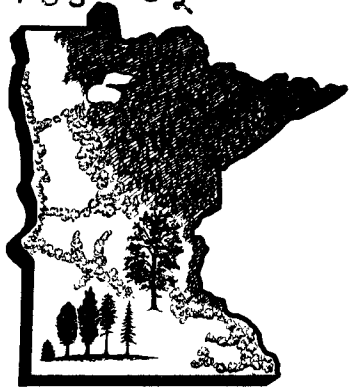


MINNESOTA FORESTRY NOTES

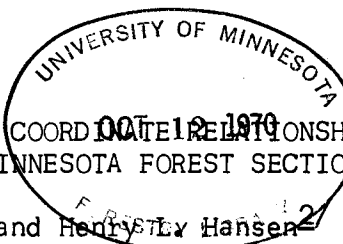
COPY 2

No. 133
July 15, 1963



SITE INDEX AND SYNECOLOGICAL COORDINATE RELATIONSHIPS OF JACK PINE STANDS IN TWO MINNESOTA FOREST SECTIONS^{1/}

Sidney S. Frissell, Jr. and Henry L. Hansen^{2/}



Synecological coordinates have been used to describe and interpret vegetational-environmental relationships in forest ecosystems (Minn. For. Notes Nos. 84, 90, 91, and 99, and Bakuzis, 1959). In addition, some relationships between site index and moisture and nutrient synecological coordinates have been reported in Minn. For. Notes No. 119.

This study compares site index and synecological coordinate values for jack pine stands in the Central Pine Section (No. 3, Fig. 1) and in the Border Lakes District (No. 1-A).

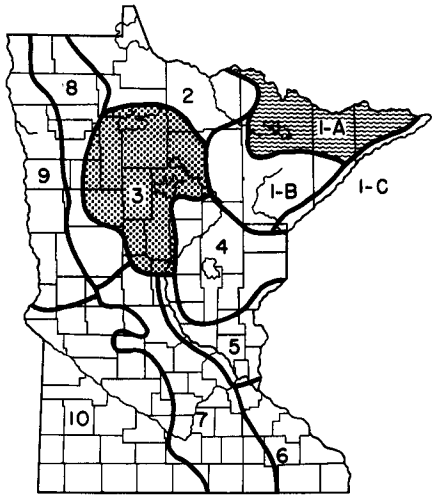


Table 1. Site index values for the Central Pine Section and the Border Lakes District.

SITE INDEX	CENTRAL PINE SECTION	BORDER LAKES DISTRICT
Maximum	72	60
Average	56	55
Minimum	37	35

Figure 1. Geographic divisions of Minnesota Forests (After Bakuzis, et. al., Minn. For. Notes No. 99, 1960).

Data for the Border Lakes District are from a field study by Richard Waring (1959). Data for the Central Pine Section are from a study in 1961 by the School of Forestry and the Soils Department of the University of Minnesota. Fifty-eight jack pine stands meeting certain compositional criteria were examined in the Central Pine Section and data were taken on the total vegetation from which site index and synecological

coordinate values could be obtained. Similar values were calculated from 25 stands in the Border Lakes District. A summary of the site index values for the two areas is given in Table 1.

For the Central Pine Section synecological coordinates were calculated for moisture, nutrients, heat, and light (See Minn. For. Notes No. 90 for procedure.) and were related separately to site index by simple regression analysis. In addition, a multiple curvilinear regression analysis related the combined moisture and nutrient values to site index.

Synecological coordinates for moisture and nutrient factors for stands in the two different geographic areas studied were plotted to give the outline configurations in Fig. 2. The large outlines represent the total edaphic field or the range of moisture and nutrient

^{1/} This project was made possible by a grant from the Northwest Paper Foundation, Cloquet, Minnesota.
^{2/} Research Assistant and Professor, respectively, School of Forestry, University of Minnesota. Published by the School of Forestry, University of Minnesota, St. Paul 1, Minnesota, cooperating with the Division of Forestry, Minnesota Conservation Department, and Forest Industries of Minnesota

values for all forest stands which have been sampled within each area. The smaller outlines represent the approximate range of moisture and nutrient values for jack pine stands sampled within each area. In addition, the pattern of site index distribution for jack pine is indicated by cross hatching. This pattern in the Central Pine Section was determined by applying the multiple curvilinear regression relationship. For the Border Lakes District the pattern of variation was established by fitting contour lines to the basic site index values as distributed over the range of synecological coordinate values.

From the data summarized, a number of relationships are suggested. The regression analysis indicated that moisture and nutrients combined are significantly related to site index at the one percent level and account for 36 percent of the variation in site index.

