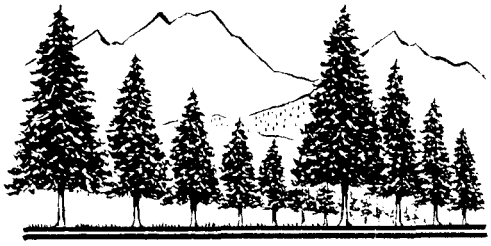

research notes

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ESTIMATION OF SITE QUALITY IN JUVENILE DOUGLAS FIR STANDS

By

G. C. WARRACK and A. R. FRASER

Research Division, B.C. Forest Service

DEPARTMENT OF LANDS AND FORESTS
VICTORIA, B.C., CANADA

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PROBLEM

Forests can be classified by quality of site on the basis of the average total height of dominant and co-dominant trees. The average total height attained at 100 years is the site index and tables present yields by values of site indices. Unfortunately, these yield tables do not clearly define age-height curves below an age of 20 to 30 years. Therefore, a problem arises in estimating site index in young stands while still using average total height as the criterion. Can a method be evolved to provide an acceptable estimate, and to provide a supplementary check on site values based on forest associations and soil characteristics? To fill this need Wylie (2) suggested and briefly worked on a method. This study develops his earlier work.

HYPOTHESIS

In Douglas fir stands, long after canopy closure, the distance between nodal branches is distinct and tends to near constant length in the decade of height growth above a level of five feet. The internodal distances may be measured by marked rod with accuracy and ease. Any combination of individual internodal distances may be summed as a single span measurement and related to the site index of the stand in which the measurements are taken. When several such sample spans are available from various stands the relationship can be determined between the span distance (for example, between the first and sixth whorl above breast height) and site index. Once established, this relationship can be used with discretion as an indicator of site index in stands even before the age of canopy closure. It would only be necessary to measure the length between a given span of main nodal branches and read off the corresponding site index.

OBJECTIVES

1. To measure in well-established stands of known site index and above an age of 40 years, annual nodal distances between the first and sixth whorl above breast height.

2. To determine the relation between two single span measurements of nodal distance and site index, namely, a 4-node span and a 6-node span, i.e., the cumulative annual nodal lengths between the first whorl above breast height and the fourth and sixth node respectively.

3. To appraise the usefulness of the two relationships in terms of field use.

EXPERIMENTAL

Thirty-six sample plots were located in even-aged, undisturbed, and well-stocked stands with clearly defined internodal distances on the dominant and co-dominant trees. The stands were all on Vancouver Island between Victoria and Campbell River and east of Port Alberni. Plots were not regular in size, but restricted to apparently homogeneous patches. The lowest average total heights in two sub-plots on very low quality site was 45 and 49 feet respectively and on a site of very high quality the average total height was 143 feet. Only one sample was taken in a stand (36 years) less than 40 years old. The remainder were well distributed in ages up to 87 years. The frequency distribution of the samples according to site indices was five plots in site index classes 80 to 109, seventeen in site index classes 110 to 149, and fourteen in site index classes 150 to 190+.

In each of the plots, ten trees, usually in the ratio of 5 dominants and 5 co-dominants (but on occasion in the ratio of six to four of either crown class) were measured for total height, diameter (b. h.), and internodal distance between each whorl starting zero at the first whorl above breast height and reading off cumulative lengths of the main nodal points in feet and tenths of feet for the next five internodal spaces. The ages of ten trees were determined accurately from increment cores. Height and nodal lengths were always taken on the same tree.

