FOREST RESEARCH NOTES

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TWO IMPORTANT PUBLICATIONS ON DOUGLAS FIR YIELDS

Two publications, resulting from years of study by the Forest Experiment Station of the growth and yield of Douglas fir forests, have just been distributed. Both are of signal value to foresters and timberland owners of western Oregon and Washington who are interested in knowing what wood volume forest lands of various qualities are capable of producing under both ideal and average conditions.

1. The Yield of Douglas Fir in the Pacific Northwest. U. S. Dept. of Agriculture Technical Bulletin 201, by R. E. McArdle and W. H. Meyer.

The first major project of the Pacific Northwest Forest Experiment Station following its organization in 1924 was a thoroughgoing study of the growth and yield of Douglas fir; over 2000 sample plots were measured in the course of several seasons. The results of this investigation are presented in popular form in this new bulletin.

The Douglas fir forests of the Pacific Northwest are among the most rapidly growing forests of the United States, and, with the exception of only one other conifer, produce the greatest volume of timber per acre. It is not generally realized that fully-stocked second growth forests often contain more sound timber per acre than the average old growth forest, although the younger timber has a smaller proportion of first quality material. Stands 100 years old on the best quality lands frequently contain over 100,000 board feet per acre, full scale. Forest lands, however, vary in fertility to an even greater degree than farm lands, and the best quality lands produce ten times as much sawlog material as the poorest. The new Douglas fir bulletin describes a practical and convenient method for determining the productive capacity of any forest area. For this purpose the average total height of the larger trees

is used as a measure of soil fertility; on the best lands these trees will average over 200 feet tall at 100 years of age, whereas they will be less than 80 feet tall at the same age on the poorest quality land.

The following table gives extracts from the complete tables published in the bulletin:

EXTRACTS FROM THE NEW YIELD TABLES TO ILLUSTRATE FOR FULLY-STOCKED ACRES THE VARIATION IN VOLUME OF TIMBER AND IN NUMBER AND SIZE OF TREES, WITH CHANGES IN AGE AND SOIL QUALITY

Age	Average Total Height of Larger trees	No. of Trees Per Acre	No. Trees 12" and Larger	Average Diameter in inches	Range in Diameter	Volume Scribner Bd. ft. Full scale	Volume Cu. ft. Full Scale
		Site I - Best Quality Lands					
40	120	240	109	12.2	4-21	24,400	7,500
80	181	97	93	23.3	10-37	92,500	16,350
120	213	63	63	31.1	14-49	131,100	21,090
160	226	48	48	37.2		153,500	23,780
		Site III - Medium Quality Lands					
40	84	585	37	7.4	2-13	4,500	5,250
80	127	232	148	14.3	6-23	45,700	11,350
120	149	152	134	19.1	8-31	75,000	14,600
160	158	117	113	22.8	10-37	92,400	16,490
		Site V - Poorest Quality Lands					
40	48	1,530	0	3.8	2-9	0	2,110
80	73	525	44	7.9	2-15	4,400	4,580
120	85	331	105	10.7	4-17	14,700	5,900
160	90	250	132	12.9	4-21	23,300	6,670

2. A Study of the Relation between Actual and Normal Yields of Immature Douglas Fir Forests. Journal of Agricultural Research, November 1, 1930. Pages 635-666, by W. H. Meyer.

Most yield studies are based upon measurements taken in "normal" or fully stocked stands; but since most stands are not fully stocked over wide areas, the "normal" tables need some adjustment when applied to ordinary stands. This study was made to determine the basic relationships between average and "normal" stands and to develop the best means of making the necessary adjustment. Understocking in second growth fir forests seems to be due more to the presence of numerous small holes to widen spacing of trees. On the average second growth Douglas fir forests were found to underrun the normal stands by about 25 per cent.

The normality of a stand cannot be judged by the total number of trees per acre, but is best indicated by the aggregate basal area of all the trees. To estimate therefore the relation of actual stand to the normal stand, it is necessary only to compute the basal area of the average acre, get the percentage of this value in respect to the normal value of the yield table, and use this ratio for predicting future yields.

An interesting finding of the study is that the highest yields are obtained on 40 per cent slopes, probably because at this gradient, the increased surface soil area, improved drainage, and greater area of tree crowns exposed to full light reach the optimum for stand development.

Both of the publications may be had free of charge upon application to the Director, Pacific Northwest Forest Experiment Station, 514 Lewis Building, Portland, Oregon.

