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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 Forest and Range Experiment Station of the USDA Forest Service. It is designed to assist 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. The report 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,

John W. Mann
Forest Engineering 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.

Current Research

Adaptive FIR

DAMAGE RECOVERY PROJECT INITIATED

In the Winter 1984 issue of the FIR Report, I reported that some seedlings severely damaged during overstory removal had recovered and could be considered crop trees three years after logging (FIR Report 5(4): 6-7). Following a random survey, 77 percent of slightly damaged, 47 percent of moderately damaged, and 26 percent of severely damaged seedlings, all judged immediately after the time of logging, could now be considered crop trees. These results were encouraging, but provided no estimate of recovery on a unit area basis and, therefore, changes in stocking levels due to seedling recovery could not be tracked.

In April, our research crew returned to the study site and systematically searched for every tree that had been monitored after logging. This will give us a better estimate of damaged trees that later died from their injuries. This data is now being analyzed and results should appear in the next issue of the FIR Report.

The observed recovery, however, prompted initiation of a new Adaptive FIR project to monitor seedling and sapling recovery from logging damage on a broader scale. This summer, 15 permanent sampling transects were installed on 5 timber sales in the Jacksonville and Butte Falls Resource Areas of the BLM. These shelterwood cutting units had received the final overstory removal after August, 1983, so the 1984 growing-season was the first year of recovery from logging damage. In all, about 450 trees were tagged. Eighty of these were undamaged and will be used as control trees. The goal is to observe recovery of damaged Douglas-fir reproduction (up to about 15 feet in height) on some of the harsh sites in southwest Oregon. The control trees will allow us to compare growth rates of damaged and undamaged individuals. Eight categories of damage were recorded, but the main ones included bole scars, broken tops, and trees pushed over during logging. After the transects were installed, several hundred photographs were taken of the damaged trees. One of the goals of the project is to produce a photo-guide showing recovery of various types of wounds over time. This will enable foresters to better estimate potential recovery of damaged trees while doing post-harvest regeneration surveys.

The target date for publications will probably be 1989; however, updates via the FIR Report and workshops will be provided as data becomes available. Our information should be useful to forest managers evaluating postharvest stocking levels and facing the decision to accept marginally stocked stands or replant. This may be particularly valuable on sites where the reforestation risk associated with starting over is considered high.

For further information on this study, contact Steve Tesch or John Mann.

S.T.

RESEARCH UNDERWAY ON MINIMIZING SEEDLING DAMAGE RESULTING FROM SHELTERWOOD OVERSTORY REMOVAL

How much damage will be done to understory seedlings during shelterwood overstory removal? This question continues to nag southwest Oregon foresters as they begin to plan removal of overstory trees from the vast acreage of shelterwood stands created over the past decade. Case studies, such as the Grub Gulch sale (FIR Reports 3(2):2; 3(3):5) and the Wild Lily sale (page 7 in this issue), have helped to identify the extent of the problem and some of the important variables involved, but our knowledge of how to minimize the regeneration impact is far from complete.

In response to this challenge, an Adaptive FIR study was initiated this past summer that will look at overstory removal operations on a broad scale. The study objective is to determine the relationships between reduction of regeneration stocking and characteristics of the overstory and understory stand, terrain, and logging system on steep terrain in southwest Oregon. Thirty-four shelterwood stands, totaling about 540 acres, have been sampled to determine preharvest understory stocking and distribution as well as the characteristics of the overstory stand and the terrain. The cutting units are scheduled for harvest within the next year, and are distributed throughout Medford BLM, Rogue River and Siskiyou National Forests. These units are felt to be representative of shelterwood conditions on steep terrain in our area. The study will concentrate on underplanted stands that will be logged by skyline systems. It has been restricted in an effort to limit variability encountered when viewing the broader spectrum of all harvest systems and all size and age classes of reproduction.

After overstory removal, the units will be revisited to determine postharvest stocking and seedling distribution, and to look at the ground area disturbed by the type of skyline system used. These data will then be analyzed with multiple regression techniques to determine the statistical relationships involved. The statistics, along with observations of the spatial patterns of logging disturbance, will then be combined in a simulation model to help answer the question posed at the beginning of this article.

The model envisioned will be an interactive planning tool which silviculturists and logging planners can use to develop a harvesting plan which will meet the silvicultural objective of minimizing damage to reproduction. Of course, the tradeoffs between increased harvesting costs and relative regeneration risk will play an important role in reaching an acceptable layout scheme. A conceptual view of how such a model would work is shown in Figure 1.

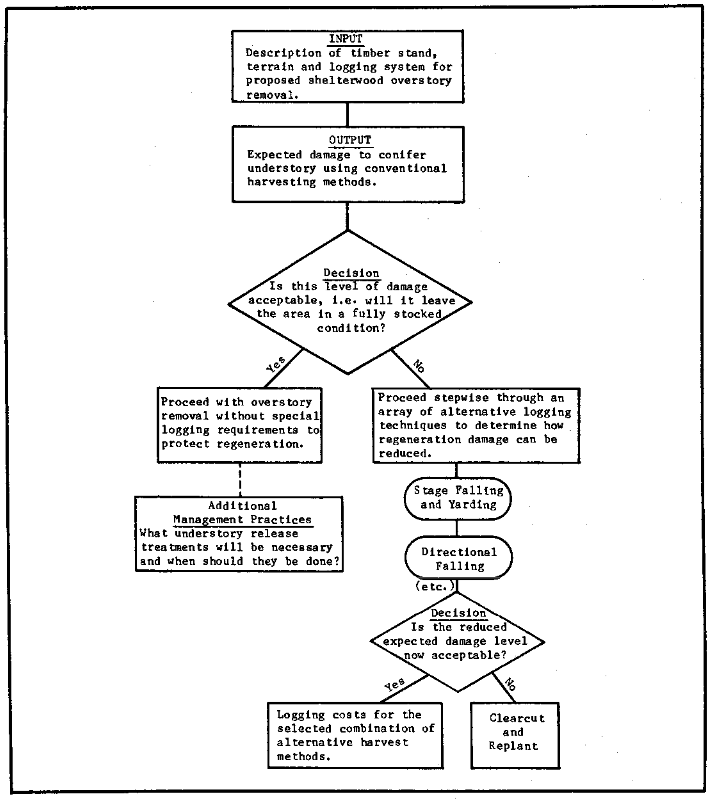

Figure 1. Conceptual model of overstory removal harvesting alternative evaluation.

