treatments was compared using an unbalanced analysis of variance.

The study site is northeast of Kerby, Oregon at an elevation of 2000 feet. The site was clearcut harvested and machine-site prepared the previous fall. The fertilized seedlings were confined to a small area with a northerly exposure and moderately deep soil of the Speaker series, a fine-loamy, mixed, mesic Ultic Haploxeralf. Seedlings were operationally planted in February 1985 and fertilized on April 3 of that year.

Three fertilizer materials were compared: 20-10-10-10 (N,P,K,S) which is a standard blend of readily available salts; Osmocote (24-5-7), a slow release granule that should persist in the soil for up to 1.5 years; and Super-60 (55-0-0), a combination of a slow-release nitrogen and urea. Five grams of nitrogen were applied to each seedling, regardless of the nitrogen concentration or amounts and kinds of other elements present in the fertilizer. Additional treatments included a double dosage of these materials. Compared with fertilizer tablets, these application rates for N are 3 to 10 times greater. Five grams of calcium as calcium carbonate granules were also added to some treatments. Two treatments consisted of fertilizing seedlings the second spring after planting with the material producing the greatest growth the first season.

All fertilizers were deposited in a 3-inch wide slit about 6 inches deep and located 3 inches downslope from a seedling's base. The slit was opened with a planting bar and closed with a boot heel. Heights and diameters of test seedlings were measured at time of fertilization and annually during subsequent winters.

After two growing seasons, some fertilizer treatments significantly increased seedling growth (Table 1). Despite a small sample size and considerable variation in the data, fertilizer increased growth by as much as 3.5 times. The best response was from a double (2X) application of the standard fertilizer (20-10-10-10) plus calcium. The standard fertilizer, Osmocote plus calcium, and Super-60 plus calcium also produced two-fold or better increases in growth. The effect of delaying the application of fertilizer until the second year is uncertain at this time.

TABLE 1.--Two-year growth of 2-0 bareroot Douglas-fir seedlings following fertilization at the time of planting.

Fertilizer	Diameter Actual (mm)	Diameter Increase (%)[1]	Height Actual (cm)	Height Increase (%)	Surv. (%)
Control	1.70b[2]	-	7.56c	-	70
20-10-10-10	3.71b	218	19.81ab	262	100
20-10-10-10 + Ca	2.52b	148	14.68bc	194	50
Osmocote	2.41b	142	13.09bc	173	100
Osmocote + Ca	3.97ab	234	19.10ab	253	60
Super-60 + Ca	4.08ab	240	19.16ab	253	100
2X(20-10-10 10+Ca)	6.09a	358	26.34a	348	70
2X(Osmocote + Ca)	3.17b	186	12.90bc	171	70
20-10-10-10 (1-yr delay)	1.93b	114	7.23c	96	70
2X(20-10-10 10+Ca) (1-yr delay)	3.31b	195	14.67bc	194	90

[1]Percent growth increase is relative to controls.

[2]Treatments not followed by the same letter differ significantly at p=0.05 (Duncan's new multiple range test).

Survival was apparently affected by fertilization, but the small sample size and lack of replication make its interpretation dubious. The data suggest that fertilizer without calcium tended to increase survival, and the addition of calcium generally decreased survival despite increased growth. The latter was most evident in the standard and Osmocote fertilizer treatments. An explanation for the effect of calcium on survival is not apparent at this time.

The large increases in seedling growth for two years after fertilization indicates that fertilization accelerates the growth of newly planted seedlings on some sites. The response was achieved despite a severe drought during January through June 1985 (FIR Report 7(2):5-7).

Continued measurement of seedlings on this site and three other installations of similar design are planned for the future. A continued response to fertilization would greatly enhance the potential for seedling fertilization to become an operational practice, particularly on sites where accelerated growth could make the seedlings more competitive with weeds.

DM
Ted Hass, Medford District, BLM

Adaptive FIR

PROTECTING SEEDLINGS FROM RAVEL

Ravel (moving rocks, soil and woody debris) can bury or deform newly planted seedlings. This is considered a serious cause of mortality on many steep slopes in southwest Oregon. In an earlier report on this study [see FIR Report (Vol. 7(4):3-4)], 54 percent of unprotected seedlings were deformed by ravel only 8 months after planting, but only about 5 percent of the seedlings were buried.

When large numbers of seedlings are affected by ravel, protecting them from burial may be justified. A few operational projects have used shingles to create an upslope-pointing "V" that deflects ravel around the seedling. However, this treatment is expensive because of the material, construction, and installation costs. A potentially cheaper alternative is to vertically install a wooden stake (1 by 4 by 16-18 inch nominal size) upslope of the seedling, with about 6 to 8 inches exposed to deflect ravel.

These two deflection devices, and unprotected seedlings for a control, were compared using 2-0 bareroot Douglas-fir seedlings planted on a steep site (77 percent, north-facing slope), in the western Siskiyou Mountains at an elevation of 3700 feet. This site had been clearcut harvested and planted without burning the slash. Ravel was substantial during harvesting but decreased in the two years following harvesting to a rate less than that measured prior to harvest (FIR

Report Vol. 7(3):4-5). An explanation for the reduced ravel was that unburned slash held the material in place.

The percentage of seedlings affected by ravel steadily increased for the first 8 months after planting, but has remained nearly constant during the succeeding 10 months. The number of deformed or buried seedlings has remained near 55 percent for unprotected seedlings, 30 percent for the stake, and 15 percent for the shingle-V treatment. Although the total number of seedlings affected has remained constant, the number of seedlings in the more seriously damaged or buried classes has continued to increase, particularly in the control.

