A METHOD OF DETERMINING THE DEGREE OF COINCIDENCE IN DISTRIBUTION OF AGRICULTURAL USES OF LAND WITH SLOPE-SOIL-DRAINAGE COMPLEXES

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It is common knowledge that in most farming regions certain types of land are better suited than others to the crops there raised, and that crops consequently tend to be concentrated on these better lands. This knowledge is based on numerous field observations, on repeated statements by farmers, and on comparison of topographic and soil maps with maps showing distribution of crops. There has been a need, however, for a method of determining quantitatively the degree of coincidence in distribution that exists between crops, pasture, and other agricultural uses of land, and slope-soil-drainage complexes.

Within the last few years geographers[1] have perfected a method of detailed field survey which makes it feasible to record on one map the facts of land utilization and the associated facts of slope, soil, drainage, and natural vegetation, in an accurate, legible,

[1] The development in the United States by geographers of field survey methods for agricultural areas is evinced by the following chronological list of articles:

Jones, Wellington D. and Sauer, Carl O.: "Outline for Field Work in Geography," *Bulletin of the American Geographical Society*, Vol. 47 (1915), pp. 520-525.

Sauer, Carl O.: "Proposal of an Agricultural Survey on a Geographic Basis," *19th Annual Report of the Michigan Academy of Science* (1917), pp. 79-86.

———: "Mapping the Utilization of the Land," *Geographical Review*, Vol. 8 (1919), pp. 47-54.

———: "A Soil Classification for Michigan," *20th Annual Report of the Michigan Academy of Science* (1920), pp. 83-91.

Jones, Wellington D. and Finch, V. C.: "Detailed Field Mapping in the Study of the Economic Geography of an Agricultural Area," *Annals of the Association of American Geographers*, Vol. 15 (1925), pp. 148-157.

Whittlesey, Derwent S.: "Field Maps for the Geography of an Agricultural Area," *Annals of the Association of American Geographers*, Vol. 15 (1925), pp. 187-191.

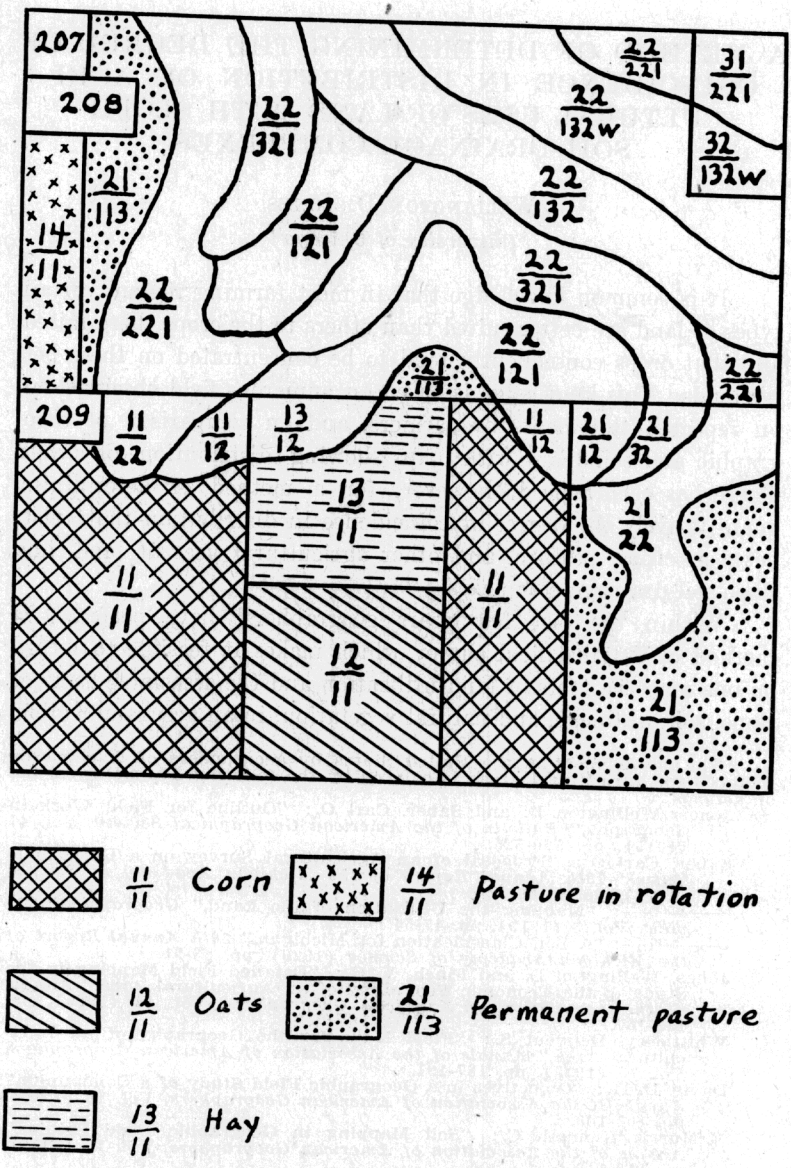
Davis, D. H.: "Objectives in a Geographic Field Study of a Community," *Annals of the Association of American Geographers*, Vol. 16 (1926), pp. 102-109.

