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DIAGRAMS TO SHOW WHICH SPECIES OCCUR IN PARTICULAR PLOTS OR STANDS

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The usual requirements in analyzing vegetation are met by ordinary summaries in tabular form: a column for each plot or stand, a line for each species. For some purposes, a diagram showing which species occur in each plot enables the reader to visualize the peculiarities of the different plots in a way that cannot be perceived from a table. In a simple geometric pattern of a few rows of circles, each species is assigned a particular position. The order is that of rank in abundance (or frequence, or bulk, or area covered, or percentage of presence in different stands).

The forest stand here used for illustration is a little larger than five acres on an upland close to the south bluff of Salt Fork of Vermilion River in eastern Champaign County, Illinois. It is 2.5 miles northwest of Homer and 3.8 miles northeast of Sidney. The bluff and the floodplain are generally tree-covered in this locality, which is known to nearby residents as Spencer Hole.

An area of 4.8 acres was surveyed in 1950 by James Franklin Coates of St. Joseph, Illinois. All trees three inches d.b.h. or larger were tallied separately for each tenth-acre plot (66 by 66 feet). The squares were contiguous in six rows, eight plots in each row. The area completely tallied is thus 396 by 528 feet. Among the several forms of summary in Coates' account of the stand (1951), he included grid maps of the area, each map divided into plots of a particular size (0.1, 0.2, 0.3, 0.4, 0.6, 0.8, 1.2, and 2.4 acres). On each plot is its diagram, with a circle for each species occurring there. The number in a circle shows how many trees of that species occur in that plot. Below the pattern of circles are three numbers. The upper number shows how many species are present; that at lower left is the sum of trees irrespective of species; at lower right is aggregate basal area for the plot (in square feet).

The first of four drawings here presented (fig.1) is the key to the pattern of positions for the 23 species, using their common names. They are arranged in order of abundance, the first three species having 157, 115, and 105 trees, the last six species represented by 3, 3, 2, 2, 1, and 1. Total number in 4.8 acres is 850; total basal area is 416.81 sq. ft. For another form of summary for the stand as a whole and for the 13 leading species, see the short paper in this same volume of the Academy's Transactions (Vestal, 1954).

Figure 2 is the basic tally for 16 tenth-acre plots, only one-third of the area, the southeastern part. In this and the remaining two figures, the top of the map is toward the east. Species present are identified by their positions.

Perhaps the outstanding fact, at once apparent, is the great difference

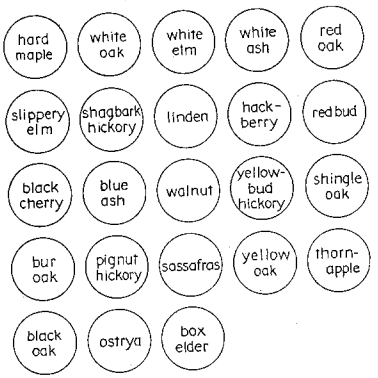

Figure 1

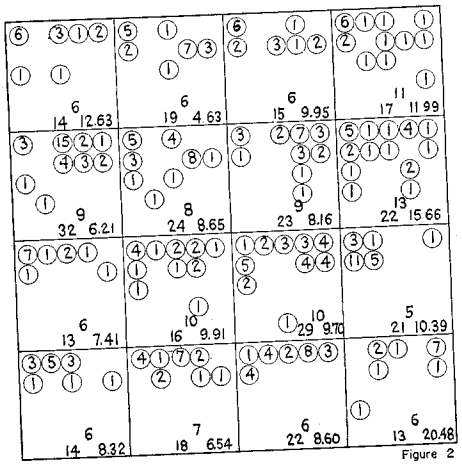

Figure 2

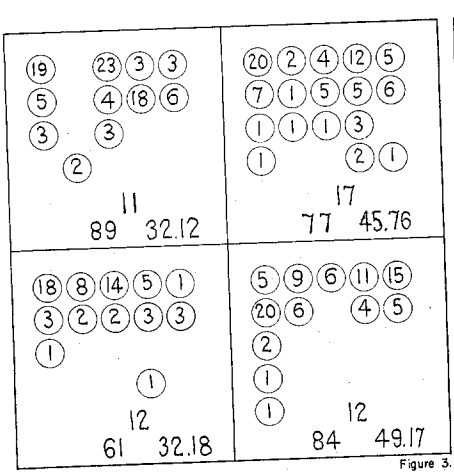

Figure 3.