More than one-half of the control seedlings were affected by ravel, whereas about one-third of seedlings protected by stakes, and less than one-sixth of seedlings protected by shingle "V"s were bent or buried (Table 1). Of the protected seedlings affected by ravel, a higher percentage were only slightly bent and fewer live seedlings were buried than in the control. Buried seedlings were defined as at least 90 percent covered and are not tallied as dead until they have been buried for nearly a year; seedlings have been found alive following burial for up to 6 months after the ravel eventually moved downslope, freeing the seedlings.

After 18 months, seedling survival ranged between 89.5 and 94.5 percent. The most obvious cause for differences in mortality between treatments was burial of unprotected seedlings, where one-third were killed by ravel burial (Table 1). Ravel has yet to kill seedlings protected with a stake or shingle-V.

TABLE 1.--Condition and mortality of 2-0 bareroot Douglas-fir seedlings after 18 months of protection from ravel.

Seedling Condition	Treatment: Control	Stake	Shingle-v
	- - - -	%	- - - -
Live Seedlings			
Bent <45°	30.6	24.9	12.2
Bent >45°	19.9	7.4	1.6
Buried	5.4	1.1	0.5
Mortality			
Miscellaneous	7.0	5.5	6.0
Ravel	3.5	0	0
Total	10.5	5.5	6.0

Of the unprotected seedlings that were buried, all but one of the dead seedlings was buried with coarse fragments and soil. Of the buried seedlings still listed as alive, about half the seedlings are covered with slash. There is some evidence that ravel may be increasing after 2 years as more of the fine fuels breakdown and decompose. Such movement may increase the number of seedlings buried by slash. As the remaining seedlings continue to grow, however, it will be increasingly more difficult to bury an entire seedling.

Although the ravel deflection devices have protected seedlings during the first 18 months after planting, the devices are beginning to collapse under the onslaught of ravel and snow. Three percent of both the stakes and shingle-V have failed and the percentage should increase in the future. The stakes typically fail by leaning downslope onto the seedling. The shingle-Vs fail by splitting and breaking of the shingle, or rotting of the webbing holding the two shingles together. More seedlings are bent over from stake failure than from the shingle-V.

More observation will determine the ultimate positive or negative effects that ravel or protecting seedlings from ravel will have on seedling survival. At present, protecting seedlings from ravel does not appear to be cost effective except on scree slopes with very active ravel.

DM

Of Interest

UPDATE ON BROADSCALE CALIFORNIA RELEASE STUDY

A study led by Gary Fiddler and Phil McDonald of the U.S. Forest Service in Redding is evaluating a broad range of methods for releasing young conifers from weed competition. The study includes lands managed by industry, 10 National Forests, and the State of California. Thirty-two study sites have been established to quantify the effects of chemical, manual, mechanical and grazing treatments on survival and growth of conifer seedlings. The treatments are being evaluated by cost and the relationship between tree response and weed presence to determine the "best" treatments in terms of cost, survival, and growth. Seven seasons of observation now have elapsed since the first study site was established and trends are becoming distinct between treatments on this and on other sites. Results from individual components of this study are being prepared for publication, but Gary and Phil have sent up highlights for the FIR Report.

Weed species targeted in these studies include grasses and other herbs, tanoak, manzanita, deerbrush, madrone, chinkapin, snowbrush, whitethorn ceanothus, bitter cherry, bearclover, live oak, lupine and gooseberry. Herbicide treatments include triclopyr, hexazinone, glyphosate and 2,4-D; broadcast and spot-sprayed in varying radii around seedlings. Manual methods include hand grubbing or cutting with power-saws, in varying radii, as many as three times immediately after a seedling is planted or after a period of some years. On suitably flat ground, Trac-mac and Hydro-ax machinery are being tested. In addition, some test plantations were grazed by sheep or cattle, and various mulch materials (tar paper, felt, terra-mat, black plastic) were also applied.

Preliminary results suggest that mulches from 4- to 10-feet square show promise for controlling grasses, forbs and shrub species such as deerbrush. Although mulches were firmly pinned to the ground, sprouting shrubs such as tanoak, lifted the mulches allowing wind to then blow them over the conifer seedlings. Alumagel fire starter is also being evaluated for control of tanoak. The gel is poured into a shallow ditch dug around the tanoak stem and then ignited. The intense heat is supposed to kill dormant buds thus preventing resprouting. Results have been inconclusive and this study is continuing.

Although most studies are not yet complete, important patterns are emerging:

1) When releasing conifers, a weed-free radius of at least five feet is required before the conifers show a significant growth response.

2) Caliper growth is consistently the best indicator of release. Height growth, at least of Douglas-fir, seems to be independent of competition level.

3) Mechanical shrub control appears to be ineffective without followup treatment of sprouting shrubs.

4) Manual treatments appear costly, but worthwhile for controlling non-sprouting species, especially if applied when weeds are young and not well-established.

5) Some of the newer chemicals produce effective and lasting results. At least two trials show release lasting up to three years from a single application of hexazinone. Triclopyr has given good control of tanoak to date, and this control has carried over in the form of reduced sprouting.

For additional details contact Gary Fiddler or Phil McDonald, Forest Sciences Laboratory, 2400 Washington Avenue, Redding, CA 96001, (916) 246-5455.

OH

NEW WRINKLES FOR OLD PAPER IN MULCHING SEEDLINGS

Many mulch materials have been used to aid the establishment of newly planted seedlings by controlling competing weeds and otherwise improving a seedling's microclimate. Mulching, however, is expensive. Its high cost has, in these days of budget cutbacks, restricted mulching to situations such as progeny test plantations and research sites, where weed control is necessary because of the high cost of re-establishment.

