evidences were available. A theory which differs widely from the one commonly expressed in our histories of mathematics and elsewhere but which is supported by a sufficient number of historical evidences to command the respectful attention of some who made a special study of this subject was recently published in a pamphlet of 51 pages, which appeared under the title "Die Entstehung unserer Ziffern," 1932, by V. Goldschmidt, Heidelberg, Germany.

According to this theory, our common numerals originated in Egypt and came into Europe through the western Arabs. Traces of the positional values of the digits are here supposed to appear in the hieratic writings of the ancient Egyptians whose number symbols are here regarded as the prototypes of our modern numerals. It is well known that the Arabs, who commonly used number words instead of number symbols, sometimes placed a dot above a digit to represent tens, two dots to represent hundreds, etc. V. Goldschmidt assumes that our common positional values of the digits are due to the observation that these dots could be omitted without ambiguity, in view of the fact that the relative positions of the digits are equivalent thereto. He regards the Hindu numerals as variants of the ancient Egyptian hieratic number symbols and hence gives no credit to India as regards our common numerals, while such credit ascribed to them by others has been commonly regarded as their chief claim for mathematical distinction.

This disaccord may serve to emphasize the fact that the extensive literature devoted to the consideration of evidences supporting the Hindu origin of our common numerals has not yet removed all the obstacles in the way towards establishing this theory on a firm basis. At any rate, the complacency with which many writers accepted this theory is not justified at the present time. Even in such a valuable work as Felix Klein's "Elementary Mathematics from an Advanced Standpoint," 1932, it is stated, page 80, that "the Hindus, especially, played a mathematical rôle as creators of our modern system of numerals, and later the Arabs, as its transmitters." The noted work by V. Schmidt will probably tend to create a better atmosphere for the progress of knowledge along this line, especially since other writers, including N. Bubnow, recently also tried to prove that our common numerals could not have originated in India.

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UNITS OF PLANT SOCIOLOGY

THE long-standing confusion in phytogeographic and phytosociologic nomenclatures has been largely cleared up by certain European ecologists. Recognizing that a classification should be carried through on a single, consistent set of principles, these Europeans have sharply differentiated between the nomenclature of geographic categories and that of sociologic categories. And while phytogeographic divisions must be correlated with phytosociologic units, they are not and can not be coterminous in area or in conception or in terminology. That this is not yet fully understood is shown by the remark of a recent reviewer.[1] After naming the larger geographic units of Braun-Blanquet[2] (region, province, sector, district), Dr. Gleason remarks, "Presumably the next lower step is the community complex or the association." In other words, presumably the smallest geographic unit is a sociologic unit or entity. Braun-Blanquet gives no occasion for this presumption. In fact, that is exactly what he aims to avoid. The word "association," meaning a unit stand of vegetation, should not be regarded as a geographic term. The association is a social unit, like a "herd" of cattle or a "swarm" of bees. It occupies space, to be sure, but the name of the space is not association. We have "yards" for cattle and "hives" for bees. But no geographic term has yet been invented, so far as I know, for the ground on which an association stands. But Braun-Blanquet, accepting a suggestion from Nichols,[3] advises using the term "association" both for the concept arrived at by generalization from a number of examples, and also for each example by itself—as, he remarks, we already use the term "house."

The association of Braun-Blanquet is the smallest sociologic unit, in the same sense that the species is the smallest systematic unit. There may be subassociations, variants, etc. Each actual living example of the association is a "stand" (comparable with the individual plant of systematic botany). The association ("species"), alliance ("genus"), order ("family") and class are strictly sociologic units. Since associations occupy space, they occur in certain phytogeographic areas. The phytogeographic units are, from least to greatest, the subdistrict, district, sector, province and region.

The association of Braun-Blanquet, and of European ecologists generally, is a much smaller unit than we in America have generally considered it. It is nearer to the society or socies of Clements, but is differently (*i.e.*, quantitatively) defined. In the "oak-chestnut" forest of Long Island, of southeastern Pennsylvania and of the vicinity of Baltimore there are several associations. There is a chestnut oak associa-

[1] H. A. Gleason, Braun-Blanquet's "Plant Sociology," *Ecol.*, 14: 70–74.

[2] J. Braun-Blanquet, "Plant Sociology." Ed. and transl. by G. D. Fuller and H. S. Conard. McGraw-Hill, New York. 1932.