As Steve Tesch and I have reported in the past two issues of the FIR Report, a number of Adaptive FIR studies are concentrating on various aspects of shelterwood management. These studies do not represent an advocacy position on our part, but rather a concentrated and coordinated effort to provide information to help us all be better informed resource managers. My efforts at pinning down important variables in harvesting are being augmented by Steve's work on conifer release potential and seedling recovery from logging damage. All individual studies in this shelterwood management effort are being planned so that each new piece of information can be included in a larger model to evaluate shelterwood management. The relationship between these planned studies is shown in Figure 2.

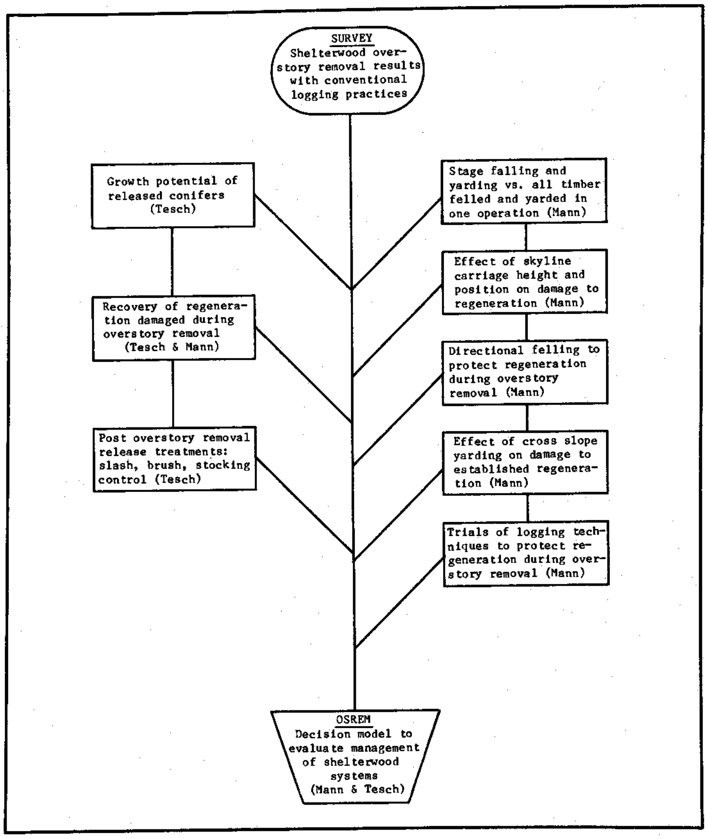

Figure 2. Outline of potential Adaptive FIR research project for shelterwood management.

As preliminary results become available, we'll keep you up to date.

J.M.

BAREROOTS SURVIVE BETTER THAN PLUGS--PINE OUTGROWS DOUGLAS-FIR AT DRY TIN PAN PEAK SITE

The Tin Pan Peak study site is part of a larger study looking at the potential for artificial reforestation on BLM lands withdrawn from the allowable cut base because of possible reforestation problems. The site was part of the Tin Pan Peak wildfire that occurred in September of 1981. The following February, study plots were planted with 1-0 container-grown and 2-0 bareroot seedlings of ponderosa pine and Douglas-fir. The site faces west on a slope of approximately 30 percent and receives an estimated 25 to 30 inches of precipitation annually. Previous survival results have been reported in past issues of the FIR Report [(5)4:4, (4)4:3].

As previously reported, the 2-0 bareroots averaged significantly better survival after two years than did the 1-0 plugs--95 percent versus 90 percent--with no differences occurring between species. Both survival rates are excellent and reflect good quality planting stock (stress testing ranked all four stocktypes as "excellent"), good planting, and very nearly total weed control.

Analyses of growth patterns reveal, however, interesting contrasts between species and stocktypes (Table 1). Significant differences existed between the stocktypes at the time of planting. The 1-0 plugs were the smallest in diameter and the pines were the shortest, even shorter than the Douglas-fir 1-0 plugs. After one growing season, the plugs increased more in diameter than the bareroots but were still smaller, and the pines were still shorter and smaller in volume than the Douglas-fir. At the end of the second growing season, however, root collar diameters of the pine were significantly greater than the corresponding Douglas-fir stocktypes and volume differences were even greater. The 1-0 plug pine at this time have a volume nearly equal to the initially larger 2-0 Douglas-fir and the 2-0 ponderosa pine is over 50 percent larger in volume than the bareroot Douglas-fir.

The relative growth rates (R.G. = $(xn+1 - xn)/xn$, where x=size attribute) also tell an interesting story. The 1-0 plug pine increased in volume more than 13 times in the first growing season and increased nearly 7 times during the second season. Similarly, the 2-0 pine, while not showing as high a growth rate, still grew faster than the 2-0 Douglas-fir.

Table 1. Diameters, heights and volumes (D^2H) of seedlings planted at Tin Pan Peak.

	Douglas-fir		Ponderosa pine	
	1-0	2-0	1-0	2-0
DIAMETER (mm)				
At Planting (1982)	2.6a*	5.5b	2.3a	5.1b
1982	4.5a	7.2b	6.2c	8.4d
1983	8.8a	12.3b	13.6b	16.3c
HEIGHT (mm)				
At Planting (1982)	215a	273b	151c	155c
1982	301a	359b	226c	250c
1983	427a	489b	357c	395a
VOLUME (mm^3)				
At Planting (1982)	1,521a	9,197b	899a	4,225c
1982	6,410a	19,753b	9,274a	18,881b
1983	36,745a	79,023b	72,604b	114,629c

(*Values in a row not followed by the same letter are significantly different at $p < 0.05$.)

These results carry implications for reforestation. Both species seem capable of achieving adequate survival given good quality planting stock, planting practices and weed control. But, so far the pine seems to have the greater juvenile growth. This characteristic may imply that the pine will be better able to withstand subsequent reinvasion of the site by weeds on these types of sites. If the observed juvenile growth patterns carry on into the future, the pine may have the capability to produce a merchantable product more quickly on these low elevation, hot, dry valley sites.

O.H.

TWO-YEAR SHADE STUDY RESULTS--BETTER SURVIVAL AND GROWTH ON POORER SITE

In 1982, a study was initiated to compare alternate shade treatments. The alternatives tested are, 1) unshaded control seedlings, 2) shadecards placed on the east side of seedlings, 3) shadecards placed on the south side of seedlings (standard practice) and 4) styrofoam coffee cups inverted around the base of seedlings. The study was installed at two south-facing sites: Lick Ridge, which receives approximately 35 inches of precipitation per year and has soils approximately 30 inches deep; and at Julie Creek, which receives approximately 80 inches of precipitation per year and has deeper soils. Soils were not skeletal on either site.