A recent demonstration trial conducted by small-woodlands consultant Marty Main shows that mulching costs may be lowered by using newspaper. The study was conducted on a grass-covered, low elevation (2,000 feet) site that receives approximately 20 inches of rain per year. The Manita series, loam soil varies between 40 and 60 inches in depth on the east-facing site, and slopes range between 10 and 20 percent.

Part of the site was planted in 1984 with ponderosa pine, followed by a backpack application of atrazine. This planting was highly successful. A 1985 planting on another part of the site using Douglas-fir, ponderosa pine, and sugar pine followed by no weed control failed completely, with survival of more grass tolerant "KMX hybrid" at only 40 percent, all of which illustrating the need to control the grass.

Twenty-five 2-0 bareroot Douglas-fir were planted in March and received newspaper applied in a 24 by 30 inch mulch around each tree after scalping away grass. The newspaper was applied by overlapping four sets (each of 10 to 16 opened sheets) around each seedling (Figure 1). Small clumps of dirt, rocks or debris were thrown on the newspaper to hold it in place. No untreated controls were used because the landowner felt that the previous year's planting had unequivocally demonstrated the need for grass control. The seedlings had been in cold storage for more than three months and were felt to be of low vigor.

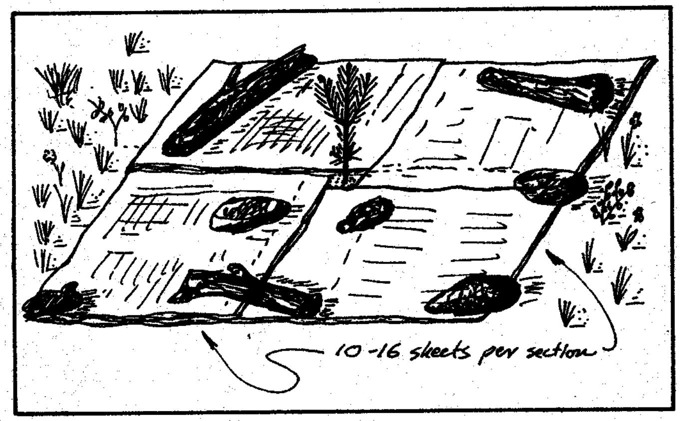

FIGURE 1.--Diagram (not to scale) of four overlapping sets of opened newspaper applied as mulch.

Eleven months after planting, 12 of 25 mulched seedlings survived. The low survival associated with mulching was attributed to seedling quality, e.g., survival would likely have been better with more vigorous seedlings. Evenso, survival of mulched seedlings were greater than seedlings planted without grass control in the previous year.

This study suggests that:

-- newspaper mulch appeared to increase survival of seedlings planted in grass during the first year and appears capable of lasting through a second growing season;

-- rain immediately matted the newspaper to the ground, preventing the mulch from blowing away or covering the seedling, a problem common to other mulch materials;

-- costs are lower: newspaper costs approximately $.05 per seedling (based on cost of $10.00 per hundredweight from recycling companies);

-- newspaper mulches could be applied approximately 30 to 50 percent faster than Kraft mulches (easier to transport, handle and secure);

-- estimated total costs per seedling range between $.25 to $.35 for newspaper compared to $.40 to $.50 for Kraft paper, depending on terrain and number of seedlings mulched per acre.

For more information on this study, contact Marty Main, 242 N. 1st, Ashland, OR, 488-2208.

OH

SEEDLING OUTPLANTING PERFORMANCE VARIES BY NURSERY AND OUTPLANTING CONDITIONS

Foresters and nursery operators have long observed that differences in soils, climate, and cultural practices exist between nurseries which affect the performance of conifer seedlings after they are outplanted. This variation was observed in a frost hardiness study set up as part of OSU's Nursery Technology Cooperative. Graduate student Ursula Schuch recently completed her Master's Degree research which suggests that seedling performance seems to depend on the nursery environment in combination with the outplanting environment.

For her study, 2-0 bareroot Douglas-fir from three nurseries were planted in four replications within each of two sites in the Coast Range (Site A and Site B) (elevation 1500 feet, seed from 061 seed zone) and two sites (Site A and Site B) in the southern Oregon Cascades (elevation 3000 feet, seed from 502 seed zone). The two Coast Range sites received two applications of herbicide for control of grass and brush whereas the Cascade sites received no weed control.

Survival and growth after one year tended to vary by nursery and planting site within location, (Table 1). Seedlings planted in Site A within both the Coast Range and Cascade locations faced considerable competition from salal, fern, and blackberries, despite herbicide application, with poison oak an additional problem in the Cascade site. Consequently, seedling growth on the two Site A's was less than on the more weed free Site B's. Also, average growth for seedlings planted on the drier, cooler, and weedier Cascade sites was approximately half of that for the more mesic and weed-free Coast Range sites.

TABLE 1.--Seedling height growth (cm) and survival (percent). Each value is the mean of 56 observations.

Nursery	Coast Range Site 1 growth	Coast Range Site 2 growth	Cascades Site 1 growth	Cascades Site 2 growth	Average
Height growth (cm)					
1	10.2 AB*	18.5 A	4.5 B	7.5 A	10.2
2	11.7 A	14.2 A	7.6 A	8.6 A	10.5
3	8.3 B	11.2 A	4.6 B	4.8 B	7.2
Average	10.7	14.6	5.6	7.0	
Survival (percent)					
1	96	98	84	89	92
2	100	100	87	91	94
3	91	89	59	91	83
Average	96	96	77	90	

*Means with the same letter within the same vertical cell do not differ significantly at the 0.05 level.

