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Cutting Ages for Second Growth Stands of Douglas Fir and Western Hemlock of the Lower Fraser River Valley

As timber cutting progresses into more remote and less accessible stands of old growth timber, a demand for more accessible stands of immature second growth is created. Demand for this class of material has already appeared in the Lower Fraser River valley, where practically all of the readily accessible mature timber has been previously utilized. Some rather extensive stands of second growth occur in the locality, of a size just large enough to render them merchantable, and of an age of about 100 years. The privately owned material of this nature is being rapidly utilized and the demand for similar Crown timber will increase as the private holdings are harvested. The question naturally arises as to whether these immature stands are yet ripe for harvest, and if not, to what age they should be held. This investigation was undertaken to suggest an answer.

Many different combinations of factors might be used in arriving at a logical answer. The kind of products desired plays an important part in the choice of the cutting age. Pulpwood may be grown on a short rotation. Lumber products require a relatively long rotation. Quality of product is a second important consideration. To produce the higher grades of lumber a long rotation is necessary. Financial considerations may play an important part in the choice. If $1.50 per thousand may be obtained for a stand 100 years of age, will the owner realize a greater net return by holding for another 20 or 40 years when a greater volume and a higher quality of material would be obtained?

Cutting ages in this report are based on the assumption that lumber is the product desired, and that the opportune cutting age is the one which will produce the greatest volume per acre over a long period of time. In other words, cutting age is determined from the time at which the greatest mean annual growth in board foot volume occurs. Quality of material is considered only indirectly.

Since the problem of second growth cutting is most acute in the Lower Fraser River valley, investigations were made in this locality, where there are extensive stands of second growth in the 80 to 100 year old age class. North of the Dewdney Trunk Road between Haney and Mission the stands are generally mixtures of fir and hemlock. Around Hope they are practically pure fir.

The fir-hemlock stands are being manufactured into lumber and ties. Logs which reach the mill are utilized to the usual degree of completeness, but a large amount of small material is left in the woods. The fir generally dominates the hemlock in the standing timber and carries heavy branches and dead stubs for most of its length. The hemlock on the other hand carries much smaller branches and is generally well pruned to about half its height. For this reason the fir yields only lower common grades of lumber, while the hemlock yields some higher common grades. Manufacture is carried on in both portable and stationary mills.

The pure fir stands near Hope are utilized almost solely for ties. Manufacture is accomplished by portable mill. These operations are extremely wasteful, as any part of a log that will not make a tie is discarded. On some logs a 5 or 6 inch slab, the best part of the log, is removed, thrown in the slab pile and later burned.

A large part of the fir-hemlock stands near Haney and Mission is privately owned and cutting is proceeding rapidly. Within a few years all this privately owned material will have been removed and Crown timber of the same nature will be in still greater demand.

Two sources of information were used in determining if the stands described above were yet ripe for cutting:

1. Permanent sample plots established in the past.

2. Temporary plots on which current growth was determined by extracting increment cores.

1. Permanent Sample Plots

Two permanent sample plots were established in 1931 near Davis Lake, about 10 miles north of Mission. Their combined area is 1.8 acres, and they are representative of the fir-hemlock stands now being cut in the vicinity. Present age (1940) of the stands in which they are established is 89 years. The D.B.H. of each tree on the plots was measured in 1931 and again in 1940. The total heights of some of the trees were measured at the same dates. From these data it was possible to compute the basal area and volume existing in 1931 and in 1940. Only trees having diameters at breast height of 11 inches or more were considered in the calculations, as 11 inches is the approximate utilization minimum. In volume computations Tables 2 and 9 of "Volume, Yield, and Stand Tables for some of the Principal Timber Species of British Columbia" were used, with utilization limits as specified therein. The outcome of the compilations is tabulated below.

Table 1. Yields Produced on 1.8 Acres of Permanent Plots in 1931 and 1940.

Species	Basal Area Sq. ft.		Volume B. M.	
	1931	1940	1931	1940
Hemlock	168	202	37,600	48,600
Douglas Fir	124	142	34,300	41,800
Both species	292	344	71,900	90,400

The mean annual growth resulting from these yields is shown below, using ages of 80 and 89 years for 1931 and 1940 respectively.

Table 2. Mean Annual Growth on 1.8 Acres of Permanent Plots in 1931 and 1940.

Species	Basal Area Sq. ft.		Volume B. M.	
	1931	1940	1931	1940
Hemlock	2.10	2.27	470	546
Douglas Fir	1.55	1.59	429	470
Both species	3.65	3.87	899	1016

This table indicates that the mean annual growth in all cases is still increasing. The culmination point will be reached at some time in the future, and it is therefore apparent that these stands may be advantageously held. The total plot volume is increasing at a rate slightly in excess of yield table expectations for hemlock, for site index 140. The normal yield at age 80 for 1.8 acres is 98,000 board feet. The actual yield of 71,900 at age 80 represents about 75 percent of full stocking, and on this basis there should be a volume of 89,000 board feet at 90 years. The excessive increase to 90,000 was to be expected since the stand is understocked and hence there should be a tendency to build up towards full stocking. Mean annual growth in fully stocked stands in board foot volume on the same site culminates at 130 years of age. Understocked stands tend to maintain their rate of growth for a longer period and the culmination point of mean annual growth on the plots should be reached at some point not far beyond age 130.