First and second year survival results have been previously reported in the FIR Report [(4)4:4; (5)4:5]. To summarize, shading had a significant positive effect at both locations. But after two years, average survival for all treatments was 96 percent at the drier Lick Ridge site compared to 81 percent for the more mesic Julie Creek site. Similarly, the effect of shading on survival was greater at Julie Creek.

The reason for these initial differences appears to lie with differences between seedling quality and planting rather than site quality. The Lick Ridge seedlings were planted earlier in the year under good planting conditions and the work was done by a more experienced crew than on the Julie Creek site.

Growth patterns during the first two years are similar for the two sites (Table 1). At time of planting, the Lick Ridge seedlings were slightly larger in diameter and volume but slightly shorter in height than the Julie Creek seedlings. After two growing seasons, the Lick Ridge seedlings are larger in every characteristic. In stem volume, the Lick Ridge seedlings enlarged over 14 fold in two years compared to about a 4.5 fold increase for the Julie Creek seedlings.

Table 1. Seedling sizes at Lick Ridge and Julie Creek (unbrowsed seedlings).

	Control	East Shadecard	South Shadecard	Styrofoam Coffee Cup
Lick Ridge				
Diameter (mm)				
At planting	4.9	4.8	4.9	4.9
1982	7.9	6.8	6.9	6.9
1983	13.6A	11.4B	12.4AB	12.2AB
Height (mm)				
At planting	246	237	243	246
1982	334	303	312	309
1983	512	464	484	489
Volume (mm^3)*				
At planting	6,387	6,185	6,296	6,165
1982	24,896	15,849	16,965	16,851
1983	117,719A	72,356B	86,647B	88,138AB
Julie Creek				
Diameter (mm)				
At planting	4.0	3.7	4.1	4.4
1982	5.3	5.5	5.5	5.8
1983	7.6	8.0	7.1	8.2
Height (mm)				
At planting	271	260	256	286
1982	294	282	283	313
1983	329	321	299	354
Volume (mm^3)				
At planting	5,228	4,215	5,109	6,396
1982	8,823	9,437	9,575	11,692
1983	21,636	25,499	17,724	30,707

*Volume = D^2H. (Values in a row not followed by the same letter are significantly different at $p < 0.05$; tested by ANOVA using previous year's size as a covariate.)

Two-year results obviously do not reflect innate long term productivity. These results do, however, illustrate that early differences in growth and survival appear to be derived from initial seedling or planting quality and can run counter to what one might expect from estimates of longer term site quality.

Implications for reforestation from these preliminary results are that better quality seedlings and better planting mean better initial seedling growth. This in turn implies that vigorous seedlings will be better able to withstand competition from reinvading weed species and thus improve the chances for successful stand establishment.

O.H.

SURVIVAL UNDER HARDWOODS APPEARS TO DEPEND ON WATER AVAILABILITY AND STOCKTYPE

Large areas of the interior Siskiyou Mountains in southwest Oregon are covered with a mosaic of hardwood sclerophyll forest and stands of conifers. In 1981, a study was initiated to test the feasibility of converting the low value hardwood stands to conifers by underplanting Douglas-fir seedlings--with and without herbicide injection of the overstory hardwoods. Previous results have been reported in past issues of the FIR Report [(5)4:5, (4)4:3].

The study sites were underplanted in 1982 and again in 1983 with 1-0 container grown and 2-0 bareroot Douglas-fir seedlings. Predawn plant moisture stress (PMS) was measured during each year. Survival of the bareroot stock was significantly lower than the plugs in 1982 (Table 1).

Table 1. First year survival (percent) for seedlings planted in 1982 and 1983.

Planting Year	Control 1-0	Control 2-0	Injected 1-0	Injected 2-0
1982	94a*	66b	95a	90b
1983	100a	89b	100a	95b

(*Values in a row not followed by the same letter are significantly different at P < 0.05.)

The lower survival in the control plots appeared to be associated with greater levels of negative moisture stress (Figure 1). In 1983, survival differences varied again by stocktype, but there appeared to be no dependence on herbicide treatment. Nor were levels of moisture stress significantly greater for seedlings under the control stands as they were in 1982.

Explanations of these observations appear to be as follows. Planting in 1982 occurred in May during warm, dry weather. The bareroot seedlings broke bud very slowly. During the 1982 PMS sampling period, 5.6 inches of rain fell. Several light showers occurred during the sampling period, but most precipitation fell in one storm just before the last measurement date. In 1983, the seedlings were planted earlier in the year during cold, wet conditions. During the 1983 PMS sampling period, 5.2 inches of rain fell. But in comparison to 1982, this was distributed in at least two periods of high intensity, adequate enough to recharge the soil profile during the sampling period.

Growth differences between the two years show a marked difference between the control stand and the injected stands in 1982 when moisture stress levels were the most severe. Again, in 1983, with less moisture stress, growth differences between the herbicide-treated and control areas were not as great. Numerous germinants of madrone, Douglas-fir and poison oak were also observed in the herbicide-injected stand at the end of the 1983 growing season. These potential competitors persisted through the 1984 growing season.

It appears that during a typically dry growing season, herbicide injection increased water availability for underplanted conifers during their first year. When precipitation events are greater in intensity, such as in 1983, the herbicide treatment makes little difference in increasing water