The low survival of seedlings from Nursery 3 planted on Cascade Site A probably was partially caused by their initially smaller size. Grading standards were lowered for seedlings from Nursery 3 because of the need to produce adequate numbers of seedlings despite overall smaller seedling size. Their lower survival illustrates how smaller and less vigorous propagules tend to fare less well on a harsher site with greater weed competition. But, note that on Cascade Site B (less weedy), survival for these seedlings did not differ from that of the other nurseries, nor did their survival differ between the two Coast Range Sites (more benign environments).

These results illustrate how nursery and site factors may interact to affect survival and growth after planting. Larger seedlings in this study appeared better able to overcome the shock of transplanting and weed competition.

For more information, contact Ursula Schuch or Robin Rose, Department of Forest Science, OSU, Corvallis, OR 97331, 754-2244.

OH

PRELIMINARY RESULTS OF NURSERY CULLING STUDY

As part of a study to evaluate culling standards, a Master's thesis, "The Effects of Nursery Incurred Tap-root Wounds on Growth of Douglas-fir Seedlings," by Elizabeth Cameron Whiting has recently been completed. The abstract follows:

Tap-root wounds frequently occur on seedlings during lifting in forest tree nurseries. Data are needed to clarify guidelines for culling wounded seedlings. Two-year-old bareroot Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings were wounded by hand on the tap-root to lengths of either 3/8, 1, or 3 inches. Wounded seedlings were used in three greenhouse experiments to determine the effects of moisture stress, wound length, potentially pathogenic fungi, and soil microflora on height growth, number of white root tips, root dry weight, and wound closure.

Results indicated that, regardless of moisture stress level, wound size had no significant effect on the number of white root tips and no effect on height growth. However, seedlings with 1- and 3-inch wounds tended, on the average, to have fewer new roots than controls or seedlings with 3/8-inch wounds. Moisture stress affected wound closure: seedlings with 3-inch wounds were sensitive to high soil moisture stress and formed much callus but left some xylem still exposed; smaller wounds closed almost completely under all soil moisture stress levels tested. Seedling response to inoculated potentially pathogenic fungi was unclear due to a bacterial problem with the fungal substrate. Soil microflora had no effect on seedlings with 1-inch wounds.

Preliminary results from outplantings indicate that "nursery-run" wounds significantly reduce early survival on harsh sites. On the other hand, seedlings with stem calipers of 3.0 to 3.9 mm survive nearly as well as those with caliper of 4 mm or more. Multiple tops may result in lower survival if top/root ratios are poor as a result of large tops, but seedlings with multiple tops in the nursery often develop single leaders in the field and vice versa.

For more information, we can be contacted at the Forestry Sciences Laboratory, 3200 Jefferson, Corvallis, OR 97331.

Pete Owston
Elizabeth Cameron Whiting
Forestry Sciences Laboratory
Corvallis

FOREST PRODUCTIVITY: WHAT ABOUT THE NEXT ROTATION?

A key question facing foresters in the Pacific Northwest is to what degree various management practices may influence the long-term producing power of the soil. Experience in other parts of the world has shown that hot broadcast burns or excessive removal of organic matter and topsoil during slash-piling can lower yields in subsequent rotations. This has occurred most dramatically in Australian Pinus radiata plantations, where yield declines of up to 35% from the first to the second rotation were partially attributable to site preparation practices.

Harvest and site preparation can influence long-term productivity by removing more nutrients than are replaced, or through effects on the physical and biological properties of soils. When trying to estimate the magnitude of such influences, it is important to distinguish between short-term and long-term. For example, windrowing may remove large amounts of nutrients and greatly impact soil properties, and at the same time reduce competition from shrubs, herbs, and grasses. The result, particularly on droughty sites, may be plantations that grow quite well during their early years, but which may become nutrient stressed later.

Nitrogen (N) is thought to be the most limiting nutrient on most sites in the Pacific Northwest, although there is evidence that in some cases others--such as iron--may also limit growth. Little or no N is contained in bedrock, and losses associated with harvest and site preparation must be made up through precipitation inputs, biological fixation, or fertilization. Some studies suggest that relying solely on precipitation inputs, it would take about 100 years to replace the N removed in boles of a typical Site 3 Douglas-fir stand. And, to replace N volatilized during burning, as many as 300 to 600 years could be required for N from precipitation inputs to return the site to its original fertility. Losses of this magnitude will almost certainly lead to decreased productivity in the future. On the other hand, other studies indicate that N replenishment does occur from biological fixation. Likewise, in areas such as southwest Oregon, the use of "cooler" prescribed fires combined with a reduction in the frequency of natural fires from suppression could decrease N losses and allow greater accumulations of N than would occur naturally. Thus site productivity may not be impaired.

A FIR-funded study comparing N and soil physical properties between harvested and forested sites in southwest Oregon will attempt to quantify the effect of harvest and site preparation on site N capital and on soil physical properties such as bulk density and water holding capacity. In addition, N inputs from various Ceanothus species will be estimated. Preliminary data should be available during 1987.

Studies underway are creating a clearer understanding of the effect of environmental and biotic conditions and disturbance types and severity on mycorrhizal populations and site productivity. On high elevation granitics, a study by graduate student Mike Amaranthus indicates that adequate mycorrhizal formation is essential in order for seedlings to survive their first year in the field. On one such site, logged nearly 20 years ago and still unregenerated despite numerous attempts, basal area growth and survival of outplanted seedlings were increased dramatically by introducing a small amount (1/2 cup) of soil innoculum from a young Douglas-fir plantation into the planting hole. The increased mycorrhizal formation apparently gave seedlings in the clearcut a critical boost, although other factors may be related to this increased seedling performance.

