Zeitschrift: Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich
Herausgeber: Geobotanisches Institut Rübel (Zürich)
Band: 29 (1954)

Artikel: Vegetation Classification
Autor: Daubenmire, R.F.
DOI: https://doi.org/10.5169/seals-307892

Vegetation Classification

By R. F. Daubenmire
State College of Washington, Pullman, Washington, USA.

Introduction

In 1753 the science of plant taxonomy had reached a degree of development that permitted an attempt to list all plant species of the world, in all phyla, using an acceptable bionomial system of latinized names. When synecology in its present state of development is compared with taxonomic history, it is clear that the former lags more than two centuries. The current differences in concepts and terminology in vegetation science are, therefore, primarily an inevitable consequence of the immaturity of this branch of science.

One of the major difficulties in vegetation classification is the inherent variability of vegetation, which makes a subjective approach inevitable. Our problem is somewhat comparable to taxonomy at the subspecific level, where most individuals can be placed in one taxon or another, but many must be designated as intermediates. There is so much diversity in the gross aspects of the earth's vegetation and there are so many intergrades on a small scale, that none but a very flexible method can ever prove universally applicable. We can take courage from the fact that other sciences have faced the same problem and developed satisfactory classifications.

The facts are not widely enough appreciated that a wealth of ideas and proposals have been published, whereas few unbiased comparisons have been made in the field to determine which terms and concepts are most useful. This I have tried to do, and the following is but a synthesis of certain terms and concepts which seem most suited to the types of vegetation I have had opportunity to study.

The smallest unit of vegetation structure—the union

In the smallest units of vegetation structure we can hope to find the greatest degree of environmental and sociologic uniformity. Stature, or layers (Kerner, Hult) are roughly indicative of a certain amount of ecologic equivalence, but this criterion is entirely physiognomic and as a classification unit it fails badly. Life-form classes (Raunkiaer, Gams) alone are also inadequate, although certainly not without significance. Phenology has proven a rather good criterion of ecologic groups, but has seldom received the attention which it deserves (Alechin). What appears to be the best criterion of all is similarity of distribution throughout the matrix of habitat types in one region. Plants of similar ecologic amplitudes tend to appear together wherever the same sum of ecologic factors obtains and thus permit a division of the total flora into ecologically significant groups here called unions.

The union may consist principally of one ecologically distinctive species occurring in abundance. If two or more species are involved, all tend to play the same role in the vegetation matrix—wherever one member is encountered in abundance the probability of encountering the other (s) is high. The soundness of the basic definition given above is suggested by the fact that these distribution groups also have a certain amount of uniformity with respect to phenology, stature, and life-form, although such characters are considered of secondary importance. This approach toward vegetation classification matrix clearly demands the study of all communities in a vegetation before final judgment is made as to the most suitable grouping of the species in the total flora. But it has also proven true in species taxonomy that the best classification is one founded on the broadest understanding of the material.

The fundamental unit of vegetation classification—the association

Unions are in large measure independently distributed (Lippman, 1939), with a result that union A may be associated with B + C on a north-facing slope, but with union D on a south-facing slop, and again with E + F + G on flat land, etc. It is therefore feasible, and in my experience most satisfactory, to recognize each significantly different combination of unions as an association.

This basic definition should not be carried to the extreme, for if a decayed log, an exposed boulder, or a rodent excavation provide special habitats for special unions in a forest, we cannot consider these as indicating the extent of stands of a special association. To overemphasize such trivia would be fatal to classification in any science. Especially would this discourage the use of vegetation classification in the management of uncultivated lands, where a sound classification can provide an excellent criterion of land-use capabilities.

In practice, the Finnish «forest site types» would be identical to the scope of the association as here defined, if trees were accorded the same importance in vegetation classification as the lower plants. In the northern Rocky Mountains one can find the same tree union above different undergrowth unions, a fact which is fully taken into account in the Finnish viewpoint (Cajander, 1925); but there are also examples of different tree unions associated with the same undergrowth unions, a fact wich is not taken into account by the Finnish system (Daubenmire, 1952). In all these examples, each combination of unions occupies a distinctive habitat type that can be characterized only by simultaneous reference to tree cover plus undergrowth.

Nomenclature

The most appropriate nomenclature for associations which are recognized as combinations of unions is a binomial (occasionally trinomial) indicating, by using the name of the dominants, the distinctive combination of unions which defines an association (Katz, 1929). It is to be understood that all constituent unions need not be listed.

Latinized nomenclature is unquestionably best to reduce confusion, and the more descriptive the name the better. When a genus name is unaccompanied by the species, or vice versa, confusion results in synecology fully as much as in species taxonomy.

The significance of the ecosystem concept

The concept of ecosystem (biogeocoenosis, holocoen) appears to be fundamental. Soil factors, aerial factors, plant unions and animal aggregations (unions?) all are interrelated, the relationship varying from absolute dependence to very remote and casual relationships. Macroscopic vegetation in its entirety seems a reasonably adequate key to the geographic extent of different ecosystems (Tansley, 1935). The union, association, and higher units of classification are best defined by not only the plants common, or potentially common to all stands (i. e. taking into account accidents of distribution), but to the extent that it is known, by the diagnostic features of animal life, and of climatic and edaphic factors as well.