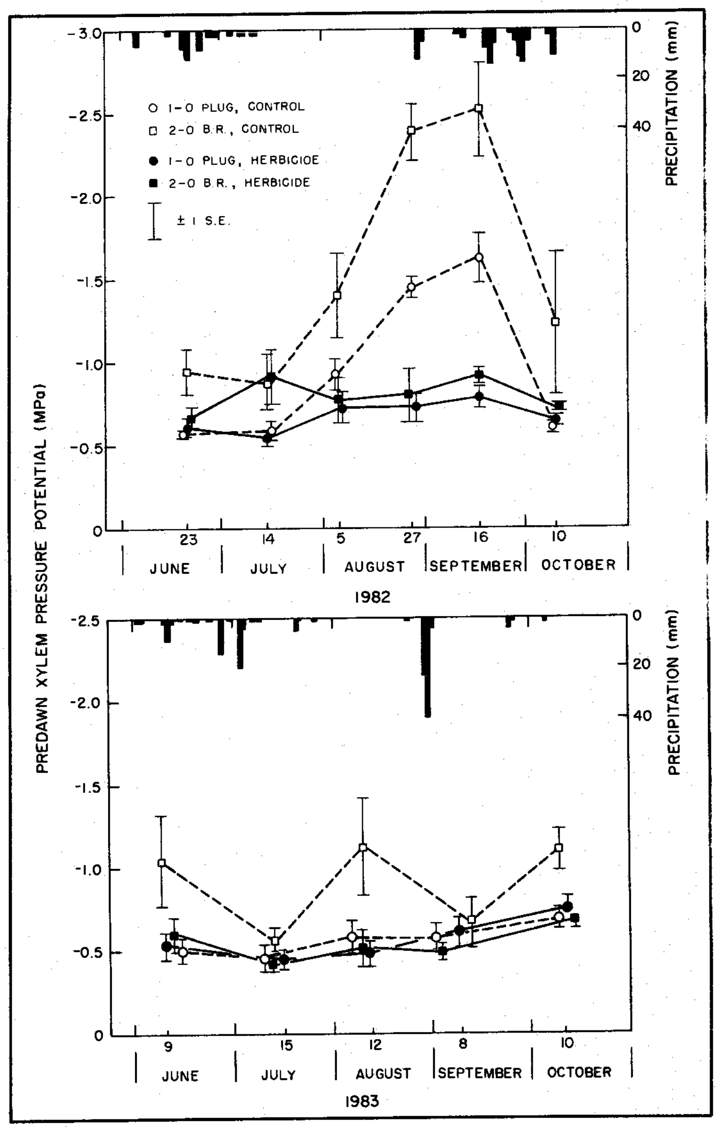

Figure 1. Seasonal trends in precipitation and seedling predawn xylem pressure potential.

availability. In addition to water availability, however, the herbicide treated stands let more light into the understory. This helps to explain the greater growth observed for Douglas-fir seedlings under injected stands.

The consistent differences in growth, survival and PMS observed between the plugs and the bareroots suggests that the plugs became acclimated to the site more quickly. Subsequent observations will indicate whether these differences continue for successive years. Indications are that deer browsing may continue to be a problem even with Vexar Tubes. Lateral branches on some seedlings which had grown through the tubes had apparently been browsed back to the tubes by deer.

O.H.

Fundamental FIR

THE TANOAK SERIES OF THE SISKIYOU REGION OF SOUTHWEST OREGON (Part 1 of a 2-Part Article)

This is the fourth in a collection of articles describing the forest and woodland vegetation found in southwestern Oregon. Previous reports include a summary of all Series (FIR Report 4(4):6), the Jeffrey Pine Series (FIR Report 5(4):7) and the Mountain Hemlock and Shasta Red Fir Series (FIR Report 6(1):4). Objectives and details of data collection procedures used in this study have been discussed in these previous issues of the FIR Report.

Vegetation described in this series of reports is based on 1642 plots sampled in the Siskiyou region, arbitrarily defined as being south of Cow Creek and west of Interstate 5. There are a total of 441 plots in the Tanoak Series, with 251 on National Forest lands, and the remaining 190 on BLM and private lands.

The Species

Distribution. The range of tanoak is along the coast from Reedsport near the Umpqua River, south almost to Santa Barbara, California. Inland there are scattered occurrences from the lower slopes of Mount Shasta, southward along the Sierra to Mariposa County, California. The coastal portion of its range is somewhat coincident with coast redwood. Consequently, it is likely to have similar environmental requirements; moreover, it is considered to be climax in much of the "redwood empire." Its occurrence diminishes rapidly north of the Rogue River. On the Chetco District near Brookings, it occurs on 95 percent of the plots. Northward through Gold Beach and Powers the percentages are 82 and 68 percent, respectively. Of the inland Siskiyou National Forest Districts, only 32 percent of the plots had tanoak; tanoak was not found east of the Illinois Valley District.

The average tanoak plot occurred at 750 m (2400 ft); however, some individuals were found as high as 1524 m (5000 ft). Cover is negatively correlated with elevation, but not strongly so ($r = -0.37$). It is found on all combinations of slope and aspect in this area, but inland populations prefer northerly aspects.

Tanoak occurs on all types of parent rock and soil throughout its southwestern Oregon range; it occurs least often on ultrabasics (serpentine and peridotite). Abundance decreases inland due to reduced moisture availability. This trend is even more pronounced on granitic soils which have the lowest moisture holding capacity in Southwestern Oregon. Soil depths average 97 cm (39 in); slightly deeper than the average depth for our Siskiyou data.

Ecology. Although tanoak occurs on over a third of all plots and is climax on most of them, it was the overstory dominant in less than 5 percent of these stands. The lack of overstory dominance should not be interpreted as an indication of intolerance to full sunlight, but rather as a result of repeated burns killing the above ground fire-sensitive stems. Tanoak survives quite well by vigorously resprouting from underground burls. Because it tolerates both direct sunlight and dense shade, tanoak can behave as either a pioneer after disturbance or a climax dominant in the absence of fire.

Tanoak, like coast redwood, needs relatively high levels of moisture and mild, even temperatures. At the coast, tanoak sites are dominated by the influence of the oceanic heat sink, where fog or high humidity reduce the evapotranspirational demand, and temperature extremes are dampened. Inland where clear, dry days occur more often, the available moisture is below ground in deep soils with high water-holding capacities. There, tanoak is found at the mid elevations where diurnal temperature extremes are minimal.

The northern extreme of its range is south of Bandon where the risk of frost during the growing season is more common. Brookings and Gold Beach average seven days of frost with minimum temperatures of -8°C (18°F); and Port Orford averages 11 days with a minimum of -10°C (14°F); while Bandon averages 22 days with a minimum of -10°C (14°F).

The Series

Distribution. The Tanoak Series occupies the mid to lower elevational band above the Douglas-fir and Ponderosa Pine Series, and mostly below the White Fir Series. The elevational range is 42 m (140 ft) to 1387 m (4550 ft) with an average of 732 m (2400 ft). A standard deviation of 266 m (872 ft) places two thirds of the Series plots between 466 m and 997 m (1528 and 3272 ft). The average aspect for the Series is northerly. The figures for average soil depth and slope are the same as those for tanoak as a species: 97 cm (38 in) and 41 percent, respectively.

Vegetation Composition. Douglas-fir is the overstory dominant in 99 percent of the Series plots and averages 59 percent cover. The next most common associate is sugar pine which occurs in 37 percent of the plots with an average cover of 10 percent. Sugar pine occurs mainly on the inland areas east of the coastal crest.

The regeneration layer is dominated by tanoak. It occurs on all plots with an average of 50 percent cover. In order of decreasing cover, Douglas-fir, Pacific madrone, golden chinquapin, white fir, and canyon live oak can all commonly occur as reproduction.

Dwarf Oregongrape is the most common shrub. It is found on 62 percent of the plots, with an average of 14 percent cover. Where it occurs, salal averages the highest cover (42 percent) but it occurs on only 38 percent of the plots. Evergreen huckleberry and Pacific rhododendron both average 36 percent cover, with about 30 percent constancy. Other common shrubs, such as baldhip rose, creeping snowberry, poison oak, and hairy honeysuckle are found on about 25 percent of the plots but make up less than 10 percent of the total cover.