On another site, Amaranthus observed low levels of nitrogen fixation from bacterial activity within the mycorrhizal tissue of Douglas-fir seedlings. In addition, madrone and manzanita are known to host some of the same mycorrhizal species as Douglas-fir, and may be important "reservoirs" or incubators of mycorrhizal inocula during the regeneration phase. The reforestation trick may be to keep adequate amounts of brush to maintain mycorrhizal levels without decreasing conifer survival and growth from competition. Adaptive FIR studies with high seedling survival and good growth in the near absence of sclerophyll brush, suggest that on many sites, very little brush may be needed as a source of inoculum.

Work on a high-elevation granitic site in SW Oregon indicates that soil physical structure is intimately tied to the presence of living roots and mycorrhizal hyphae. In these very sandy soils, virtually all soil aggregation--hence water holding capacity--comes from organic matter, exudates from living root systems that "glue" mineral particles together into aggregates. Dead organic material can't do it on these types of soils.

The following picture seems to be emerging for these fragile sites: after clearcutting, soil aggregation and populations of mycorrhizal fungi begin to decline. If the site is rapidly revegetated by the "right" plants (conifers, ericaceous shrubs, perhaps others), this degradation is arrested. However, if revegetation is delayed, the consequent loss of mycorrhizae and decreased soil-water holding capacity increases the difficulty of regenerating the site. A downward spiral develops leading to granitic sites that are extremely difficult to reforest.

Many questions remain to be answered concerning this scenario. How rapidly does this occur? How widespread is the problem--is it confined to a few granitic sites, or is it more general? What kinds of mitigation practices are useful? It is likely that given the abundance of evergreen hardwoods on most sites in southwest Oregon, this problem may prove to be localized and that prompt reforestation will mitigate the problem. These questions will be addressed in subsequent field work.

Determining the effects of management practices on long-term site productivity is difficult. Growth at one stage of stand development may not adequately reflect growth at a later stage. Furthermore, we are hampered because there is no good reference point for how stands should be performing--is a given level of growth in a plantation the same as, better than, or worse than what might have been attained with different management practices? Studies underway have given, and will continue to give, good insights. More reliable answers will come from controlled experiments, in which different levels of biomass removal and site preparation are compared in a properly designed study.

Dave Perry
College of Forestry, OSU

[NOTE: For other FIR Report articles on fire, nutrients and forest productivity, see FIR Report 7(3):6-7, 12-14. OH]

COARSE WOODY DEBRIS IN DOUGLAS-FIR FORESTS OF WESTERN OREGON AND WASHINGTON

Amounts and structural characteristics of coarse woody debris (CWD) were examined in relation to stand age and site condition in 196 *Pseudotsuga menziesii* stands in western Oregon and Washington. Stands ranged from 40 to 900 years old and most, if not all, originated after fire. In a chronosequence from the Cascade Range, the amount of CWD followed a U-shaped pattern for stands <500 years old, with moderate levels (92 Mg/ha) in stands <80 years old, lowest levels (<50 Mg/ha) in stands 80 to 120 years old, and highest levels (173 Mg/ha) in stands 400 to 500 years old. After 500 years the amounts of CWD declined to intermediate levels. In the southern Coast Range lowest levels (32 Mg/ha) of CWD were in the youngest stands (60 to 80 years) primarily because they inherited little CWD from the preceding (prefire) stands. In the Cascade Range, levels of CWD inherited from preceding stands were highest in young stands and declined to near zero by 250 years. The overall decay rate constant (k) for snags and logs in the Cascade Range, calculated indirectly from the chronosequence was 0.029/year. Volume and biomass of CWD differed significantly in old-growth stands (>200 years old) among site moisture classes. Dry sites averaged 72 Mg/ha, moderate sites 137 Mg/ha, and moist sites 174 Mg/ha.

The dynamics of CWD were modeled for three fire histories, each beginning with an initial fire in an old-growth stand but differing in number and severity of subsequent fires. All three models exhibited low values of CWD between 80 and 200 years. The lowest and most prolonged minimum in CWD during succession occurred when additional fires burn early in succession, which probably happened preceding many stands in the southern Coast Range. The results of the study indicate that a steady-state condition in CWD may not be reached for over 1000 years and that the nature and timing of disturbance plays a key role in the dynamics of CWD in the region. Look for a complete description of this study to be published soon, or contact us directly if you have questions.

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Continuing Education

CONFERENCES, SHORT COURSES, AND WORKSHOPS OFFERED BY THE COLLEGE OF FORESTRY, OREGON STATE UNIVERSITY

Course	Director	Date	Location	Limit
Oregon Forestry Education Program	Middleton	Apr 24-25	Salem	30
Vegetation Management Issues for Upper-Level Managers	Radosevich Norris	May 27	OSU	50
Silviculture Institute: Regeneration and Stand Management	Tappeiner	May 11-22	OSU	30
Effective Inventory: Asking the Right Questions	Bell	May 13-15	OSU	120
Scientific Writing	Boyle	May 15-16	OSU	100
Variable Probability Sampling: Variable Plot and Three-P	Bell	June 8-12	OSU	50
FORPLAN: The Microcomputer Version	N. Johnson	June 8-12	OSU	20
North American Wholesale Lumber Assoc. Marketing Course	FP Dept.	June 14-19	OSU	45
Elementary Harvest Scheduling and Stand Level Analysis Computer Software	Brodie	Sept. 9-10	OSU	20
Geographic Information Analysis	Manfredo	Sept. 16-17	OSU	30
Lumber Quality Control	T. Brown	Sept. 21-23	OSU	50
Reforestation Methods Workshop	Cleary	October	OSU	100
Silviculture Institute: Integrated Forest Ecosystems	Cromack	Oct. 26-Nov. 6	OSU	30
Community Stability in Forest-Based Economies	OSU	November	Portland	150
Recreation Economics	R. Johnson	December	OSU	20
Lumber Drying	Holmes	Dec. 14-18	OSU	30

For more information on these programs, CONTACT: Pam Henderson, College of Forestry, Oregon State University, Corvallis, OR 97331, (503) 754-2004.