[3] G. E. Nichols, "A Working Basis for the Ecological Classification of Plant Communities," *Ecol.*, 4: 11–23, 154–179. 1923.

tion, a white oak association, a chestnut oak association with *Kalmia latifolia,* a black oak association, a Liriodendron association, and many moss and lichen associations. The forest as a whole may represent an alliance or order. The coastal dune region of Long Island and New Jersey has also many associations: Ammophiletum, Hudsonietum, etc. The "dune complex" is a complex of associations which can not be classed together floristically. They may be classified syngenetically (by successions, which are often highly hypothetical), or they may be grouped under such a mongrel term as "formation," meaning all the types of vegetation on a given area. Useful as such a "formation" is for some purposes, it is compounded of vegetation and land area.

The application of these ideas to the vegetation of North America will make the distinctions more clear and concrete. We may cite the great grassland area of the central United States and Canada. From the geographic standpoint this constitutes a province, which may be divided, following the map of Shantz and Zon,[4] into two sectors: the prairie (tall grass) sector and the plains (short grass) sector. The prairie sector is divisible into at least a northern district, including the eastern part of the Dakotas and western Minnesota, two central districts and a southern. The most of Iowa, with parts of Illinois, Missouri, Nebraska and Kansas, including all the rich prairie region with mild climate, may be termed the Iowa district (one of the central districts cited above). In this district several subdistricts can be clearly recognized. And if still smaller geographic units are desired, geographic terms must be invented for them.

From the sociologic standpoint Weaver and Fitzpatrick[5] and Weaver[6] have given us the most exact analysis of the prairie yet available. From their work it is plain that the associations of the prairie are several. There is at least one *Andropogonetum scoparii* (two others occur on Long Island. *Cf.* Blizzard),[7] apparently as *Andropogonetum furcati,* certainly a *Spartinetum michauxii,* apparently a Stipetum. In the Iowa prairie region there is also the *Typhetum latifoliae, Phragmitetum communis* and various Cariceta and Cypereta. Besides these, the Iowa district has many stands of Quercetum of two or three types, *Ulmetum americanae,* and many moss and lichen associations.

[4] H. L. Shantz and R. Zon. Atlas of American Agriculture, "Natural Vegetation," U. S. Department of Agriculture, Bur. Agric. Economics, 1924.

[5] J. E. Weaver and T. J. Fitzpatrick, "Ecology and Relative Importance of the Dominants of Tall Grass Prairie," *Bot. Gaz.,* 93: 113–150, 1920.

[6] J. E. Weaver, "Who's Who among the Prairie Grasses," *Ecol.,* 12: 623–632, 1931.

[7] A. W. Blizzard, "Plant Succession and Vegetational Change on High Hill, Long Island," *Ecol.,* 12: 208–231, 1931.

Geographic units and categories are essential and adequate for geographic purposes. Sociologic units and categories are wholly distinct and should be sufficient unto themselves. The recognition of these units will make possible the long-desired description and understanding of plant distribution, and thereby of animal distribution also.

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ON CONCEPTS IN PHYTOSOCIOLOGY

DR. H. S. CONARD, who is largely responsible for the actual work of translating Braun-Blanquet's "Pflanzensoziologie," and to whom I am indebted for the opportunity of examining his critique in advance of its publication, is entirely correct in his statement that confusion in phytogeographic and phytosociologic nomenclature has long existed. It is also a fact that Braun-Blanquet has done much to clear up this confusion, or at least to state one view-point in such terms that one may easily grasp his meaning.

All classification is based on the grouping of individuals and the unit-individual in plant sociology is the *stand,* as numerous geobotanists have stated, as Braun-Blanquet emphasizes and as Dr. Conard reiterates. In all classifications, similar unit-individuals are brought together to form a group-unit, which in this case is the association.

Objects which have only a single character may be classified in one way only, but stands of vegetation show similarities in various characters and may be grouped in various ways accordingly. These lead to very diverse group-units, just as men may be classified according to politics, religion or occupation, resulting in each case in a different set of groups. Floristic similarity is the character chosen by Braun-Blanquet for phytosociologic classification, and in that most botanists will agree.

One must also distinguish carefully between the mental processes of classification and combination. In the former, units are grouped according to similarity and the result is an abstract concept. In the latter, units are grouped on a different basis and the result is a concrete unit of entirely different nature. Thus we classify leaves into simple and compound, opposite and alternate, depending on similarity but leading to different groups, while we combine leaves, stems and roots to make a concrete individual plant. If we classify stands of vegetation, we arrive at the association in one form or another, depending upon the character chosen as a basis. If we combine stands, we arrive at the mosaic of vegetation which covers an area. Generally speaking, we arrive first at the mosaic of a small area and by successive combinations at that of successively larger tracts. This is