McMurry, Kenneth C.: "Soil Mapping in Geographic Field Studies," *Annals of the Association of American Geographers*, Vol. 16 (1926), pp. 110-116.

Cosby, Stanley W.: "Utilization of the Soils in the Gilroy Region," *Hilgardia*, Vol. 1 (1926), pp. 455-478.

Whittlesey, Derwent S.: "Devices for Accumulating Geographic Data in the Field," *Annals of the Association of American Geographers*, Vol. 17 (1927), pp. 72-78.

Platt, Robert S.: "A Detail of Regional Geography—Ellison Bay Community as an Industrial Organism," *Annals of the Association of American Geographers*, Vol. 18 (1928), pp. 81-126.



Field map of one-fourth square mile, illustrating fractional notation scheme for recording in detail various characteristics of use-site complexes. See explanation on opposite page.

and usable manner. The accompanying section of a field map illustrates the method.

By field inspection, areas uniform throughout in the details of use and of associated natural site characteristics are delimited on a map of a scale sufficiently large (e. g., 1:20,000) to carry the details desired. Fractional notations are employed to record these details. The numerator of the fraction gives the details of use of the area to which it applies, the denominator the details of site. The left-hand digit of the numerator gives the major fact of use, such as for crops, for permanent pasture, etc. The second digit of the numerator gives a detail of this use, such as kind of crop or type of pasture. Additional digits may be employed to record further details, such as quality of crop or pasture. The left-hand digit of the denominator records the angle of slope of the area to which the fraction applies, the second digit the soil type, the third digit the type of natural vegetation (if not removed), the fourth digit drainage (if it be inadequate). As the field investigator, traversing the area being mapped, encounters an areal change in any one of the details recorded, either of use or of site, he enters on the map a line separating two different use-site complexes.

From such a map it is possible to determine quantitatively the degree of coincidence in distribution between (a) the various items

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Use recorded in numerator of fraction, as follows:
Crop land—left-hand digit—1.
Crops—second digit from left:
Corn—1.
Oats—2.
Hay—3.
Pasture in rotation—4.
Permanent pasture land—left-hand digit—2.
Type of pasture—second digit from left:
Grass—1.
Wooded—2.
Idle land—left-hand digit—3.
Potential use—second digit from left:
Crops—1.
Pasture—2.
Farmsteads are numbered serially (207,208,209); descriptions in notebook carry appropriate numbers.
Site characteristics recorded in denominator of fraction, as follows:
Angle of slope—left-hand digit:
From 0 to 7 degrees—1.
From 7 to 14 degrees—2.
More than 14 degrees—3.
Soil profile—second digit from left:
Upland prairie—1.
Upland woodland—2.
Floodplain woodland—3.
Natural vegetation (where not destroyed)—third digit from left:
Oak-hickory forest—1.
Elm-maple forest—2.
Prairie—3.
Drainage, if inadequate, is indicated by W after the denominator; if adequate, no record.
On this map, the various uses of high-class land (slope less than 7 degrees, upland prairie soil profile, drainage adequate) are picked out for measurement by the addition of bendays; in the office, colors are employed.

or combination of items of land utilization recorded and (b) the various characteristics or combinations of characteristics of the land thus used. For example, within a tract surveyed, all areas in corn, in oats, in hay, in permanent pasture, on land with a given degree of slope, a particular soil profile, and a certain type of drainage, can be measured, as well as the areas in these various uses on other kinds of land (see map).