ANALYSIS

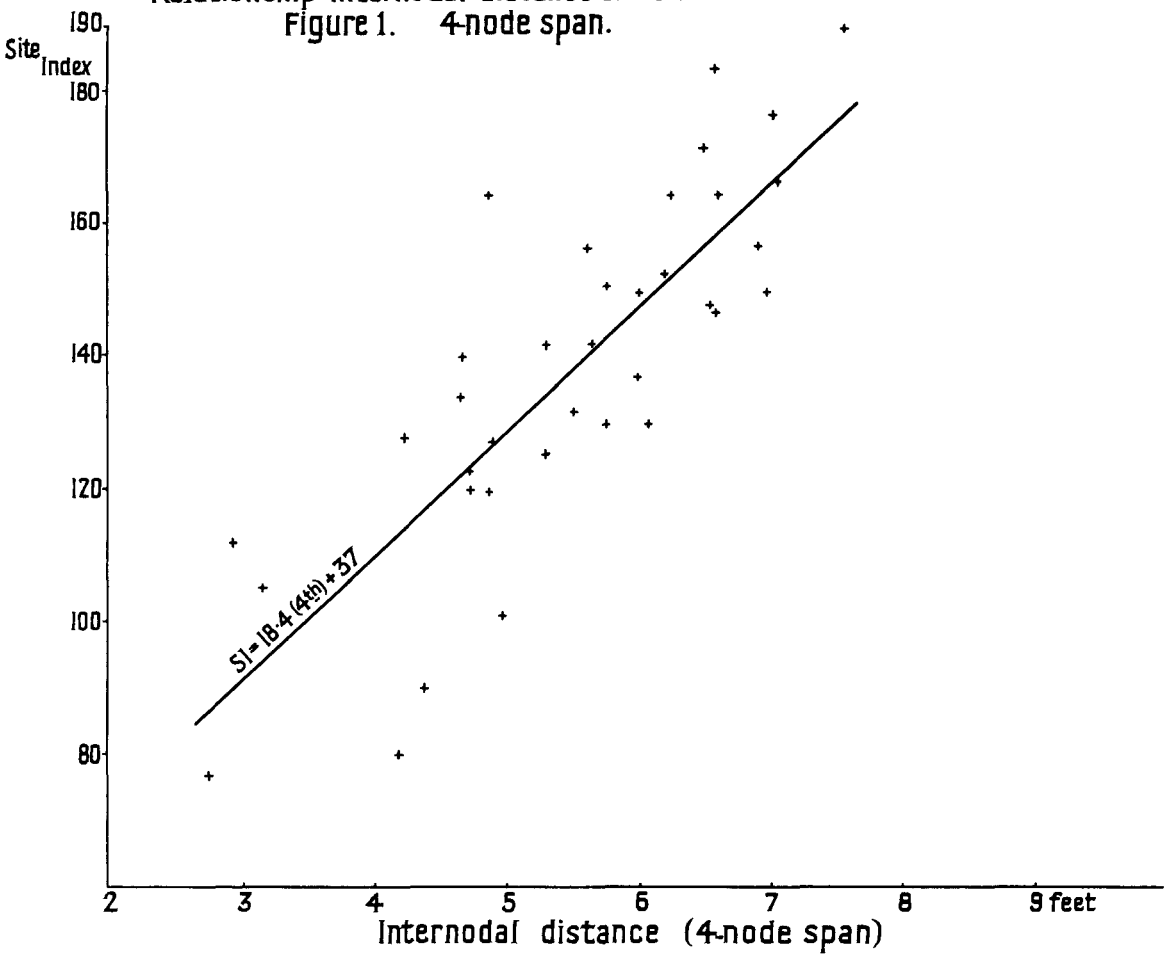
1. The site index of each plot was determined from age-height curves derived from the permanent plots of the B. C. Forest Service. (1)

2. In each plot, individual internodal distances for the ten trees were averaged as 4-node and 6-node span-lengths. The intention was to determine whether the lower span gave as reliable an estimate as the distance between six nodes.

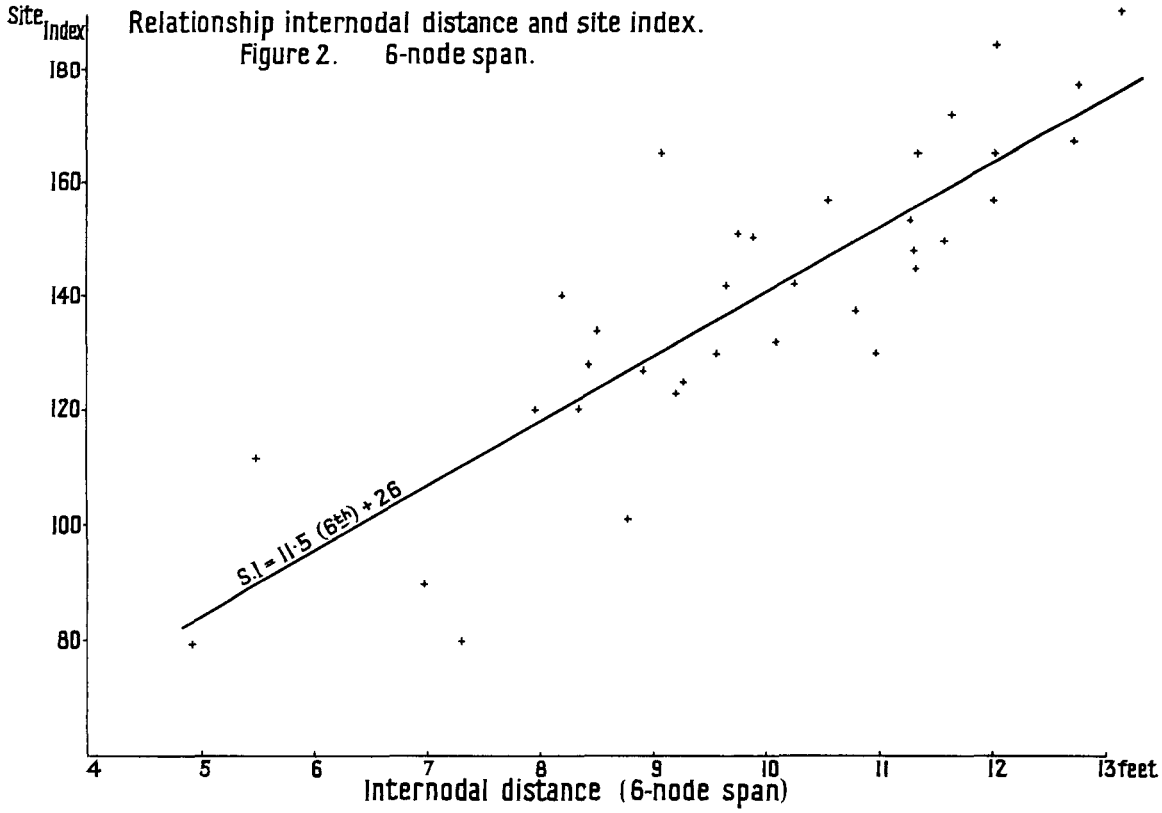
3. Separate relationships between the 4- and 6-node span-distances and site index values were derived in the form of a linear regression fitted by method of least squares and graphically illustrated in Figures 1 and 2. Both regressions are highly significant.

