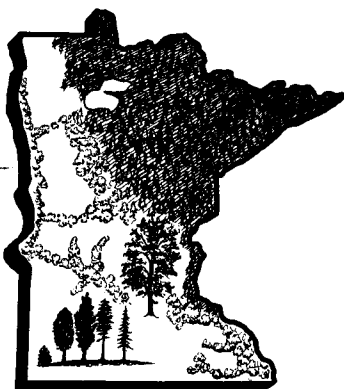


# MINNESOTA FORESTRY NOTES



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DISTRIBUTION OF BALSAM FIR REPRODUCTION AND BASAL AREA IN THE EDAPHIC FIELD OF FOREST COMMUNITIES IN THE CENTRAL PINE SECTION OF MINNESOTA <sup>1/</sup>

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This is the second report dealing with data from a 1960 and 1961 synecological study in the Central Pine Section of Minnesota. The general method used, the method of synecological coordinates, was described in a series of Minn. For. Notes (Nos. 84, 90-92, 99-101, 117-119) and by Bakuzis (1959). The specific field procedure was described and other basic information for the present problem was given in the first report (Minn. For. Notes No. 119).

Briefly, the edaphic field outlined in the illustration shows the total range of forest ecosystems in the Central Pine Section. This range is shown by moisture-nutrient coordinates presented on a relative scale of the factor intensity from 1 to 5.

Some essential morphological characteristics of the soils within the edaphic field were presented in the preceding note. The Figure gives the morphological characteristics of the stands studied. Basal area of live trees shows several maxima which do not agree with the maxima of site indices. A correction for dead trees and past cutting resulted in greater consolidation of the curves but did not change the basal area pattern substantially. The tree species associated with balsam fir in 9 stands where the basal area of balsam fir exceeded 10 percent are in order of decreasing frequency, as follows: Populus tremuloides, Betula papyrifera, Ulmus spp., Fraxinus nigra, Picea glauca, Populus balsamifera, Acer rubrum and others. There are three major shrub areas within the edaphic field, characterized primarily by hazel, mountain maple, and alder. Balsam fir is distributed between these shrub centers in an area where the shrub cover is generally under 10 percent. The most frequent shrub associates of balsam fir are: Prunus virginiana, Corylus cornuta, Acer spicatum, Amelanchier spp.; Cornus racemosa, Lonicera canadensis, Ribes americanum and others. The distribution of higher groundcover which includes halfshrubs and herbs is rather complex and a result of interaction of tree cover, shrub cover and edaphic conditions. Balsam fir distribution coincides with the richest flora. Between 70 and 100 species, excluding mosses, lichens, grasses, and sedges were found on individual investigation areas. The most frequent associates of balsam fir are as follows: Rubus pubescens, Athyrium filix femina, Botrychium virginianum, Dryopteris spinulosa, Galium triflorum, Mitella nuda, Asarum canadense, Circea alpina, Trientalis borealis, Cornus canadensis, Streptopus roseus, Uvularia sessilifolia, Viola rugulosa, and such ubiquitous species as Aralia nudicaulis, Aster macrophyllus, Fragaria virginiana, and Maianthemum canadense. Litter cover generally reflects the distribution pattern of tree basal area. Moss cover appears to indicate the nutrient level rather regularly. All these patterns in comparison with distribution of reproduction or measurable basal area of balsam fir, provide an insight to the complexity.

Balsam fir reproduction can be found over most of the edaphic field. However, older age classes are more restricted to the optimum zone of balsam fir distribution. The number of

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seedlings is variable: 1-2 year-old may reach 120,000 per acre (1 ha = 2.5 acres); 3-5 years, 10,000; 6-10 years, 4,000; and older than 10 years may reach 800 per acre.

Balsam fir seldom constitutes 50 percent of the total stand basal area. The pattern of distribution of total basal area including living, dead and cut trees during the last 30 years, is very similar to the pattern of living basal area. The highest mortality was 160 percent computed with respect to the present living basal area of balsam fir. The lowest mortality occurs within the same narrow moisture range where the highest balsam fir site index also occurs.

