STATION NOTE

Crown Development: An Index of Stand Density

A study of crown characteristics of several hundred open-grown oak, hickory, and Norway spruce trees in Iowa revealed a high correlation between stem diameter and crown area. Consideration of this relationship led to the idea that perhaps here was a realistic way to measure and evaluate stand density or stocking. If, given unlimited growing space, trees of a certain species and diameter developed crowns of almost identical size, why couldn't the extent to which this development is limited in a forest stand be used as an index of stand density? Such an index would also express numerically the amount of competition existing in a stand.

The idea was developed further along these lines: If enough open-grown trees were distributed over an acre of land so that the crowns met but did not overlap, there would be no competition yet no wasted space. Then the percentage of an acre that the crown of each tree occupied would be a significant figure. The sum of these percentages for all the trees on the acre would be 100. This figure was called the "Crown Competition Factor" or CCF. A similar stand containing twice as many trees of the same species and d.b.h. would have a CCF of 200. Because stands having a CCF of 100 would be made up of trees with open-grown form, an optimum CCF for all species would of course be somewhat greater than this.

Encouraging results have been obtained in a limited application of this method. In heavily stocked, even-aged oak stands in Iowa a very consistent CCF value was obtained regardless of site or age of the stands. When the CCF method was applied to yield tables for even-aged upland oak a nearly constant value was also obtained independent of site index and age. The independence of the CCF on site, age, and diameter distribution is a highly desirable feature that is not present in most density control methods. In theory the CCF should apply equally as well to uneven-aged stands, although it has not yet been applied to such stands.

Relatively few measurements of open-grown trees are required, but the sample trees selected should be truly open grown without evidence of past competition. When the relationship between crown diameter and d.b.h. is known, computing the CCF is a simple matter (table 1).

Table 1.--Determination of the Crown Competition Factor (CCF) for an Even-Aged Upland Oak Stand, Age 50, Site Index 50.

D.b.h. (inches)	Trees[1]	Open-grown crown acreage per tree	Total crown acreage
	Number	Percent	Percent
0.25	2	.023	.05
1	25	.044	1.10
2	62	.082	5.08
3	94	.133	12.50
4	115	.196	22.54
5	114	.270	30.78
6	93	.356	33.11
7	61	.455	27.76
8	32	.566	18.11
9	17	.688	11.70
10	7	.822	5.75
11	1	.969	.97
	623		

Crown Competition Factor = 169.45

[1] From: Schnur, G. Luther. Yield, stand and volume tables for even-aged upland oak forests. U. S. Dept. Agr. Tech. Bul. No. 560, table 37, 1937.

A more detailed account of this study will be published soon. The publication will describe the methods used in collecting the field data, the development of the crown competition concept, and the derivation of formulae.

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