In the dense coastal stands herbaceous development is inhibited by lack of sunlight and the allelopathic action of tanoak. Inland stands are more often disturbed, usually lack such dense cover and consequently support higher herbaceous cover. Swordfern, braken, beargrass, vanillaleaf, and twinflower are the most common herbs. Only twinflower (11 percent) averages more than 10 percent cover.

The Associations and Management Implications

There are 28 associations in the Tanoak Series. Their environmental descriptions are summarized in Table 1 and their relationships are categorized in Table 2. The associations all occur on productive forest land, with the exception of TANOAK/CALIFORNIA COFFEEBERRY which occurs on generally infertile, ultrabasic parent materials. Their high capacity for producing biomass is responsible for a major management problem common to the associations--dealing with the noncrop vegetation.

Table 1. Summary of the tanok association; all names listed are preceded by "tanoak."

ASSOCIATION NAME	ELEV (M)	ASPECT	SLOPE (%)	SOIL DEPTH (CM)	NO. PLOTS	BASAL AREA (M^2/HA)
Evergreen huckleberry - salal	550	339	38	112	12	48
Evergreen huckleberry	427	345	38	120	21	52
California laurel/evergreen huckleberry	361	259	42	110	8	53
California laurel/Pacific rhododendron	298	306	55	110	10	58
California laurel/whipplevine	598	172	63	127	3	61
Pacific rhododendron	378	344	44	114	7	58
Pacific rhododendron - evergreen huckleberry	574	14	34	109	25	47
Pacific rhododendron - salal	856	30	28	84	24	61
Salal	755	345	43	104	29	61
Western redcedar/evergreen huckleberry	459	33	53	>40	3	60
Port-Orford-cedar	658	348	31	99	30	60
California coffeeberry	717	164	21	76	7	16
Beargrass	894	20	40	>40	3	44
Salal - Pacific rhododendron	963	350	35	91	30	72
Salal - dwarf Oregongrape	782	48	33	104	37	60
Vine maple	808	73	34	97	8	80
White fir - vine maple	1102	355	41	119	11	83
White fir/dwarf Oregongrape	1018	370	40	85	21	67
White fir/California hazel	1048	143	46	>40	8	46
Sadler oak/salal	966	40	32	81	11	42
Dwarf Oregongrape	908	19	50	87	37	74
Dward Oregongrape - poison oak	796	66	54	74	8	64
Canyon live oak	938	197	60	>40	7	37
Canyon live oak/poison oak	740	324	54	85	21	51
Canyon live oak/dwarf Oregongrape	762	58	56	78	15	58
Poison oak - hairy honeysuckle	643	240	53	85	19	53
Coast redwood	344	310	28	106	6	60
Western hemlock	563	352	46	99	20	58

Table 2. Associations of the tanoak series; all names listed are preceded by "tanoak."

COASTAL ASSOCIATIONS

- Evergreen huckleberry-salal
- Evergreen huckleberry
- California laurel/evergreen huckleberry
- California laurel/Pacific rhododendron
- California laurel/whipplevine
- Pacific rhododendron
- Pacific rhododendron - evergreen huckleberry
- Pacific rhododendron-salal

TRANSITIONAL ASSOCIATIONS

- Salal

UNUSUAL ASSOCIATIONS

- Western redcedar/evergreen huckleberry
- Port-Orford-cedar
- California coffeeberry
- Beargrass
- Coast Redwood
- Western Hemlock

INLAND ASSOCIATIONS

MOIST

- Salal - Pacific rhododendron
- Salal - dwarf Oregongrape
- Vine maple
- White fir - vine maple
- White fir/dwarf Oregongrape
- White fir/California hazel
- Sadler oak/salal
- Dwarf Oregongrape

DRY

- Dwarf Oregongrape - poison oak
- Canyon live oak
- Canyon live oak/poison oak
- Canyon live oak/ dwarf Oregongrape
- Poison oak - hairy honeysuckle

The potential for competition is directly related to the cover of noncrop species on the site before treatment. Therefore, if a site with high noncrop cover is to be harvested, the prescription should consider modifying all activities to minimize the competitive potential. Unit boundaries, shape and size, preharvest treatment, cutting prescription, logging methods, site preparation, species selection and placement, and timely planting can all reduce the need for noncrop vegetation control. It cannot be overemphasized that the time and energy required to shift the dominance in favor of the crop tree species increases significantly with delays in the establishment of the crop.

Another well-known, common problem on productive sites is managing stand density. The higher the site the higher the rate of mortality in overstocked stands. Therefore, significant volume loss occurs if thinning is put off or ignored.

Associating animal habitat with specific plant associations in southwestern Oregon is still in the future. However, several generalities can be made about the structure of the tanoak associations related to animal needs. Most of the stands have variable vertical structure. Tanoak, being tolerant of shade, is often dense and of various size classes. Both hiding and thermal cover are abundant and acorns provide mast. Birds and small mammals are also abundant.

The tanoak associations are important for watershed protection merely from the standpoint of their extent. The Series comprises about one half of the total area in the western Siskiyous and considerably more west of the coastal crest.

The associations can be divided into three general categories: coastal, transitional, and inland. The coastal associations are usually found east of the crest, but not often in the Applegate River drainage, and there are some transitional associations that occur ecologically midway between coastal (wet) and inland (dry) environments.

(Due to space limitations and the length of this article, the remainder will be presented in the Winter 1985 issue of the FIR Report. The second part of the article will include discussion of each individual plant association in the Tanoak Series and a summary of the entire article.)

Tom Atzet, Siskiyou NF
David Wheeler, Siskiyou NF
Brad Smith, OSU
Gregg Riegel, OSU
Jerry Franklin, PNW

SHELTERWOOD REMOVAL AND UNDERSTORY DAMAGE

Thousands of acres of shelterwood overstory are scheduled for final harvest in southwest Oregon during the coming decade. On many of these acres, natural regeneration is well established or has been supplemented by underplanting. In all areas, a considerable investment has been made in securing regeneration. High harvesting costs to establish the shelterwood and the cost of carrying the overstory volume several more years add to this investment. Protecting this investment in regeneration is an important goal of most managers.

Scientists at Oregon State University recently completed a study of overstory removal costs and understory seedling damage in cooperation with Medford District BLM. The study was funded by the Forest Engineering Systems project of the USDA Forest Service, Pacific Northwest Forest and Range Experiment Station as a Fundamental FIR grant. One portion of the study compared harvesting costs and seedling mortality on units harvested using tractors on conventional skidtrail layout with that on units harvested from skidtrails designated prior to logging. In the latter case, skidders were restricted to operate only on the designated trails, and operators had to pull winch line to reach the logs. The second portion of the study focused on harvesting costs and seedling damage on three units logged with a skyline system in steep terrain.

