ECOLOGICAL VEGETATION MAPS

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INTRODUCTION

An ecological vegetation map may be defined as a vegetation map on which the vegetation categories are related to one or more features of the environment. The manner in which an ecological vegetation map is prepared determines the degree to which the map content can be interpreted correctly. Authors of ecological vegetation maps must therefore be careful to proceed in such a way that interpretation of the map content will benefit the reader or user.In order to achieve this, the following observations may be useful.

THE VEGETATION

Vegetation is the mosaic of plant communities in the landscape. A plant community or phytocenose is adequately defined by the combination of its structure and its floristic composition. Structure is the spatial distribution pattern of the growth forms, whereas floristic composition refers to the taxa of which the phytocenose is composed.

Every taxon has limited ranges of tolerance for every individual feature of the environment. These ranges of tolerance may change with the age of the plant as well as seasonally, in an environment that also changes seasonally. In addition, every individual plant must compete with neighboring plants. Such competition affects the ranges of tolerance of the competitors.

A phytocenose may therefore be defined as an aggregation of plants which can tolerate the conditions of the biotope on which they occur and which can successfully compete with one another.The relations between plants, and between plants and their environment are extremely complex.As a result,a phytocenose consists of certain taxa and only these. These members of the phytocenose therefore reflect the environment i.e. the conditions of their biotope. Indeed, vegetation is the integrated expression of the ecological conditions of the landscape. It is this fact which underlies the theory that a vegetation map, in fact, portrays ecosystems.

THE ENVIRONMENT

The environment of a plant community consists of everything that affects any and all plants which are members of the community. I urge all ecologists to carefully study the work by MASON and LANGENHEIM (1957) in order to become genuinely aware of the meaning, the application and, indeed, the applicability of the term environment.

We have already found that the nature of vegetation is extremely complex,but the biotope is just as complex. To speak of it as climate and soil is equivalent to hiding the issue. With regard to the climate,even such features as heat and water are enormously complex and often very difficult to express. Take heat, for instance. Temperatures are usually measured in instrument shelters in order to obtain comparable values. But trees do not grow in instrument shelters. Wat is the temperature of a tree? On a sunny day, the temperature of the outer leaves may be high and fluctuate with the passing of every cloud. What then is the temperature inside the trunk and at the tips of the lower roots where temperatures may fluctuate annually rather than daily? The tree must tolerate all these temperatures, different as they may be, yet most of them are never measured. While these temperatures directly affect the normal functioning of a tree, most ecologists simply disregard them. Innumerable complexities can be cited for other aspects of heat, of water, of soil and practically all features of the biotope, most of which are similarly disregarded.

I have emphasized the complexities of the relations of plants to their environment because it is basic in the consideration of ecological vegetation maps. Authors of such maps must never forget that the environment is holocenotic, i.e. that individual environmental features affect one another, making it almost impossible or at least impractical to consider any one of them in isolation.

ECOLOGICAL VEGETATION MAPS

There are different types of ecological vegetation maps, although they all attempt to establish correlations between the plant communities and their biotopes. We found above that vegetation maps portray ecosystems. Therefore, the ecological implications are already there, although they may not be obvious. Ecological vegetation maps are attempts to translate these implications into directly observable relationships.

GAUSSEN's well known vegetation maps of France are ecological vegetation maps insofar as the color scheme expresses the availability of heat and water. But this is not stated on the map nor are there any quantitative indications. These features are therefore shown only by implication. If the reader does not know this, he will have a difficult time finding it out. Such unnamed selections of given environmental features are therefore of a rather limited values.

DAVIS (1967) is more explicit on his map of Florida. He decided arbitrarily for each phytocenose which of all its environmental features may be considered the dominant one. He then linked every vegetation category with such a dominant feature, thereby attempting to explain to the reader why a given phytocenose has its particular distribution. For every plant community, DAVIS selected one particular environmental feature, albeit an important one, disregarding all the rest. The method is seductive and has been used by others. But we know now that it may be superficial, and that the ecological explanations of the distributions may be quite incomplete.