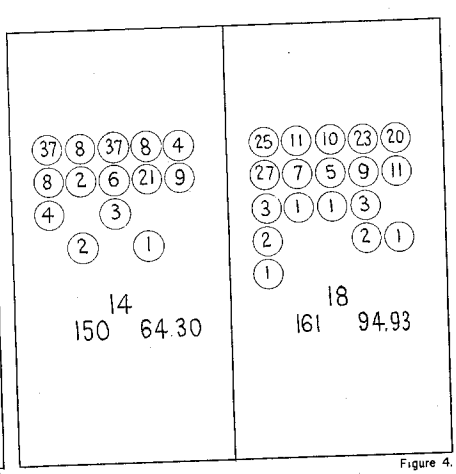

Figure 4.

FIGS. 1-4.—(1) Key to positions in the pattern for the 23 tree species. (2) (upper right) Grid map of southeast part of the stand: 16 plots, each 0.1 acre. (3) Same area: 4 plots, each 0.4 acre. (4) Same area: 2 plots, each 0.8 acre.

in composition in individual plots. Hardly ever in any one stand does one find two plots with the same combination of species. This is true in mixed forests, in bush, and in herbaceous vegetation of several types, as found by experience with numerous examples. It is true of small, large, and very large plot-sizes, and it is also true of whole stands. Even if the leading species should happen to be the same, as is true of Brownfield Woods and of Trelease Woods, a little over a mile apart, several minor species occur in one stand that are not found in the other. In the forest at Spencer Hole, two of the 48 tenth-acre plots do happen to contain the same species (only three, 1st, 2d, and 6th). These plots are north and northwest of the 16 plots shown in fig. 2.

This form of diagram makes it quickly evident whether the combinations of species in particular plots are widely different (the common situation) or closely similar. The more one studies details of composition, the more one is impressed with the complexity of a mixed all-aged forest, like many in eastern United States.

A little reflection on the mathematics of combinations shows how small is the probability that from among the many species available nearby, the particular selection which occurs in any one sample will be repeated in any other sample. In other words, if the average number of species per plot is 8 to 13 or more, as in this forest, the number of possible combinations of 4 or 8 or 12 species out of 20 or more becomes very large.

In Coates' study the patterns made it easy to discover that for the most part the two most abundant species occupy different parts of the stand. Hard maple has over 3 sq. ft. of basal area per plot in 11 of the tenth-acre plots in the east half, white oak in 12 plots in the west part.

Figure 3 shows plots four times as large as in the preceding grid-map. Again the individuality of plots is apparent. In Fig. 4 we see diagrams for two 0.8-acre plots. Individual plots may be compared with figures just below for a hypothetical average plot, using the whole area of 4.8 acres as the basis:

Average plot for each of three sizes:

plot size	no. of species	no. of trees	aggregate b. a., sq. ft.
0.1 acre	8.0	17.7	8.68
0.4 acre	13.0	70.8	34.73
0.8 acre	15.5	141.7	69.47

The method of using species-positions in a pattern was first used in 1936 to show which tree species in Trelease Woods were found in all plots of a set, and in different sets of plots. It was found that only four species were generally distributed within the stand, according to the test used. The diagrams which show this appear in the thesis of William Marberry (1936, pp. 28-29).

Grid-map summaries made up of plot diagrams, as well as their more familiar counterparts in tabular form, can be useful in the following types of study: (1) Ordinary presentations of data, as in descriptions of vegetation, (2) Inquiries into relative homogeneity or internal diversity of vegetation, (3) Studies to find which size of plot is most effective for a particular purpose, (4) Species and area (number of species in relation to extent of stand or sample), (5) Comparisons of plot-arrangements (contiguous vs. separated plots, etc.)

As to tabular arrays of plot data: for some purposes they are superior to the diagrams (e.g., in arranging data for coding for punch-card analysis). Both tables and diagrams can be very compact. The chief advantages of plot diagrams are their visual distinctiveness and the spatial orientation: each plot is correctly located in the stand and in relation to its neighbors. A table can give some visual distinctiveness, if each species is put in a column and if the columns

are arranged in groups of 4 or 5 (corresponding to rows of circles in the diagrams).

Just as tables for plots within a stand, or association-tables for a number of different stands, can be modified according to the kinds of information shown, so grid-maps made up of diagrams of plots can be modified. Many variations will suggest themselves as to kinds of data which can be shown and as to modes of showing them. The method can be adapted also to kinds of vegetation other than forest.

It is appropriate to express my appreciation to Mr. Coates for use of his findings, which are detailed and complete over a one-piece area much larger than is available in most sets of data.

REFERENCES

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