Designated Skidtrails vs. Conventional Skidding

Ninety-two fiftieth-acre plots were randomly located along transects in two designated skidtrail units and ninety-eight were located in the conventionally logged units on the Blue Cow timber sale. Understory trees in each plot were observed before and after logging. During logging, a time-and-motion study provided scientists with detailed information about skidding production with the two logging techniques. Following logging, a detailed map was made of all skidtrails in order to compare soil disturbance on the two types of units. Results of this study showed that:

1. The production rate for conventional skidding, including delays, was 1,024 ft^3/hr and for skidding on designated skidtrails was 885 ft^3/hr. Production was 13.6 percent less on units logged from designated skidtrails.

2. Thirty-six percent of all trees in plots on the designated skidtrail units were killed or severely damaged compared to sixty-six percent of all trees in plots on the conventionally logged units.

3. Smaller trees were damaged more than larger trees (Table 1). Trees less than 5 feet in height experienced greater mortality than did larger trees for both conventional and designated skidtrail areas.

Table 1. Percent of trees killed or severly damaged overall and by size class for two treatments at Blue Cow.

	Percent of Trees Killed					
Treatment	<5 ft	5-10 ft	10-20 ft	≤7 in dbh >20 ft	>7 in dbh	Overall
Designated	44	38	35	35	21	36
Conventional	87	73	73	58	30	66

4. The proportion of study plots that were understocked (less than 100 trees per acre) after logging was completed rose dramatically, from 5 to nearly 50 percent, on the conventionally logged units. Understocked plots on the designated skidtrail units increased moderately from 4 to 19 percent (Figure 1).

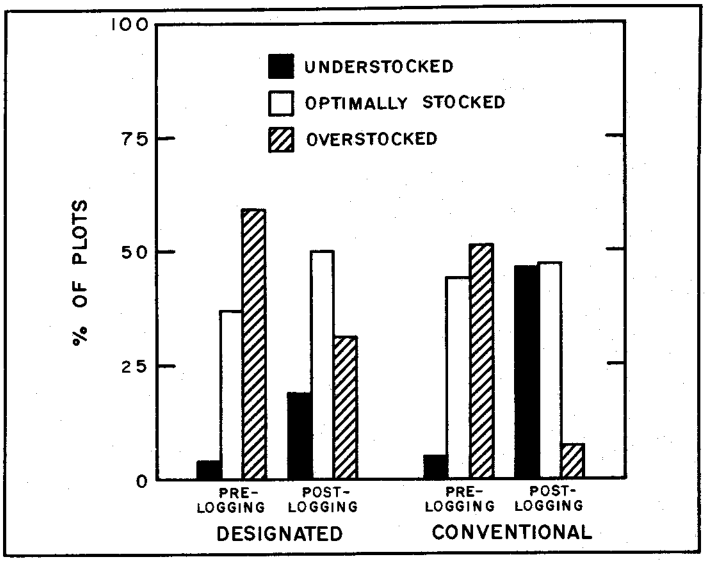

Figure 1. Pre- and post-logging stocking on units logged conventionally and with designated skidtrails.

5. The portion of the harvested area in skidtrails was about 20 percent on the conventionally skidded units and about 6 percent on the units skidded from designated trails.

A post-logging review of the designated skidtrail operation with BLM personnel and the logger identified some opportunities for improving logging production on these units.

1. Keep trails as straight as possible, but allow trails to avoid large trees. Big stumps in skidtrails seem to "grow" after a couple of skidding passes as soil is compressed around the stump base.

2. Clearly mark the skidtrails before logging equipment is on the site. This should be done by the sale administrator working with the logging supervisor. Where this is not possible, the job should be done by sale preparation foresters, but the skidtrail layout must remain flexible so that adjustments can be made as needed.

3. Clear indication of skidtrail endpoints minimizes confusion as to where one trail ends and another begins. Do this with several pieces of flagging hung in a group or with different colored flagging.

4. Fall trees to lead only after the timber on the designated trails has been felled and skidded out. Doing this allows timber fallers to clearly see the trails. It also makes winching easier, clears the way for more efficient skidding, and reduces understory damage.

5. Changes in skidtrail direction should be gentle, not abrupt. Junctions between skidtrails should be at a 45° angle or less. Both of these tips will keep skidder speed high and avoid understory damage from logs sweeping around sharp corners.

6. Avoid joining several skidtrails at one point. Where 3 or more come together at one spot, the disturbed area tends to grow.

Skyline Logging

Overstory removal on steep terrain usually requires skyline yarding systems. An earlier Adaptive FIR study on a BLM overstory removal operation demonstrated that significant seedling mortality occurred if logs were yarded cross-slope and a fan-shaped yarding pattern used (FIR Reports 3(2):2;3(3):5). The final report of this Grub Gulch study suggested several techniques for reducing seedling mortality, including one-end suspension of logs, a carriage which could be held in place during lateral yarding, and skyline corridors perpendicular to the contours spaced no closer than 150 feet apart. Skyline corridors should be flagged before falling so that trees can be felled toward them. Maximum log length should be 34 feet.

A study was designed to test these techniques for minimizing understory damage. Three BLM harvest units, part of the Wild Lily timber sale, were selected for study.

Yarding production was determined with shift-level data provided by the operator. Seedling damage was determined using 288 circular 1/100 acre plots randomly located along parallel transects in the three units. Plots were established prior to timber falling and then relocated following yarding.

Hourly yarding production averaged about 7 MBF/hour, felt to be a satisfactory production rate for overstory removal operations.

Overall, about 50 percent of the understory seedlings were killed on the study plots. On those areas with high understory stocking prior to logging, 70-80 percent of the plots remained in an optimally stocked or overstocked condition following harvest. In those areas where pre-logging stocking was low, the number of understocked plots jumped from about 50 percent to as high as 84 percent. Analysis of all the stocking inventory data revealed a very strong correlation between the preharvest mean basal area per acre and the percent of trees damaged.

These results suggest that overstory removal on steep terrain continues to be a major reforestation problem for southwest Oregon foresters. Mortality in this study was equal to that observed in the earlier FIR study where no special logging techniques were used.

One main source of damage in the study reported here seems to be from insufficient elevation of the tail blocks, resulting in low deflection and poor lift on the logs. Since none of the logging crew were qualified climbers, blocks were hung only as high as the crew could reach. During lateral in-haul, this situation resulted in poor control over logs.