An ecosystem tends to make slow internal adjustments leading toward a state of equilibrium wherein none but minor oscillatory changes can be demonstrated, unless the climate changes, or new species with superior competitive abilities are introduced, or some catastrophe occurs. When an ecosystem is thrown out of balance by fire, grazing, etc., secondary succession may restore the ecosystem by a series of recognizable stages, but often the sequence does not lend itself to description as stages. Because of the frequence of the second alternative, and the general heterogeneity of disturbed vegetation, I have thus far used the term association only in connection with phytocoenoses that are demonstrably self-perpetuating.

Primary succession, exemplified by vegetation development on rock outcroppings, ponds, sandbars, etc. commonly is slow and rather easily described as stages which are fairly homogenous from one stand to another. These might conveniently be treated as associations in the areas I have studied or visited.

Higher units of vegetation classification

A phytosociologic classification assumes geographic character when we begin to group associations with a view to constructing a complete classification of the world's vegetation. This problem is beset with many difficulties, but in part this is compensated by taking advantage of principles worked out in species taxonomy and in pedology, both of which are more advanced than vegetation classification.

As a first principle we must recognize that we are dealing with only part of an ecosystem; therefore, the end product of our classification must be in harmony with other classifications, namely pedology, climatology, and zoology. Since animal distribution (also that of saprophytic plants) is either dependent upon the configuration of the vegetal pattern or is completely unrelated to it, this segment of the ecosystem need not be a major consideration in guiding our decisions. Descriptive climatology has long used major vegetation boundaries as a guide to the location of suitable subdivisions of gradual climatic gradients which would otherwise be completely arbitrary. Therefore the major subdivisions of a vegetation classification must involve somewhat continuous areas, except in mountainous regions, if there is to be any correlation between climatic classification and vegetation classification. We cannot consider all grasslands as part of the same plant formation, for there is no climatic or edaphic continuity among the edaphically determined grassy openings in forests, the steppes that border deserts, the *Distichlis* grasslands along marine estuaries, etc. Life form is not an adequate basis for synecologic taxonomy at any level.

Species taxonomists have, during the course of two centuries, come to the point of recognizing that an approach to a natural classification of species must take into account simultaneously morphology, anatomy, cytology, biochemestry, geographic distribution, ecology, etc. So in community taxonomy we must not confine attention to taxonomic affinities, or physiognomy, or geologic history, or environment, but must consider all these points in the construction of a hierarchy. If, for example, all *Pinus* forests were segregated as a group, the subarctic *Pinus banksiana* forests, the tropical *Pinus elliotii* forests, and the desert-border *Pinus cembroides* forests would all be placed together, whereas all they share is a common phyletic ancestry many millions of years ago. They differ too much in physignomy, genozoic history, climatic relations and soils to merit juxtaposition. On the other hand, the taxonomic diversity of chaparral (macchie, garigue) in different parts of the world is inadequate ground for denying all five of these ecologically similar areas a common category.

Pedology has much to offer geobotany in its concepts of zonal, intrazonal, and azonal soils. A zonal soil is the matrix that characterizes a geographic province, developing on normal topography in response to climate, relief, parent material and organisms as they operate through time. Within the geographic limit of such a matrix innumerable deviations may be found in the various intrazonal and azonal soils (planosols, meadow soils, rendzinas, etc.) which have a place of secondary importance in the pedologic hierarchy. Thus the classification made by the soil scientist is in complete accord with climatic classification since climate is recognized as the master force molding the character of normal soils. The synecologist might well base his major vegetation divisions upon the same principles using climatic climaxes (here I mean specific associations, not broad «climatic climax formation-types») —the apparently stable vegetation of loamy soils and undulating topography—to define the limits of geographic zones (Daubenmire, 1943). Each zone then is a matrix composed of a closely related group of climatic climaxes plus various edaphic, topographic and zootic climaxes and their successional stages, all of which are related to soil and climatic classifications. This seems to be the nearest approach toward a natural classification of vegetation. It carries the concept of ecosystem to its logical end, taking fully into account the broad dependence of vegetation and soils upon the climatic pattern. At its lower level such a hierarchy is founded primarily upon vegetational details (unions and combinations thereof), but in progressing to higher levels (the zone, then the formation) climate and soil patterns become as important as vegetation in determining suitable groupings.

The framework for a vegetation classification outlined above emphasizes broad geographic relations and the desirability of harmonious classifications in several natural sciences. Although it embraces concepts that were originated or developed by ecologists widely separated in both time and space, these concepts have proved mutually compatible and at the same time adaptable to wide variety of vegetation types. Admittedly some topics (e. g. a special horizontal classification of unions to show degrees of relationships) have not been discussed above, but the most we can hope for at present is a definition of desirable guiding principles and possibly some agreement on major issues.