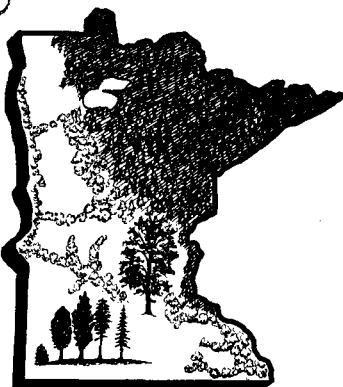


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WEIGHTED SITE INDICES IN RELATION TO SOME CHARACTERISTICS OF THE EDAPHIC FIELD OF THE CENTRAL PINE SECTION OF MINNESOTA FORESTS^{1/}

Egolfs V. Bakuzis, Henry L. Hansen and Vilis Kurmis^{2/}

This note reports some of the results of an ecological study of 55 forest stands located in Section 3 (see Minn. For. Notes No. 99), an area lying approximately between Itasca State Park, Red Lake, Grand Rapids, and Brainerd. These stands were studied using the method of synecological coordinates as described previously (see Minn. For. Notes Nos. 84, 90-92, 99-101, 117, 118, and Bakuzis, 1959). The entire edaphic field was sampled. The minimum size of area was 4000 sq. m. (1 acre). Stands over 40 years old and without recent disturbances were selected. Trees were measured on two Bitterlich stations and on eight subplots, each 128 sq. m. in size. Dead trees and stumps were also tallied. Reproduction, shrubs, and lesser vegetation were measured on eight subplots, each eight sq. m. in area. Soil samples for analysis and greenhouse tests were collected from a central soil pit for all horizons and from two upper horizons on the eight subplots.

Site indices were determined from Lake States Forest Experiment Station charts, using the red oak chart for all northern hardwood species and the aspen chart for balsam poplar. To characterize growing conditions as they are influenced by soil and climate and modified by species composition, stand density, and stand history, weighted site indices were computed for individual species and the whole stand. Weighting was done proportionally to basal area within individual age, crown-class, and species groups.

Results are presented in edaphic (moisture-nutrient) coordinate axes on a relative scale from 1 to 5 indicating increasing intensity of the factor complexes.

The illustration indicates that silt and clay content does not change systematically over the mineral part of the edaphic field. Thickness of organic layer and depth of mottling and groundwater level show regular zonation patterns reflecting moisture conditions of the mesic and wet sites. Acidity of the upper organic layer is related to both moisture and nutrient regimes. However, low pH values associated with pines on dry sites and with black spruce and tamarack on wet sites extend into higher nutrient levels. Water holding capacity of the upper organic layer may have some indicator value as to the productivity of deeper organic soils.

The maxima of the average site indices for all species are located in the central areas of the edaphic field. The maximum on relatively dry and poor soils is due primarily to jack pine but the corresponding basal area is low. The maxima of the weighted site indices of individual species are dispersed over the entire edaphic field. The mesic-rich position is occupied by the maximal indices of basswood and sugar maple. The maxima of red oak, elms, and black ash are located at high nutrient levels. Balsam fir maximum is reached only at the outer fringes of basswood distribution, and it appears that there is no basis for a climatic balsam fir-basswood climax in this area as has sometimes been proposed. The site index

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^{2/} Assistant Professor, Professor, and Research Assistant, respectively, School of Forestry, University of Minnesota.

maximum for balsam fir is located between narrow moisture limits. Aspen and paper birch have several maxima indicating a possible existence of several ecotypes of these species. On wetter sites aspen maximum grades into balsam poplar. White pine shows rather small variation of the site index. The maxima of red pine and jack pine are located on the same nutrient level with the jack pine maximum at the drier side. Bur oak shows the lowest maximum of all upland species and black spruce of all lowland species.