Walter H. Meyer

DESTINY OF DOUGLAS FIR SEEDS THAT FALL IN THE VIRGIN FOREST

Over a period of years much seed falls on the forest floor under young and old stands of Douglas fir and yet no seedlings of this species become established there. What happens to this seed--what per cent of it is eaten by birds and rodents, what per cent decays, what per cent germinates at once, what per cent lies viable in the duff for a period of years ready to germinate when the old forest is removed? The answers to these questions have a definite bearing on the management of Douglas fir lands.

In the course of the Experiment Station's sutdies of natural reproduction, Douglas fir seedlings have been noted in the late spring under both old and young stands, but they seldom survive the first summer; on one specific area where hundreds of seedlings were staked and numbered during three successive years, all died within six weeks of germination.

To secure some definite information on the amount of germination and decay that occurs in the dense shade of the virgin forest, seeds were placed within a rodent proof enclosure in May 1925, the seed used was found to be 86% sound by cutting test and gave a germination of 53% in the nursery. Germination obtained under forest cover is shown in the following table:

Areas 4 ft. square 9000 seed sown in each	Germination 1925-26		Seedlings Alive	
	Per Cent	Number Seedlings	Per Cent	Number Seedlings
Seed sown in spaded soil (roots removed)	9.0	811	1.0	8
Seed sown on surface of duff	.76	69	0.	0
Seed placed under inch layer of duff	.7	63	0.	0
Total (27,000 seed)	3.5	943	.85	8

Two thirds of the germination occured the first year and the remainder the second. Had the seed been sown in the fall it is probable that no germination would have occured beyond the first growing season. An examination of a quantity of the remaining seed revealed that none were viable, many had germinated sufficiently to crack open but by far the largest number decayed. A total of 8 seedlings or .03 of one per cent of the number of seed sown, remain alive and these are so frail that they will probably die within the next couple of years.

The work definitely demonstrates that some germination takes place under timber but the seedlings soon die, probably from a lack of light primarily but also from a lack of soil moisture as seedlings lived longest on the prepared surface where competing roots were removed. For the areas studied at least it is evident that the life of fallen seed is short. That which is not consumed by birds and rodents or does not germinate the first (with possibly a small per cent the second) year is taken by decay. It appears, therefore, that Douglas fir seed to be a factor in restocking logged-off land, must have fallen within a year, or at most two years, previous to the time of cutting.

THE YEAR'S PROGRESS ON THE FOREST SURVEY OF THE DOUGLAS FIR REGION

A review of the first year's work of the Forest Survey in the Douglas fir region indicates a satisfactory rate of progress. Information on over 8,250,000 acres of private and public land other than national forest, and approximately 5,000,000 acres of national forest land has been obtained. Reducing these figures to a percentage basis shows that the gathering of field data on the inventory phase of this project is about 40 per cent complete.

Timber cruises covering over 3,000,000 acres of privately owned timberland have been secured from private owners and this phase of the work is practically completed. About 1,000,000 acres of the O and C revested land grant cruises have been transcribed. The condition of over 200,000 acres of land logged before 1920 has been determined from reports and maps of private operators. Approximately 1,000,000 acres of cut-over land, burned areas, second growth stands, and farm land have been mapped in place by field examiners. Some 966,000 acres of mixed farm and forest land in the Willamette Valley have been covered by strip surveys; using strips spaced three miles apart in order to get a statistical expression of the amount and character of woodland within the so-called agricultural zone. Approximately 63,000 acres of cut-over land have been covered by a strip survey using strips spaced two miles apart. The location of about 2,000,000 acres of land logged since 1920 has been fixed and recorded, but no attempt will be made by the Survey to determine the present unstable cover condition of these lands.

The work of adjusting the private and county cruise records by field examination for the purpose of bringing these estimates to a common standard has commenced and four counties have been completed. Work is now under way in three additional counties. The four counties completed involved the actual cruising of 11,000 acres with a 10 per cent cruise. In addition some studies of the utilization practice of private logging operators in the area check cruised were made. This work has been very much facilitated by the substantial help of the Forestry Department in both States.

Through the cooperation of State agencies an entirely new base map of both States is being prepared to use in presenting the forest types in colors. The Oregon map is about one-half completed.

All estimate assembly and type mapping is completed for the following counties in Oregon: Benton, Columbia, Clatsop, Marion, Polk, Tillamook, Yamhill, and Washington, and work is underway in Coos and Linn Counties, Oregon, and Cowlitz and Lewis Counties, Washington. Check cruising is completed in Clatsop and Columbia Counties, Oregon, and Cowlitz, Wahkiakum and Lewis Counties, Washington, and underway in Coos and Yamhill Counties, Oregon, and Pacific County, Washington.