BIOLOGICAL PEST CONTROL: THEORY AND APPLICATION

May 11-12, 1987. LaSells-Stewart Center, Oregon State University, Corvallis, OR. This 48th Annual Biology Colloquium will explore the ecological approach to biological pest control and its role in integrated pest management. A poster session will emphasize results from biological pest control efforts. CONTACT: Dr. Logan A. Norris, Forest Science Department, College of Forestry, Oregon State University, Corvallis, OR 97331, (503) 754-2244.

FOREST AND WILDLIFE MANAGEMENT: CONFLICT, COMPROMISE AND COOPERATION

May 20-22, Ashland Hills Inn, Ashland, OR. The joint annual meetings of the Oregon SAF and the Oregon Chapter of The Wildlife Society will present information on technical and policy aspects of the interaction between management of spotted owls, raptors, big game, riparian zones, and old growth and second growth forest. Field trip and recreational activities planned. CONTACT: Lenore Lantzsch, 1301 Maple Grove

Drive, Medford, OR 97501, (503) 776-7116, or John Crawford, Department of Fisheries and Wildlife Biology, 036 Nash Hall, Oregon State University, Corvallis, OR 97331, (503) 754-4531.

INTRODUCTION TO THE SOUTHWEST OREGON VERSION OF THE ORGANON GROWTH AND YIELD MODEL (SW-ORGANON)

June 23 and 24, 1987. Medford. Two identical one-day introductory workshops for people interested in using the output from SW-ORGANON for decision making. Workshop directors: Steve Tesch and David Hann. CONTACT: Adaptive FIR (503) 776-7116.

OPERATION OF THE SOUTHWEST OREGON VERSION OF THE ORGANON GROWTH AND YIELD MODEL (SW-ORGANON)

July 14-15 and 21-22, 1987. Corvallis. These identical two-day workshops will provide hands-on instruction in the operation of SW-ORGANON, and a detailed explanation of how the model operates internally. Workshop director: Dr. David Hann, College of Forestry, OSU. CONTACT: Conference Assistant (503) 754-2004.

OVERSTORY REMOVAL: SEEDLING DAMAGE AND FUTURE GROWTH

Summer, 1987. Medford. One-day workshop will discuss overstory removal, seedling damage recovery and release potential. Workshop directors: Steve Tesch and John Mann.

MANAGING THE FROST PRONE FORESTS OF THE CASCADES

Late August, 1987. Medford. Program is being organized to address the issues associated with managing forests where radiation frosts severely limit silvicultural systems and reforestation options. Workshop director, Dave McNabb. CONTACT: Adaptive FIR (503) 776-7116.

RESPONSE OF SOUTHWEST OREGON FORESTS TO THINNING AND FERTILIZATION

September 22, 1987 in Roseburg and September 23, 1987 in Medford. Two identical half-day workshops which will review the results of the Fundamental FIR studies on the growth of conifer stands after thinning and/or fertilization and predicting the response of stands to fertilization. Workshop director, Dave McNabb. CONTACT: Adaptive FIR (503) 776-7116.

WORKSHOP: REFORESTATION AND WEED CONTROL IN SOUTHWEST OREGON

September 29, 1987, Best Western Conference Center, Grants Pass, OR. This workshop will focus on seedling mortality and loss of growth caused by weeds and methods of maximizing seedling performance. Fee: $40. For foresters and others involved in reforestation and weed control. Workshop Director: Ole Helgerson. CONTACT: Adaptive FIR, 1301 Maple Grove Drive, Medford, OR 97501, (503) 776-7116.

SYMPOSIUM ON THE AERIAL APPLICATION OF PESTICIDES IN FORESTRY

October 20-22, 1987, at the Skyline Ottawa Hotel, 101 Lyon Street, Ottawa, Ontario K1R 5T9 Canada. Sponsored by the Associate Committee on Agriculture and Forestry Aviation, the Symposium will focus on the technical aspects of aerial application. The purpose of the Symposium is to provide a platform leading to significant improvements in aerial application both on the short and long-term. CONTACT: Mr. Ken Charbonneau, Head, Conference Service, National Research Council Canada, Montreal Road, Ottawa, Ontario, Canada K1A 9R6.

Recent Publications

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:

(OSU) - Forestry Business Office, College of Forestry, Oregon State University, Corvallis, OR 97331

(PSW) - Publications, Pacific Southwest Research Station, P.O. Box 245, Berkeley, CA 94701

(PNW) - Publications, Pacific Northwest Research Station, P.O. Box 3141, Portland, OR 97208

(INT) - Publications, Intermountain Research Station, 324 25th St., Ogden, UT 84401

(CFS) - Northern Forestry Centre, Canadian Forestry Service, 5320 - 122 Street, Edmonton, Alberta T6H 3S5, Canada.