Summary

Both harvest operations contributed good information about the relationship between overstory removal and understory seedling damage. Designated skidtrails seem to hold great promise as a technique to reduce both the area disturbed by logging vehicles and the damage to understory trees. Though logging costs were somewhat higher, there are several techniques that may help to reduce the cost of logging with designated skidtrails. More work needs to be done on improving the survival of seedlings in overstory removal operations using skyline systems. In fact, a major Adaptive FIR study led by John Mann is now underway that will investigate that topic (see page 2-3 of this issue).

A detailed report on the Blue Cow study is being prepared for a Journal of Forestry article. Wild Lily study results will be published as a Forest Research Laboratory Research Note.

Acknowledgments

The FIR research team wishes to send a special thanks to all the BLM Medford District personnel who helped us get this study started on very short notice. Without your extra efforts and cooperation, we would not have been able to complete the study on time. Thanks for an outstanding job.

George Brown, Forest Engineering Dept., OSU
Dave Perry, Forest Science Dept., OSU

NEW STUDIES PLANNED BY FUNDAMENTAL FIR SCIENTISTS

If Congressional budget support for Fundamental FIR goes as currently planned in FY 1985, several new studies will begin on October 1, 1984. These are designed to address some of the remaining gaps in our knowledge of southwest Oregon forestry, and they include the following topics:

Study Title	Principal Investigator
Modeling young stand establishment	Steve Tesch, OSU
Silvicultural strategies for maintaining long-term site productivity	Dave Perry, OSU
Rapid methods for evaluating nursery stock quality	Joe Zaerr, OSU
Application of ecological site classification to interior southwest Oregon	Jerry Franklin, PNW
Analysis of nursery culling standards for Douglas-fir	Pete Owston, PNW
Comparison of financially optimal early stand management treatments under low-cost and high-cost reforestation	Roger Fight, PNW
Growth rates of southwest Oregon shrub species	Don Minore, PNW

Breeding zones and provisional seed transfer rules for ponderosa pine in southwest Oregon	Bob Campbell, PNW

Jack Walstad
FIR Program

Of Interest

THE USE OF WIDE TIRES ON LOG SKIDDING EQUIPMENT

The Forest Engineering Research Institute of Canada (FERIC) recently completed a four-year investigation of wide tires on log skidders. The results of a number of their different studies on this topic are detailed in the FERIC publication, "The Use of High Flotation Tires for Skidding in Wet and/or Steep Terrain" by P. G. Mellgren and E. Heidersdorf, May 1984, Technical Report No. TR-57. This article is a summary of those portions of this report that seem to be pertinent to the FIR area. The information contained in this article is principally from my contact with Ernie Heidersdorf of FERIC and from their written report.

One of FERIC's main interests in wide tire usage is for flotation; that is, a piece of equipment's ability to move over the soil surface without excessive sinkage. This machine characteristic is especially important on low strength soils, such as the peats, clays, and silts that comprise large forested areas throughout Canada. These areas have historically been harvested in the winter when the ground was frozen, but this practice has presented problems in planning and scheduling and is totally dependent on the weather. Harvesting these wet areas in the summer with skidders having conventional, narrow logging tires has proved to be environmentally unacceptable and expensive because of bogged down machines, reduced payloads and excessive ground disturbance. Efforts to solve this problem with tracked vehicles had limited success because of high track and undercarriage maintenance costs.

An analysis of this situation suggested to FERIC the need for a low-pressure, high-flotation tire. Two options exist to obtain higher tire flotation; increase either tire diameter or width. For most types of rubber tire logging equipment, tire diameter is limited for machine stability because increasing height means raising the center of gravity, and for other practical reasons, like wheel mounting and dismounting. Thus FERIC, as well as several forest products and equipment manufacturing companies in the southeastern U.S., looked to wider tires as a potential solution to the flotation problem.

Wide tires for off-road vehicles are not a particularly new concept. They were experimented with in the early 1960's but failed to gain industry support at that time. The principal reasons that FERIC felt the practical application of wide tires deserved another look were:

1. A growing silvicultural and environmental awareness about the negative effects of ground disturbance and soil compaction.
2. An increased interest in reducing fuel consumption because of escalating fuel costs.
3. Recent developments in the techniques and materials available for tire fabrication indicated the possibility of manufacturing light-weight, thin-walled, penetration-resistant, wide tires.

In 1979, when this project began, the only wide tires available that could be adapted to conventional skidders were made by Rolligon Corporation of Stafford, Texas. These 68 inch wide, KEVLAR based tires had been developed for geophysical exploration and pipeline construction work, but had never been tested in logging.
The Rolligon tires were tested in 1980 in the wet ground of Northern Ontario. Here, in the black spruce swamps and deep organic soils, conventional width tires easily break through the thin root mat and cause equipment to bog down. This also causes silvicultural problems since the severely disturbed sites become difficult to regenerate. When the 68 inch wide tires were mounted on a John Deere 540 skidder, the results were extremely encouraging. Skidding productivity was increased by 60% because of improved flotation and the opportunity for increased loads and travel speeds. Fuel consumption per unit volume was reduced by up to 40% because of reduced slippage, thus converting more of the equipment's work effort into production. Perhaps most important of all, ground disturbance was drastically reduced even after repeated passes, resulting in much improved regeneration conditions.

These positive results led to other tire manufacturers getting on the bandwagon. In 1981, United Tire developed a 50-inch wide "Swamper" logging tire and Firestone came out with a 43 inch wide agricultural tire that could be mounted on log skidders. Both tires were tested under the same conditions as the Rolligon, with the United tire resulting in unacceptable ground disturbance because of too aggressive a lug pattern and the Firestone tire needing still more width. These two companies subsequently improved their designs; United developed a "Super Muskeg" model with less aggressive lugs, and Firestone produced a 50-inch wide tire called the "Flotation 23° Logger." Testing of these tires showed their performance to be comparable with that of the Rolligons. Thus, there are now a number of high flotation tires available, including 43-inch and 50-inch wide models from Goodyear.

Looking for applications outside of wet ground conditions, FERIC continued their testing program on rolling hills near Thunder Bay, Ontario and in the foothills of the Canadian Rockies in Alberta. The Thunder Bay tests concluded no real advantage in using such tires in that terrain and soil type, but the Rocky Mountain tests could have particularly useful implications for southern Oregon and other parts of the Western U.S. During comparisons between 50-inch wide tires and conventional 23-inch wide tires on 25% slopes of wet, clay-loam soils, the wider tires were able to achieve 15% faster travel speeds and 18% lower fuel consumption, even when compared to more narrow tires with chains on the front wheels. This is a result of reduced tire sinkage and the corresponding reduction in rolling resistance. Slippage was also greatly reduced with all models of the wide tires. I have seen pictures of the relative amount of ground disturbance done in these tests and the results are remarkable. In fact, ground disturbance with the wide tires after 20 passes was quite obviously less than after 4 passes by the conventional tires. Relative climbing ability and sidehill stability were also tested. Climbing ability was not greatly enhanced but sideslope stability was noticeably better when using wide tires.