Jack pine sites as rated by site index values average about the same for the two areas studied. However, the extremes of good site index are distinctly higher in the Central Pine Section. The site index zones in the Border Lakes District tend to be somewhat horizontally oriented and those in the Central Pine Section vertically oriented (Fig. 2). This indicates that site index responds more to nutrients in the Border Lakes District and to moisture in the Central Pine Section.

A comparison of the pattern of variation of jack pine sites studied in the two areas reveals considerable similarity in location and orientation. This is of special interest since the analysis in the Central Pine Region used multiple regression in locating the site index curves and that in the Border Lakes Section used the contour mapping technique which has been applied in earlier work.

References

- Bakuzis, E.V. 1959. Synecological coordinates in forest classification and in reproduction studies. Unpublished thesis, 244 pp.
 Waring, R.H. 1959. Some characteristics of the upland forest types in the rock outcrop area of northeastern Minnesota. Unpublished thesis, 49 pp.

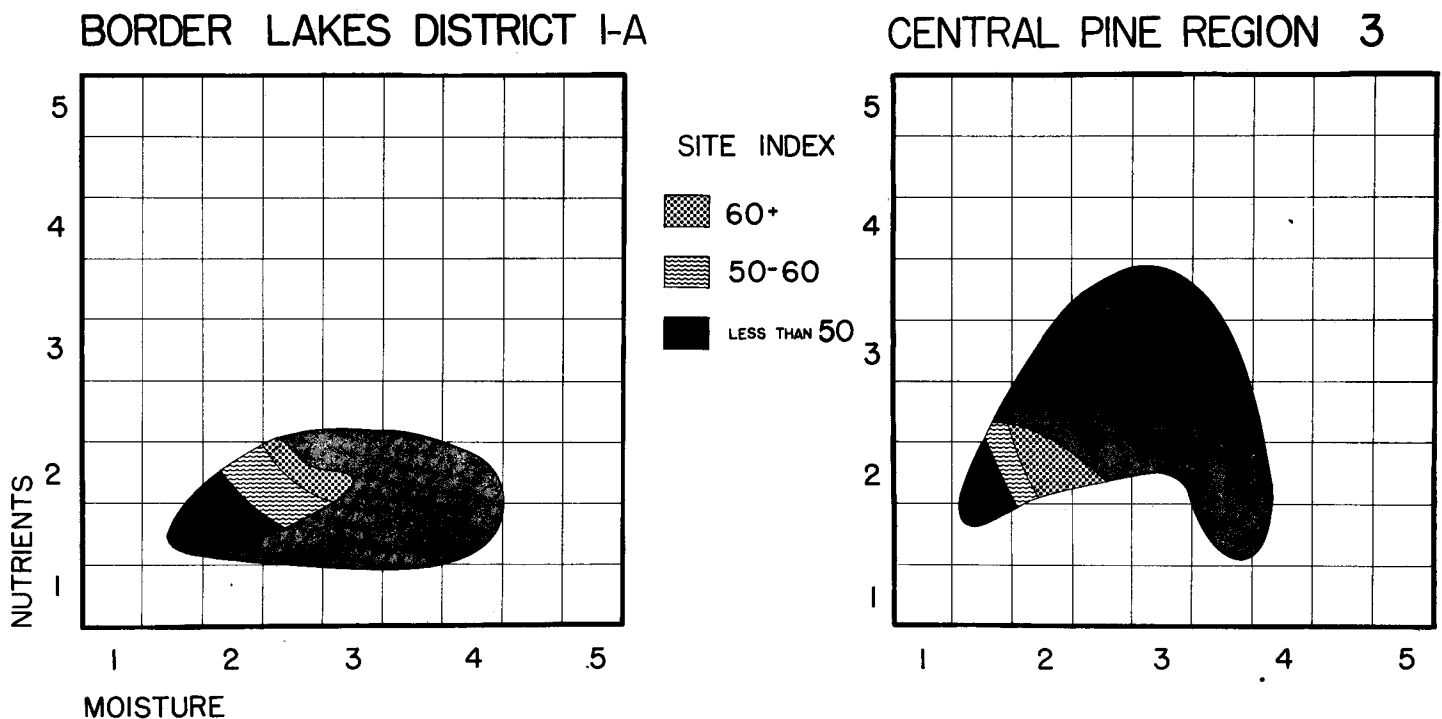


Figure 2. Jack pine site index relationships within edaphic fields. Total edaphic fields adapted from Bakuzis et. al., Minn. For. Notes No. 99, 1960.