PRESCRIBED FIRE IN PACIFIC NORTHWEST FORESTS: AN ANNOTATED BIBLIOGRAPHY compiled by D.M. Loucks, S.R. Radosevich, T.B. Harrington, and R.G. Wagner. 1987. Forest Research Laboratory, Oregon State University, Corvallis. $45.00. This publication provides citations and abstracts of over 500 articles on prescribed fire. Specific topics addressed are methods and uses for prescribed fire, effects of prescribed fire on vegetation and animals, environmental impacts, and human concerns. Most citations pertain directly to the Pacific Northwest. However, some references from the Intermountain and Rocky Mountain regions are included because they consider vegetation types similar to those of the Pacific Northwest--and, of course, the air, health, and public-opinion categories have no geographic boundaries. Articles concerning wildfires were excluded from this publication unless they also considered prescribed burning. (OSU)

LARGE SCALPS IMPROVE SURVIVAL AND GROWTH OF PLANTED CONIFERS IN CENTRAL IDAHO by J.P. Sloan and R.A. Ryker. 1986. Research Paper INT-366, Ogden, UT: U.S. Dept. of Agriculture, For. Serv., Intermountain Research Station. Three conifer species were planted and compared on a large clearcut in central Idaho. Three scalp sizes were also compared. The study site is harsh and has a history of plantation failures due at least in part to a heavy coverage of elk sedge (Carex geyeri F. Boott). Fifth-year results indicate that lodgepole pine (Pinus contorta var. latifolia Engelm.) had the best survival and height growth. Ponderosa pine (Pinus ponderosa Dougl. ex Laws.) was intermediate, while Douglas-fir (Pseudotsuga menziesii var. glauca [Beissn.] Franco) showed the poorest performance. On

2-ft (0.6-m) handmade scalps, tree survival was lower and total height was less than on 4-ft(2.4-m) wide dozer strips. This was especially true for the pines. It appears that on hot and dry sites where elk sedge or other grasses are extremely competitive, 4-ft scalps are the minimum site preparation required. Adequate site preparation along with matching of proper species to the site conditions as well as adequate control of livestock and gophers can help ensure success in reforesting these sites. (INT)

EFFECT OF JELLYROLLING AND ACCLIMATIZATION ON SURVIVAL AND HEIGHT GROWTH OF CONIFER SEEDLINGS by W. Lopushinsky. 1986. Research Note PNW-438, Portland, OR: U.S. Dept. of Agriculture, For. Serv., Pacific Northwest Forest & Range Experiment Station. Field tests with control (C), root-dipped (D), jellyrolled (J), and jellyrolled and acclimatized (J+A) bare-root seedlings were conducted at 14 sites in Oregon and Washington in 1984. Nine tests were conducted with ponderosa pine, four with Douglas-fir, and one with lodgepole pine. A separate test with ponderosa pine and Douglas-fir was conducted in Washington in 1983. In the 1984 test, average values of survival for ponderosa pine for the C,D,J, and J+A treatments were 82, 86, 85, and 87 percent, respectively. The increases in height were 16, 18, 17, and 15 percent, respectively. Survival of the J+A seedlings was significantly higher than that of C seedlings, but other differences among treatments for survival or growth were not significant. For Douglas-fir, average values of survival for the C,D,J and J+A treatments were 77, 72, 74, and 70 percent, respectively; height growth was 18, 19, 17, and 18 percent, respectively, with no significant differences. Survival of lodgepole pine was 99 percent for all treatments, and height growth ranged from 28 to 34 percent. In the 1983 test in Washington, survival of ponderosa pine ranged from 70 percent for C seedlings to 80 percent for J+A seedlings, but results were not consistent among the three sites and therefore not conclusive. Height growth in pine ranged from 34(J) to 41(D) percent. Survival of fir seedlings ranged from 97 to 100 percent, and growth from 21 to 23 percent. Seedling moisture stresses prior to planting were significantly higher in J+A fir and pine seedlings than in C,D, or J seedlings in two cases, and higher than D or J seedlings in another. Control seedlings developed significantly higher moisture stresses in a planting bag than did D, J, or J+A seedlings that developed similar stresses. Collectively, the results indicated that there is no advantage in survival, height growth, or moisture stress from jellyrolling or acclimatizing seedlings as compared to root dipping the seedlings. (PNW)

CONTAINERIZED CONIFER SEEDLING FIELD PERFORMANCE IN ALBERTA AND THE NORTHWEST TERRITORIES BY N.R. Walker and H.J. Johnson. 1980. Information Report NOR-X-218, Northern Forest Research Centre, Edmonton, Alberta, Canada. This publication describes field trials for white spruce, lodgepole pine and Engelman spruce of two types of 40 cubic centimeter container-grown plugs and "conventional" bareroot seedlings of unspecified age and cultural regime. Planting sites were established throughout Alberta from the U.S. border to the Northwest Territories. Although these species are not widely used for reforestation within Oregon, the relative performance of the three stocktypes is congruent with stocktype trials of ponderosa pine and Douglas-fir within southwest Oregon. To wit: most mortality occurred in the first growing season after planting; all three stocktypes tended to have similar growth trajectories (dry weight) for a given species, with the initially smaller container-grown seedlings tending to catch up to the bareroots in the fifth growing season after planting. Other conclusions are that container-reared seedlings could be successfully planted during June, July and August, whereas bareroots planted after June failed; larger and heavier seedlings had better survival and growth rates particularly on weedier sites (weeds were apparently not controlled on any site); a shoot/root ratio between 1 and 2 for container seedlings was not necessarily optimum - larger seedlings did better regardless of larger shoot/root ratios; frost heaving of plugs could be prevented by planting the plugs 1 cm below the soil surface and covering the potting mix with soil; and that root spiraling in seedlings grown in "unribbed" styroblocks persisted for five years after planting in the field. (CFS)