Compilation of adjusted timber volumes and type areas has been started for Columbia County and a technic has been developed for tabulating the field data for final presentation.

The field work of the Survey on the national forest is about 46 per cent complete. The following table shows the status of the field work on the individual forests:

Mt. Baker	30 per cent complete
Snoqualmie	Work not started
Rainier	100 per cent complete
Olympic	33-1/3 per cent complete
Columbia	53 per cent complete
Mt. Hood	32 per cent complete
Santiam	Work not started
Cascade	56 per cent complete
Siuslaw	5 per cent complete
Umpqua	60 per cent complete
Siskiyou	100 per cent complete
Crater	55 per cent complete

The above concerns only the inventory phase of this project. Work has been hardly begun on the other less time-consuming phases of this comprehensive economic study, namely, the growth phase, the depletion phase, and the requirements for forest products.

R. W. Cowlin

SUPPOSEDLY HARMLESS SURFACE FIRES DAMAGE OLD GROWTH FORESTS

Damage appraisals recently made for the forest insurance study show that surface fires often do unsuspected damage to even the thick-barked old growth Douglas fir trees, although this damage may not be evident for a year or more after the fire.

A year after a surface fire in one old growth stand, 3.5 per cent of the stand, by volume, of trees over 15 inches DBH was shown to have been dead as a direct result of injuries inflicted by the supposedly harmless fire. Two years after another fire 19.8 per cent of the volume of Douglas fir in the stand was in killed trees.

In the Coast Range forests where there is a considerable admixture of hemlock and spruce with a sprinkling of balsam firs, surface fires do truly serious damage. These species have thin bark and many are killed by the fire. A composite picture of two surface fires in the Coast Range shows, for trees over 15 inches DBH, 13 per cent of the Douglas fir, 71 per cent of the hemlock, 90 per cent of the spruce, and 100 per cent of the balsam fir, by volume, dead as a direct result of supposedly innocuous surface fires.

This damage does not show up for a year or two. Fire reports made immediately after the fire are therefore likely to be erroneous in this respect.

H. B. Shepard

THE INTERCEPTION OF SUMMER RAINS BY FOREST COVER

The interception of summer rainfall by the forest canopy is an important factor in fire control. For the surficial wetting effect of an equal amount of precipitation falling in the open and on the forest is quite different; and the percentage of the total precipitation that is caught by the tree crowns and evaporated without ever reaching the ground is greater than one might imagine, though it varies with the type and density of the crown canopy and with the duration and intensity of the rainfall.

In order to evaluate this interception, comparative precipitation measurements were made near the Wind River Branch Station in the open and under forest cover during 118 showers, totalling 48.38 inches and ranging in amount from a mere trace to 3.99 inches. The average per rain was .41 inches and the most probable amount was .04 inches. Using 8 to 12 gauges, 777 measurements were made of summer rains caught under a mature Douglas fir forest. While the crown canopy was estimated to average 65 per cent of complete coverage, the gauges were so placed as to obtain data under a variety of cover densities ranging from 5 to 95 per cent.

When these data were compared with simultaneous measurements made in the open a half mile away, they showed that on the average the forest intercepted 34 per cent of the summer precipitation. In the case of light showers, little or none of it reached the ground under the trees, but when the rain continued until the surficial storage capacity of the overhead foliage was satisfied, the interception became much less.

A dozen gauges were also placed at 20-foot intervals checkerboard fashion under a dense 25-year-old Douglas fir stand and 522 precipitation measurements made. They indicate the interception under this type of cover to amount to 43 per cent. Actually, however, the interception is probably somewhat less than 43 per cent, being decreased by a small amount of run-off down the trunks of the trees.

The interception values obtained from this study conform well to the findings of other investigators both in the United States and in Europe.

From the foregoing it appears that, while the forest tends to preserve moisture in the forest litter by retarding run-off and evaporation, it also prevents an appreciable portion of the summer precipitation from ever reaching the forest floor. Hence it can, and frequently does, happen that a shower which temporarily reduces the fire hazard in the open or cut-over areas to a negligible quantity may have but little alleviating effect in the forest. In the absence of positive knowledge, it is dangerous business for the forest protectionist to assume that a summer shower has caused any significant changes in the fire hazard in the forest itself, regardless of the effect in the open.

A. G. Simson