Other Canadian logging engineers that I have talked with feel that results of this FERIC project provide the single most important advance in ground-based logging systems in the last two decades. Exactly how this research will apply to southern Oregon is, of course, not substantiated by the FERIC report, but the potential to extend our concept of tractor loggable terrain may be an important idea to investigate.

J.M.

Recent Publications

BRUSH REDUCES GROWTH OF THINNED PONDEROSA PINE IN NORTHERN CALIFORNIA, BY William W. Oliver, 1984. USDA Forest Service Research Paper PSW-172. Pacific Southwest Forest and Range Experiment Station; Berkeley, CA. 7 p. The effects of tree spacing and brush competition were evaluated on a ponderosa pine site of low productivity in California's Northern Coast Range. Eleven-year-old saplings were thinned to square spacings of 2.1, 2.4, 3.0, and 4.0 meters and all, half, and none of the understory brush (principally manzanita) was manually removed in a split-plot design. Analysis of variance showed that brush crown cover was significantly related to periodic annual increment in diameter-at-breast-height, height and volume of the pines. Spacing significantly influenced diameter growth only when all brush was removed. A nonlinear equation relating brush cover and trees per hectare to periodic annual increment in diameter explained 90% of the variation. Results suggest that any amount of brush in a pine plantation will restrict diameter growth. When cover exceeds 20-30%, brush competition overwhelms intertree competition, and trees grow at about the same rate regardless of spacing.

Source: Publications
Pacific Southwest Forest and
Range Exper. Stat.
P.O. Box 245
Berkley, CA 94701

FOREST NURSERY MANUAL: PRODUCTION OF BAREROOT SEEDLINGS, by M. L. Duryea and T. D. Landis (eds.). 1984. Martinus Nijhoff/Dr Junk Publishers, The Hague, for Forest Research Laboratory, Oregon State University, Corvallis. 386 p. ($39.50). This manual has been written by leading scientists and nursery managers and represents the latest in technology for the production of bareroot seedlings. Organized into 30 chapters and 4 appendices, it covers a wide range of subjects such as nursery-site selection, layout and development; water management; lifting, grading, packaging and storing; and planting-stock selection. The chapters are written in considerable detail with numerous photographs, illustrations, and tables. The major stages of seedling production are emphasized. Useful conversion tables and a glossary of technical terms add to this comprehensive publication.

Source: Forestry Business Office
College of Forestry
Oregon State University
Corvallis, OR 97331

PREDICTING LEAF AREA AND BIOMASS OF 1- TO 6-YEAR OLD TANOAK (LITHOCARPUS DENSIFLORUS) AND PACIFIC MADRONE (ARBUTUS MENZIESII) SPROUT CLUMPS IN SOUTHWESTERN OREGON, BY T.B. Harrington, J.C. Tappeiner, II, and J.D. Walstad. 1984. Canadian Journal of Forest Research 14:209-213. Methods were developed to predict site occupancy by sprouting understory hardwoods after conifer harvest. Equations predict leaf area and aboveground biomass, enabling foresters to predict resprout potential based on the diameter of the parent hardwood tree before the stand is harvested. An inventory of hardwood trees before harvest can be related to maximum site occupancy of tanoak or madrone up to 6 years after harvest, assisting in planning for post-harvest vegetation management needs.

Source: Forestry Business Office
College of Forestry
Oregon State University
Corvallis, OR 97331

THE PRACTICALITY OF TOP-ROOT RATIO IN NURSERY STOCK CHARACTERIZATION, by G. D. Racey, C. Glerum, and R. E. Hutchison. 1983. Forestry Chronicle 59:240-243. Traditionally, seedling top-root ratio has been used by foresters for many years to characterize the balance between shoot and root. This is perceived by many as being related to survival potential. Top-root ratios have a positively skewed frequency distribution which produces a biased estimate of the sample mean. Top length, diameter, top volume and root volume were all better indicators of stock quality than top-root ratio. The authors conclude that top-root ratio is of little use in the evaluation of nursery stock.

Source: Midhurst Research Unit
Ontario Tree Improvement and
Forest Biomass Institute
Ministry of Natural Resources
Midhurst, Ontario, LOL 1XO

Continuing Education

REGENERATION PLANNING

January 21-23, 1985. Corvallis, OR. An OSU Forestry Extension program to be held at the university campus in Corvallis. This workshop will cover all components of the forest regeneration process from cone collection to plantation maintenance. The objective is to provide foresters with a review of fundamental concepts and some up-to-date information on what is needed to achieve regeneration success the first time. The program will emphasize the importance of sound, biologically based decisions and spending dollars wisely to insure success on the initial effort. A regeneration planning exercise conducted in three separate sessions throughout the workshop will allow small groups of participants to develop prescriptions for actual stands that have been considered regeneration problem areas. Attendence limited to 100 participants. CONTACT: Dave DeYoe, Workshop Director, (503) 754-2244, or Conference Assistant, College of Forestry, (503) 754-2004.

1984-85 CONTINUING EDUCATION SCHEDULE - ADAPTIVE FIR

COURSE TITLE	DIRECTOR(S)	LOCATION	DATES	ATTENDANCE LIMIT
NON-HERBICIDE FOREST WEED CONTROL	HELGERSON, HOBBS	MEDFORD ROSEBURG	NOV. 7, 84 NOV. 8, 84	100 100
MYCORRHIZA MANAGEMENT IN NURSERY PRACTICES	TRAPPE, HOBBS	MEDFORD	MARCH, 85	40
SHELTERWOOD MANAGEMENT SYSTEMS	MANN, TESCH	MEDFORD	MAY 14-15, 85	100
STAND DENSITY MANAGEMENT	TESCH, MANN	MEDFORD	JUNE 11-12, 85	50
FOREST PEST MANAGEMENT	HELGERSON	GRANTS PASS	JULY, 85	150
SOILS, SITE CLASSIFICATION AND FOREST PRODUCTIVITY	MCNABB	GRANTS PASS	SEPT., 85	100

As program dates and other arrangements are completed, more detailed information will be published in this newsletter and individual announcements mailed to all FIR Report recipients. In the meantime, questions on course objectives and program content can be answered by program directors.

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