SOME CHARACTERISTICS OF THE EDAPHIC FIELD AND SITE INDICES OF THE FORESTS OF CENTRAL MINNESOTA PINE SECTION

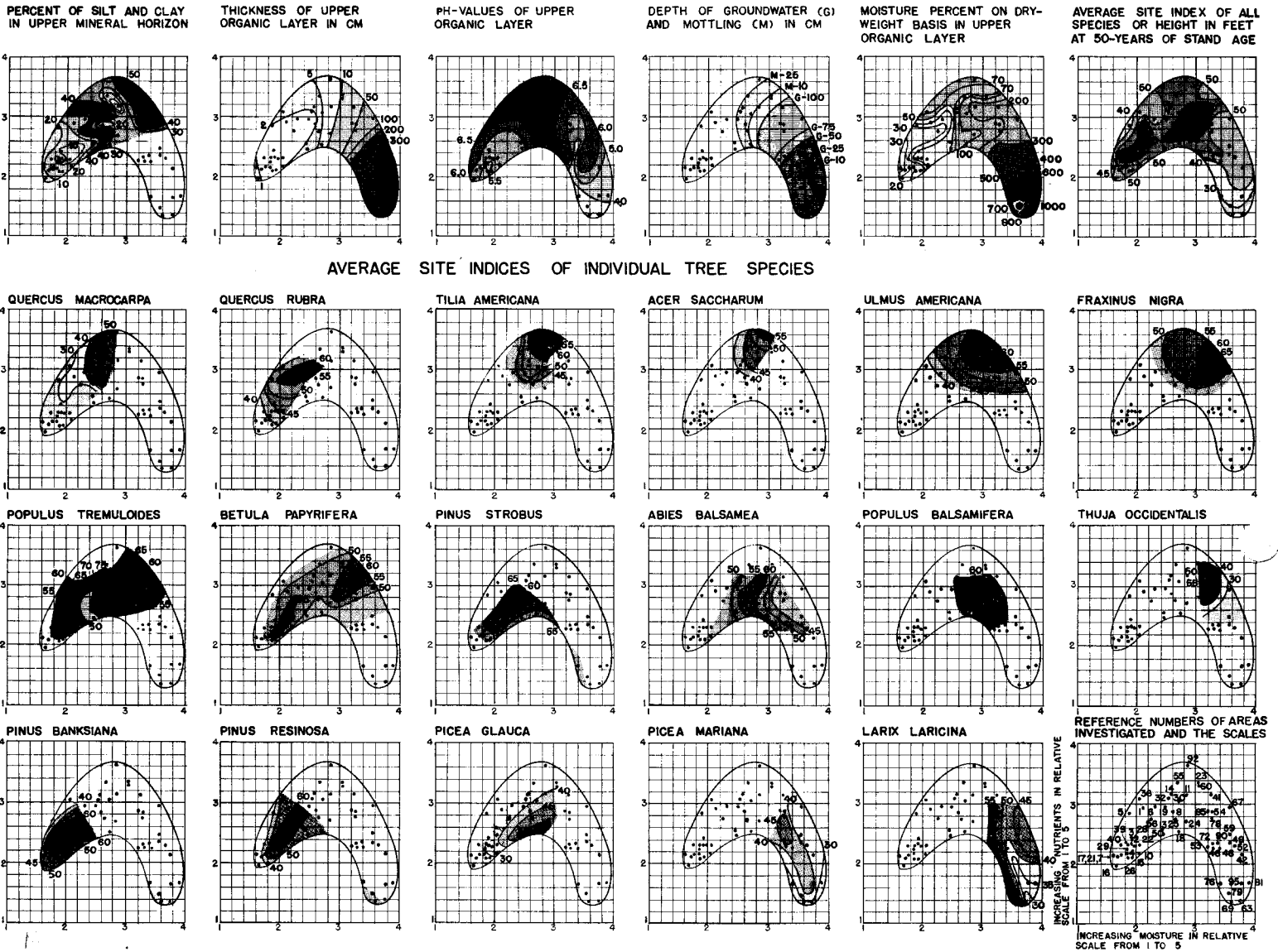


Figure. Characteristics of the distribution of forest communities of Central Minnesota Pine Section in moisture-nutrient coordinate system (the edaphic field) in relative scale from 1 to 5 indicating increasing intensity of the two factor complexes. Weighted site indices of stand averages and for individual species as related to the edaphic field.

Literature Cited

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