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FOREST RESEARCH NOTES

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

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THE SURVIVAL OF DOUGLAS FIR SEED TREES

Some definite figures on the survival and seed production of seed trees left on national forest timber sales in the Douglas fir region are now available for six representative areas where approximately two trees were left per acre. The studies were made by men in charge of timber sales on the national forests under the direction of the Experiment Station, and have now been under way from two to five years.

The losses to date on the different plots are shown in the following table:

N.F. Area	Date Est.	Av. Diam.	Trees Defective	Losses by Causes: Falling	Losses by Causes: Skidding	Losses by Causes: Slash fire	Losses by Causes: Windfall	Died	Total Lost	Alive 1929
		In.	P.ct.	P.ct.	P.ct.	P.ct.	P.ct.	P.ct.	P.ct.	P.ct.
Snoqualmie	1926	49.5	72	0	0	20	24	34	78	22
Mt. Baker	1927	39.6	63	0	0	*	23	18	41	59
Cascade	1925	44.1	76	4	0	4	29	2	39	61
Santiam	1926	--	--	22	6	14	12	0	55	45
Mt. Hood	1927	35.1	46	2	12	1	16	0	31	69
Cascade	1926	34.6	66	3	1.5	*	3	1.5	9	91
Average		40.6	64.6	5.17	3.25	9.75	17.83	9.25	42.27	57.83

* Not burned

The study areas varied in size from 30 to 70 acres, and because of the wide range of conditions existing in the region the variation in results is to be expected. The average may be considered a good cross section for the losses in the region as a whole.

The percentage of trees listed as defective include all trees having visible defects, such as conk and fire scars, and many of them contain little or no sound volume.

Many trees were injured and some died after the logging operation was finished. Since the exact cause of death could not be determined, they were given a separate classification - "Died".

Windfall is by far the greatest single cause of loss; however, fire losses are greater than is indicated by the table. Only four of the six areas were burned, and on those burned many trees were not killed outright but were seriously injured by the slash fire; if trees so injured died later, they were listed under "Died", though fire was the most probable cause of death.

In general the heaviest losses occurred on the best sites. This is explained by the fact that in the heavy stands the amount of debris is greater, the ground is more moist, the trees taller, and the degree of exposure is greater.

The seed production of the reserved trees on these areas has been light, but in general was similar to that of surrounding timber, except on one plot on the Cascade Forest where a good cone crop occurred on the seed trees during a season when very little seed was produced on surrounding timber.

Since some doubt exists as to the adequacy of two trees per acre for reseeding, the average loss of 42 per cent assumes profound significance. Several modifications of the present practice may bring better results, more seed trees may be left, they may be left in groups or strips in locations where they are more windfirm and less subject to injury by the logging operation and the slash fire, better fire protection may be provided and less as well as more carefully controlled burning done, delayed logging on occasional settings may be substituted for seed trees and at the same time furnish firebreaks for the area. When none of the above measures appear feasible because of high stumpage values or for other reasons, artificial planting may be resorted to where natural reproduction does not come in.

Many of the above measures are being given a trial on national forest timber sales, and the results are being studied by sample plots and otherwise.

RESPONSE OF FOREST FUELS TO CHANGES IN ATMOSPHERIC HUMIDITY

Variations in the moisture content of forest fuels from hour to hour and day to day are caused largely by variations in atmospheric relative humidity, aside from the effect of precipitation. However, the fuel moisture does not change immediately with changes in relative humidity. Instead there is an appreciable lag in the two events. The degree of this lag is fixed largely by the composition of the fuel itself. Dense woody materials respond much more slowly than do the lighter materials such as weeds and grasses.

As a basis for a study of the daily changes in relative humidity and fuel moisture content, hourly measurements were made of the moisture content of 21 forest fuels common in the Douglas fir region, together with concurrent humidity measurements over a period of 100 hours. Large samples of each fuel were similarly exposed to the air in wire baskets. Analysis of these data showed the lag of the more important fuels in responding to changes in relative humidity to be as follows:

1 to 1½ hours
- Bracken fern
- Fire-killed vine maple leaves
- Outside 1/8 inch of fir snags

1½ to 2 hours
- Gray moss
- Douglas fir duff
- Pearly everlasting
- Fireweed

2 to 2½ hours
- Douglas fir twigs
- Bark from Douglas fir snag
- Decayed Douglas fir wood
- Decayed sap, Douglas fir snag

2½ to 3 hours
- Hawkweed
- Douglas fir needles and twigs

3 to 3½ hours
- Western hemlock bark

It will be observed that Douglas fir twigs responded more quickly to changes in relative humidity than did the sample of needles and twigs. The needles, being hard and oily, were slow to take on and give off moisture. The latter sample averaged lower in moisture during the period of measurements than did the twig sample. Both samples were from slash cut the previous winter.