PERFORMANCE OF CONTAINER AND BARE-ROOT STOCK ON PRESCRIBED BURNS IN SASKATCHEWAN by W.J. Ball and V.S. Kolabinski. 1986. Information Report NOR-X-283, Northern Forestry Centre, Alberta, Canada. Fall and spring-planted jack pine (Pinus banksiana Lamb.) and white spruce (Picea glauca (Moench) Voss) bare-root and container seedlings outplanted on burned jack pine clear-cuts in central Saskatchewan were evaluated in terms of survival, height, and height increment for 5 years. At 5 years, survival was 88% for pine and 96% for spruce. Height of spruce was 50% greater for 2+2 bare-root stock than for Styroblock 2 seedlings; with pine the difference was more than 20%. For both species, season of planting did not affect fifth-year height of bare-root stock, but heights of fall-planted Styroblock 2 seedlings were greater than those that were spring planted. Fifth-year height increments for both pine and spruce were greater for 2+2 bare-root stock than for container seedlings. (CFS)

THE GROWING IMPORTANCE OF RETIREMENT INCOME IN TIMBER-DEPENDENT AREAS by D.J. Salazar, C.H. Schallau, and R.G. Lee. 1986. Research Paper PNW-359, Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. This paper examines five socioeconomic changes related to selective migration of retirees to nonmetropolitan, natural resource-based counties in the United States. A retirement sector is defined to include transfer payments to retirees. The growth of this sector and net migration rates of the 65-year-old and older age group are examined in three counties in Oregon and two in Washington. Historically, these counties have been dependent on the timber industry. During the 1970's, retirement became a dominant economic sector in three of the counties. This change has at least two implications for those making land use decisions in these counties. First, economic diversification may lessen the effects of projected declines in timber harvests. Second, local concern for the management of amenity-related resources may grow. Land use planners and resource managers in similar counties throughout the country should become aware of changes in the economic and political environments in which they work. (PNW)

EFFECT OF OPERATIONAL FERTILIZATION ON FOLIAR NUTRIENT CONTENT AND GROWTH OF YOUNG DOUGLAS-FIR AND PACIFIC SILVER FIR by P.H. Cochran, W. Lopushinsky, and P.D. McColley. 1986. Research Note PNW-445, Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. Nitrogen concentration in current year needles of Pacific silver fir (Abies amabilis Dougl. ex Forbes) showed a significant ($P<0.05$) 1.9-fold increase after fertilization with sulfated urea (40-0-0-6), compared with a nonsignificant 1.3-fold increase in Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) and a significant ($P<0.05$) 2.5-fold increase in bracken fern (Pteridium aquilinum (L.) Kuhn.). Nitrogen concentration in needles of unfertilized Pacific silver fir (0.99 percent) indicated a deficiency of nitrogen, whereas the concentration in Douglas-fir (1.35 percent) was above threshold levels. total sulfur concentration in needles ranged from 0.05 to 0.09 percent for both species, with no significant effect of fertilization. Fertilization resulted in increased needle surface area for Pacific silver fir. Diameter growth of the trees, stand basal area growth, and volume growth were all increased by fertilization. More trees on the fertilized plots had broken tops, and rates of height growth for undamaged trees were greater for the fertilized plots; but the difference attributed to fertilization was not quite significant at the 5-percent level of probability. (PNW)

EFFECTS OF SITE PREPARATION ON SEEDLING GROWTH: A PRELIMINARY COMPARISON OF BROADCAST BURNING AND PILE BURNING by Don Minore. 1986. Research Note PNW-RN-452, Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. Site preparation is often necessary to obtain adequate forest regeneration, but inappropriate treatment may reduce subsequent growth. Broadcast-burned and piled-and-burned plantations were studied in southwestern Oregon to determine if burning method affected the growth of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco Var. menziesii). The measured and potential heights of 5-year-old seedlings were about equal where broadcast burning occurred, but measured heights were less than potential heights on most of the piled-and-burned plantations. Site quality probably is damaged by piling and burning. (PNW)

PREDICTING DUFF CONSUMPTION FROM PRESCRIBED BURNS ON CONIFER CLEARCUTS IN WESTERN OREGON AND WESTERN WASHINGTON by S.N. Little, R.D. Ottmar and J.L. Ohmann. 1986. Research Paper PNW-362, Portland, OR: U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station. Duff consumption by broadcast fire was studied on 15 cable-yarded clearcuts in western Oregon and western Washington. Units were divided into treatment blocks where either the amount of large fuels (greater than 7.62 cm diameter outside bark (d.o.b.)) or the moisture content of large fuels varied within the unit. Duff consumption was predicted from large fuel loading, consumption, moisture content, and days since rainfall. Prediction of duff consumption was enhanced by dividing the data into two populations: burns conducted less than 25 days since rainfall and burns conducted more than 25 days since rainfall. The duff consumption from burns in the first population depended on consumption of large fuels. Duff consumption depended on the diameter reduction of large fuels on burns that had not received rainfall for more than 25 days. Mineral soil exposed during burns was predicted from preburn duff depth and days since rainfall. The results suggested that savings in duff consumption can be achieved by removing large fuel before the burn, by scheduling the burn under moist conditions, or both. Methods are demonstrated for prescribing the proper level of fuel removal and moisture regime at the time of burning to achieve a given level of duff consumption. (PNW)

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