4. Values of site index can be read off the graphs according to the nodal span-length in feet. For example, if measurements of 6-node span-lengths average $8\frac{1}{2}$ feet then the site index of the sample is 124.

Relationship internodal distance and site index.
Figure 1. 4-node span.



Relationship internodal distance and site index.
Figure 2. 6-node span.



DISCUSSION

The relationship of these two internodal distances to site index can now be represented by the following regression equations:

S.I. = 18.4 (4-node span-length) + 37..... I
S.I. = 11.5 (6-node span-length) + 26.....II

In the derivation of these relationships internodal distance was assumed free of error and the simplest regression procedures were followed. In fact, span-distance is the mean of a sample of 10 dominant and co-dominant trees from a restricted, apparently homogeneous, patch within a stand, and is subject to an error of the mean averaging 5 to 6 per cent. The relationship should be weighed according to these errors, if a complete appraisal of the utility of the expression in application is to be made. However, such a refinement is believed to be of small practical value. The basic data was collected in stands 36 to 87 years old, and hence reflects average effects of growing conditions, for example, climatic cycles, of the dates when these stands were in their juvenile stages of development. In application to individual stands, currently less than 20 years old, the effect of prevailing environment would upset refined estimates of expected precision. Moreover, the use of site determination in juvenile stands is such that no great refinement is necessary.

For practical purposes the following simple appraisals of the usefulness of the expressions are made.

	6-node span (5 internodal spaces)			4-node span (3 internodal spaces)		
	No. of samples	%	Cum. %	No. of samples	%	Cum. %
within ± 10' of S.I.	20	55	55	17	47	47
within ± 20' of S.I.	11	31	86	13	36	83
within ± 30' of S.I.	3	9	95	4	12	95
within + 35' of S.I.	2	5	100	2	5	100
	36	100		36	100	

Provided measures of 6 nodes on not less than ten future dominants and co-dominants are averaged for single site determinations, (i.e., average of ten trees) then 55 per cent of single determinations should be within 10 feet of site index, 86 per cent within 20 feet, and 95 per cent within one quality class. When several individual determinations are made for each tract to be site-classified much more confidence can be placed in tract averages.

Statistically, determinations by 4 nodes are not significantly less precise than by 6 nodes. Because this may be due to the relatively small numbers of the samples and, further, as longer periods are better for reducing climatic effects, it is recommended that the 6-node span measurement be favoured over the 4-node span, except on those juvenile stands which do not have the necessary whorls developed above breast height.

CONCLUSION

By intention, the scope and amount of data collected for analysis was restricted to a minimum number of plots necessary in the development of a relationship between internodal distance and site index. Even though the result of the analysis augurs well for the method, it is not intended to proclaim it as a final prescription. It can be used as an adequately reliable aid in classifying juvenile stands for general management purposes.

LITERATURE

1. B. C. Forest Service Annual Report, 1952 (see page 42).

2. Wylie, N. A. Determining Site Index in Young Douglas Fir Stands. Thesis submitted in partial fulfillment for requirements of British Columbia Registered Foresters' Association.