It is significant that of the fuels tested, bracken fern, vine maple leaves, and outside of snags responded most quickly to changes in atmospheric humidity. When fires pick up and begin to spread in these materials, it is indicative that the fire day is commencing, and conversely when fires die down in them it marks the beginning of the end of the fire day. They are to a degree barometers of fire behavior.

A SITE QUALITY CLASSIFICATION FOR WESTERN YELLOW PINE LANDS

The attached chart, which is similar to one recently prepared for Douglas fir (see Research Notes No. 2, March 11, 1929), illustrates a convenient method for determining the productive capacity - the site quality - of western yellow pine lands. This scheme for gauging the ability of any forested area to produce timber is based on the total height which the larger trees attain in a given number of years. For young forests the chart is based chiefly on measurements from even-aged stands in which the dominant and codominant trees attain the heights indicated by the curves; for the older ages, the chart is based on measurements of mature, dominant trees in typical uneven-aged forests.

The site quality of any given area is determined as follows:

1. Measure the total heights of 15 or 20 of the largest trees in a young, even-aged forest (or of mature, dominant trees in an older stand) and average these height measurements.

2. Obtain the total ages of these trees by increment borings or by counting the annual growth rings on the stumps of an adjacent area. (To obtain total age about 10 years should be added to ring counts made at a height of 3 feet above the ground.) Average these ages.

3. On the chart over the average age of the dominant trees, plot the average height of the trees. The site quality of the land is indicated by the zone in which this plotted point falls. For example, if the average age is 350 years and the height is 170 feet, the site is quality II.

Site quality IV is the most common class in eastern Washington and eastern Oregon; qualities II, III, V and VI are less abundant, and site quality I, the very best, is rare. The site quality is a direct index of the potential capacity of the soil and climate to produce tree growth; yield tables for the commoner site classes found in Oregon and Washington are now in preparation.

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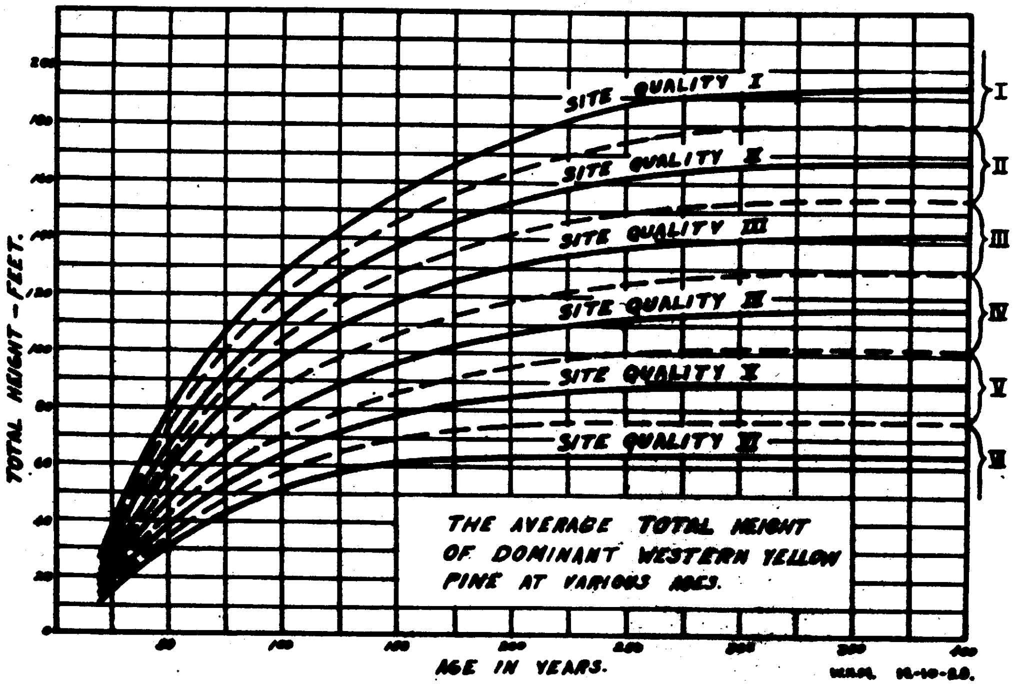

THE EFFECT OF THINNING SAPLING DOUGLAS FIR STANDS

The farmer secures the largest possible yields by giving each plant the right amount of growing space. The forester applies the same principle to forests when he selects certain trees for his final crop of timber and cuts away the neighboring trees which are competing for growing space. It is to be expected that as forest practice becomes more intensive in the Douglas fir region, foresters will have more and more occasion to make thinnings, particularly since Douglas fir is a malleable species that responds readily to improvement in its growing conditions.