The plots are representative of very good sites, and for such, a cutting age of 130 years is suggested. On poorer sites the mean annual growth does not culminate until a greater age is attained. On site index 100 at 100 years of age, it is reached at about the same time, but on site index 60 at 100 years, it is not reached until 170 years is attained.

2. Temporary Sample Plots

Circular sample plots varying in size from 0.1 acres to 0.25 acres were established at random in second growth stands. The present D.B.H. and the radial growth at B.H. over the last four decades of each tree on the plot were measured and recorded. The total height of six or seven trees on each plot was also recorded. A total of sixteen plots was established, having a total area of 2.075 acres.

From these data the D.B.H. of each tree on the plots was calculated for 1930 and 1920, and from this the basal area of each tree was worked up for 1940, 1930 and 1920. The total basal area for each plot and the total of all plots were computed at each decade. By means of a diameter-height curve board feet volumes of trees of 11 inches and over were computed at the same dates. The results over all plots are shown below, separately for mixed hemlock-fir stands found in the vicinity of Hope.

Table 3. Yields Produced on 1.575 Acres of Temporary Sample Plots in Mixed Hemlock-Fir Stands--Age in 1940, 90 years.

Species	Basal Area Sq. ft.			Volume B. M.		
	1940	1930	1920	1940	1930	1920
Hemlock	191	169	146	52,200	42,000	33,400
Douglas Fir	135	120	107	46,300	38,800	31,400
Both species	326	289	253	98,500	80,800	64,800

The mean annual growth resulting from these yields is shown below using ages of 90, 80 and 70 years for the dates of 1940, 1930 and 1920 respectively.

Table 4. Mean Annual Growth on 1.575 Acres of Temporary Sample Plots in 1940, 1930 and 1920.

Species	Basal Area Sq. ft.			Volume B. M.		
	1940	1930	1920	1940	1930	1920
Hemlock	2.12	2.11	2.08	580	525	477
Douglas Fir	1.50	1.50	1.34	515	485	449
Both species	3.62	3.61	3.42	1095	1010	926

These records indicate that mean annual growth is still increasing; slowly in respect to basal area, more rapidly in respect to volume measured in board feet. It is thus evident again that these mixed stands may be held advantageously for future cutting.

Table 5. Yields and Mean Annual Growth on 0.50 Acres of Temporary Sample Plots in Pure Fir Stands--Age in 1940, 100 years.

Item	Basal Area Sq. ft.			Volume B. M.		
	1940	1930	1920	1940	1930	1920
Yield	103	93.5	84.5	27,600	23,800	20,200
M.A.G.	1.03	1.04	1.05	276	264	252

These records indicate that the culmination point of mean annual growth in basal area has already been reached, although the decrease from 1920 to 1940 is very small and probably of little significance. In board foot volume on the other hand, mean annual growth is still increasing, and it is this in which our interest is mainly centered.

Conclusions

From the foregoing data it is evident that in the stands examined which ranged from about 90 to 100 years of age, mean annual growth in board foot volume, inclusive of all trees 11 inches and over, is still increasing. That this should be so is indicated in the provincial yield tables for western hemlock which show that mean annual growth for the stand 10 inches and over culminates at age 130 on the best sites, and at a greater age on poor sites. The provincial yield tables for Douglas fir, which have been compiled in board feet down to a minimum D.B.H. of 6 inches, show a culmination point for this size limit of 80 years. For the 11 inch limit the culmination point would occur at a greater age. The yield tables for Douglas fir published by the Pacific Northwest Forest Experiment Station for site index 140 or site III, which is a site comparable to that of the stands studied, indicate a culmination point of about 110 years for trees 12 inches and over, but even after this point has been reached the growth rate decreases slowly. Stands could be advantageously held beyond this age.

It is therefore recommended that, from the standpoint of volume recovery, no cutting should be allowed before an age of 120 years has been attained, and at this age only on the best sites. On poorer sites cutting should not be allowed until age 140 or more has been reached. This rule may be applied generally to pure stands of either Douglas fir or western hemlock, and to mixtures of the two species. A tendency is evident for the growth in pure hemlock stands and in mixed stands of Douglas fir and hemlock to culminate at an age of 10-20 years greater than in Douglas fir.

The cutting ages recommended herein check closely with those computed by Meyer and Briegleb (1) for Douglas fir in Washington and Oregon. In this report rotation ages for board foot volume in trees 11.6 inches and over range from 90 years on the very best site to 150 years on the poorest site. Sites on the British Columbia Coast are generally lower than in Washington and Oregon, and for this reason the cutting age in British Columbia should be generally higher.

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(1) W. H. Meyer and P. A. Briegleb. Forest Growth in the Douglas Fir Region. Forest Research Notes. Pacific Northwest Forest Experiment Station. No. 20, 1936.