Several detailed surveys employing this method of mapping agricultural occupance and utilization of land have been made by the departments of geography at the University of Chicago and the University of Wisconsin.

In the spring of 1928 a group of graduate students from the University of Chicago made such a survey of the farming area served by and supporting the village of Orland, 22 miles southwest of the heart of Chicago on the Wabash Railroad. The objectives of this survey were stated as follows: to discover (through observation, interview, and perusal of the literature), to depict (by maps, photographs, statistical tables, and written statements), to analyze, to explain (in terms of the natural site characteristics of the land used, the density and character of the population using the land, the past uses made of the land, and the connections and other relations of the area under study with the outside world), and to appraise, the present occupance and utilization of the area embraced within the limits of the Tinley Park Community (the village and the farms using the village as a trade center). A map of the type described in this paper constituted the foundation of the survey.

The area survey covered 10,953 acres (17+ sq. miles), of which 9,973 acres were in farms, 7,323 acres in crops, and 1,543 acres in permanent pasture. Corn, oats, and hay, in rotation, were found to occupy most of the land in crops, and to be largely fed to livestock. Dairying was found to be the major farm interest. The several natural complexes recognized and mapped in this study may be grouped into three classes:

I. High-class land, i. e., slope less than 7°, upland prairie soil profile (largely Carrington silt loam), drainage adequate; such land constituted 52 per cent of the area surveyed.

II. Medium-class land, i. e., slope less than 7°, upland woodland soil profile (largely Miami silt loam), drainage adequate; 15 per cent of the area surveyed.

III. Low-class land, i. e., all other site complexes; 33 per cent of the area surveyed.

The extent to which the high-class land was used for crops rather than for pasture, and for corn rather than for oats or hay—in other words, the tendency to employ the best land for the most productive uses—is revealed by the following statements:

I. High-class land, which constituted 52 per cent of the area surveyed, carried 78 per cent of the corn acreage, 70 per cent of the oats acreage, 64 per cent of the hay acreage.

II. Medium-class land, which constituted 15 per cent of the area surveyed, carried 10 per cent of the corn acreage, 11 per cent of the oats acreage, 18 per cent of the hay acreage.

III. Low-land land, which constituted 33 per cent of the area surveyed, carried 12 per cent of the corn acreage, 20 per cent of the oats acreage, 19 per cent of the hay acreage, 40 per cent of the permanent pasture acreage.

Field maps of the type herein described serve various other purposes than making possible the determination of the degree of coincidence between different kinds of land utilization and the several types of land employed. For example, from the data on the field map, a map may be made showing the pattern of utilization, both in its large lineaments and in detail, as well as maps of soils and of slopes, the latter supplementing in a most useful manner even a very detailed contour map. As the field map is made, farm boundaries are recorded on it, as well as types of roads, as to surface and resulting usability. With these data available, a valuable map may be made which shows the pattern of farms, all tied to their trade center, through their farmsteads, by the highway system.

In a field study involving the making of such a detailed record, many data are gathered which are recorded in the notebook rather than on the field map. For example, at each farmstead the population thereof, and the numbers of different kinds of livestock, are ascertained. From these data, maps of distribution and density of population, and of livestock distribution and density, can be constructed.

Scientific investigation, in geography as in any other discipline, is well-grounded in the degree to which it rests on quan-

titative data. In the study of agricultural occupance and utilization of regions, the method described in this paper, insofar as it has been tried, appears to be effective in accumulating quantitative data desired by the geographer. It is to be hoped that the method may now be tested in regions differing greatly, both in use and in the character of the land employed, from the sections of northern Illinois and southern Wisconsin where the studies referred to have been made.

FIG. 1. (*Upper left*) Ship canal rolling stock.
FIG. 2. (*Upper right*) Transport used in Manchester.
FIG. 3. (*Below*) Unloading equipment.