The Pacific Northwest Forest Experiment Station is now gathering the information which will be needed for properly thinning young forests of Douglas fir. This information can not be obtained in a few months or a year, but must be found by actual experimentation over a period of several decades. A record for 10 years on one experimental area is now available and furnishes instructive figures. A series of three plots was established 10 years ago on land logged in 1910 in Wind River Valley, Washington. One plot was thinned so that the trees were left to an exact 8' x 8' spacing, regardless of the dominance of the sapling found at the regular intervals. Another plot was thinned to an approximate 8' x 8' spacing but leaving only the dominant trees. A third plot was left untouched as a check.

Each plot has been remeasured twice. The thinning does not seem to have affected height growth as indicated at least by the average height. The average height of the trees on the regularly spaced plot is close to that of the average height of all the trees on the unthinned stand while the average height on the plot having dominant trees only is close to the average height of the tallest 500 trees in the unthinned stand. This is probably to be expected since one contains trees of various degrees of dominance, while its mate contains only dominant saplings.

The effect of thinning upon diameter growth, however, is more pronounced. On the plot having dominant trees only the average diameter is one-half inch larger, and there are two and one-half times as many trees above 4 inches in diameter as on the check plot. On the regularly spaced plot, however, the diameters are hardly better than those of the best 500 trees on the check plot. These two relations indicate that in a young stand like this, a thinning should strive to select the more promising dominant saplings than to effect exactly uniform spacing.

Basal area growth, being dependent upon diameter growth, also reflects the favorable effect of the thinning. Though the thinned plots had at the start a considerably smaller basal area than that of the check plot, namely, 15 per cent for the regularly spaced and 41 per cent for the plot with dominants only, now at the end of 10 years, their basal areas are 30 per cent and 58 per cent, respectively, of that of the check plot. If a thinning in a young stand can have such a pronounced effect in such a short period, what can be expected during the full life cycle of a timber crop?

STATION NEWS ITEMS

Forest Insurance Study Begun

A study of forest insurance is now under way in the Pacific Northwest as an activity of this Station. Its purpose is to determine the practicability of insuring both old timber and immature growth and to arrive at some measure of the factors upon which rates might be based. It will be conducted purely as a fact-finding economic research. Mr. H. B. Shepard who has been selected to make this study is a graduate of the Harvard forest school with several years' experience in fire insurance. The study will be closely correlated with the studies of fire behavior, fire damage, and hazard rating which the Station is making. The insurance project will in a year or two be extended to other regions, as it is national in scope.

McArdle Back

R. E. McArdle, who first joined the Station in 1924, has returned after being on furlough the last three college years while taking graduate study at the University of Michigan. He has been given the degree of Doctor of Philosophy. Dr. McArdle will be assigned to fire studies for which he has been especially preparing himself.

Forest Research Council

The officers of the Council for 1930 elected at the annual meeting in February are Dean George W. Peavy, Chairman, Aubrey R. Watzek, Vice-chairman, and Thornton T. Munger, Secretary. The Secretary of Agriculture has appointed S. V. Fullaway to fill the place on the Council made vacant by the retirement of A. W. Cooper.

Forest Survey Staff

The technical staff for the Forest Survey of the Douglas fir region was gradually increased as the field technic was worked out and now consists of the following:

Senior Forest Economist H. J. Andrews, in charge of project
Associate Forest Economist R. W. Cowlin (superintending collection of private cruise records)
Assistant Forester Donald N. Matthews (superintending the inventory of the National Forests)
Assistant Forester W. H. Bolles
Assistant Forester P. D. Kemp
Junior Forester F. L. Moravets
Junior Forester P. A. Briegleb
Junior Forester E. D. Buell

Further additions to the staff will be made shortly. Among them will be Logging Engineer James W. Girard, for a long time Chief Logging Engineer in the Northern Region of the Forest Service, later General Manager of the Fred Herrick Lumber Company, and now Logging Engineer in the Eastern Region of the Forest Service.