## BALSAM FIR IN FOREST COMMUNITIES OF CENTRAL MINNESOTA PINE SECTION

### GENERAL CHARACTERISTICS OF FOREST COMMUNITIES

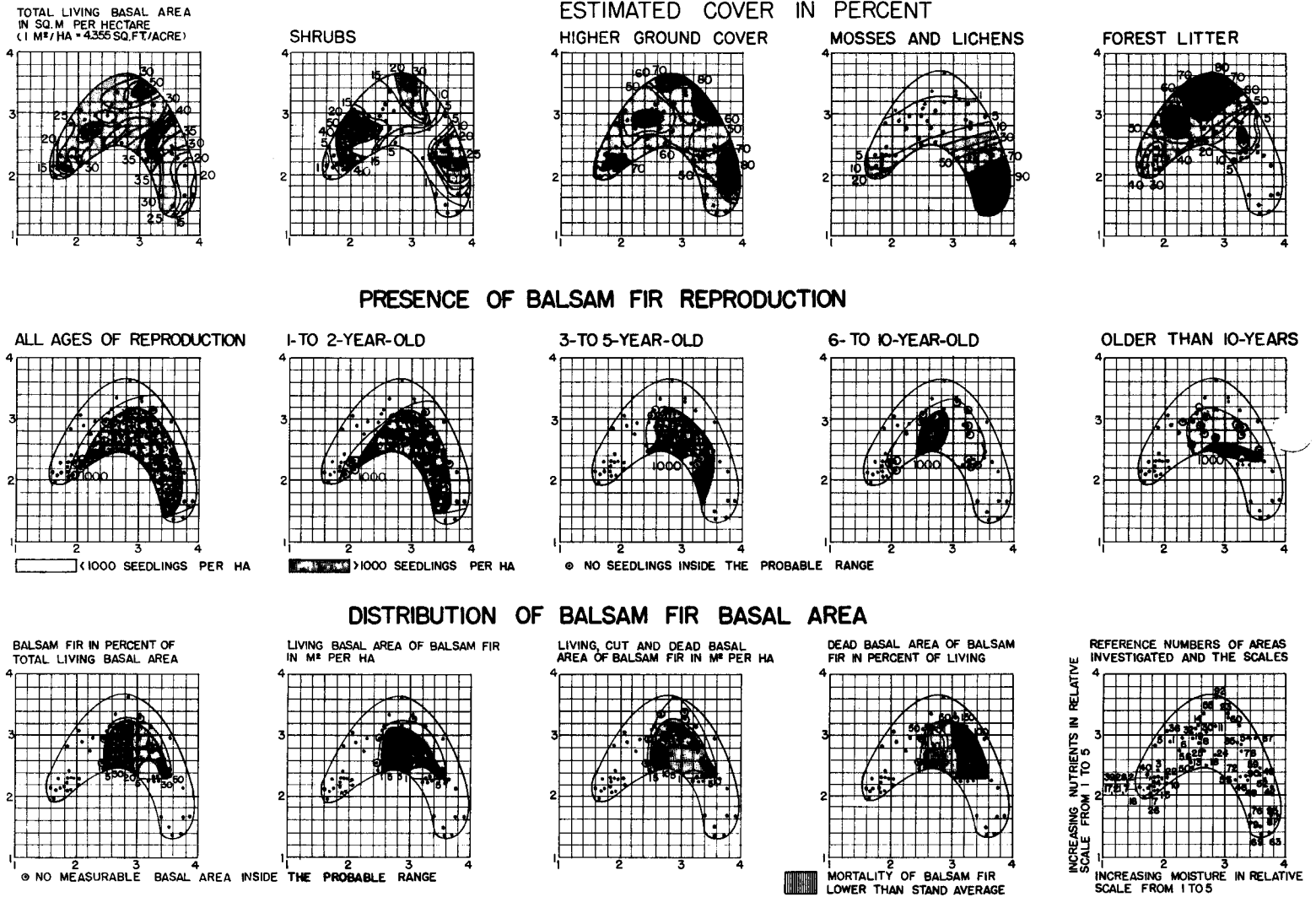


Figure. Some general characteristics of forest communities of Central Minnesota Pine Section in moisture-nutrient coordinates in a relative scale from 1 to 5 indicating increasing intensity of the factor complexes. Dynamics of balsam fir reproduction within the edaphic field or the site complex in moisture-nutrient coordinates. Contribution of balsam fir to the total stand basal area and some characteristic changes during the last 30 years.

#### Literature Cited

Bakuzis, E. V. 1959. Synecological coordinates in forest classification and reproduction studies. Ph.D. thesis, Univ. of Minn. Microfilm and xerox publ. University Microfilms, Inc., Ann Arbor, Michigan. 242 pp.