In view of the complexity of both the vegetation and the environment, some authors of ecological vegetation maps have quite successfully attempted to relate all vegetation categories on a map to a single site quality. Thus, EMBERGER, GAUSSEN and REY (1955) showed the various heath types of the Landes in southwestern France as a response to drainage conditions. Similarly, WALTHER (1957) correlated the phytocenoses of the Elbe floodplain in northern Germany with fluctuations of the water table. Such ecological vegetation maps can attain an extraordinary degree of accuracy and thus, within the narrow confines of their framework, become very useful.

A more comprehensive approach has been attempted, too and the ecological vegetation maps by ELLENBERG and ZELLER or the C.S.I.R.O. in Australia are good examples. The Australian land system expresses every map unit by geology, topography, soil texture, annual precipitation and vegetation. The latter is described both physiognomically and floristically. ELLENBERG and ZELLER (1951) on their map of Leonberg, establish a tabular correlation between plant communities, soil, geology and a phenological interpretation of the climate. For other examples of ecological vegetation maps with tabular legends, I invite you to study the exhibited maps of Vancouver and Livingstone-Porcupine. Basically, the authors of such more comprehensive ecological vegetation maps try to come closer to mapping ecosystems.

THE SCALE

This conference considers mapping vegetation at small scales. The scale, however, has important implications regarding the usefulness of ecological vegetation maps. Note please, that WALTHER's map of the Elbe floodplain has a scale of 1/5 000! A number of interesting ecological vegetation maps has been published in the "Documents de Cartographie Ecologique". All are of relatively large scale.

A small scale implies generalization. But this generalization is not limited to the vegetation. On ecological vegetation maps, the generalization is extended to the environment as well. This creates problems.

If a small scale map is based on information of maps with larger scales, the reduction results in the sacrifice of details. Which environmental features are so unimportant that they may be disregarded? Very broad vegetation types may be related to very broad environmental types. Forests occur where there is sufficient precipitation, grasslands spread where the rainfall is less reliable, and scrub characterizes arid regions. All this may be true but it tells us little. DAVIS disregarded all environmental features but one for each vegetation type. To what extent can that be justified? The impressive accuracy of WALTHER's map is quickly lost when the scale shrinks, and the usefulness of ecological information may diminish even faster.

THE INTERPRETATION

The interpreter of ecological vegetation maps must be very well acquainted with both the vegetation and the site qualities before he may come to any conclusions. Thoroughness of preparation is essential. As plant communities are so tightly bound to their biotopes, it is easy to see that vegetation must change when the soil changes. In this connection, it is useful to consider the map of the Hunter Valley in New South Wales (GALLOWAY et al. 1963) which is based on the Australian land system. On this map, the boundaries of the units enclose types of vegetation on types of soil. Soil and vegetation agree throughout the area of the map but they disagree on large inset maps of vegetation and soil respectively.

Agreement applies to the entire phytocenose and the entire biotope. On an ecological vegetation map, both are described by a very limited number of criteria. If a feature of the biotope changes, one or more features of the phytocenose will change, too, but which? On a map, a change in the soil can therefore result in a change of the vegetation only if the particular feature of soil that has changed happens to be one to which the described feature of the vegetation reacts. If this is not the case, the interpretation of an ecological vegetation map may lack any kind of foundation.

CONCLUSION

Ecosystems can not be expressed in all details, least of all in the limited space of a map. Ecological vegetation maps therefore show only interrelations of selected features of an ecosystem. Yet, such maps are valuable documents, and many more should be published. But it is equally clear that such maps are valuable only to the extent that they can be interpreted properly. This calls for a great deal of research in order to explain why a given phytocenose, and only it, will naturally occur on a given biotope.

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ABSTRACT.- Ecological vegetation maps are defined and the complexities of vegetation and of the environment are discussed. These complexities affect the utility of ecological vegetation maps. The map scale also has important implications. The proper interpretation of ecological vegetation maps, while most important, may be difficult to achieve without a great deal of research.

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