

THE ORGANIZATION OF THE CONTENT OF SMALL SCALE VEGETATION MAPS

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INTRODUCTION.

The fact that an international group of vegetation mappers is meeting to discuss various aspects of vegetation mapping at small scales indicates that the value of small scale vegetation maps has been established. It is clear that small scale vegetation maps are essential if the innumerable vegetation maps of relatively small areas and large scales are to be linked into larger more comprehensive units. Only then can one appreciate interregional relationships. It has become useful to guide vegetation mappers along the most productive lines of procedure because of the large number of small scale vegetation maps of very uneven quality that has already been published and continues to be published on all continents today. Small scale vegetation maps are here to stay, and it is up to the authors to make such maps as useful as possible.

Authors of vegetation maps like to believe that their maps are useful. They know the vegetation in great detail as well as the area covered by the map. They understand the meaning of the geographical distribution of the vegetation types in the landscape and the implications of this information for a variety of applications. For them, every item on the map has meaning, expressed or implied, and the authors can interpret the map content, at least to their own satisfaction.

Once the map is published, however it is the reader or user of the map who is the judge. Does the map tell him anything? Can he use it? Will it serve his needs, whatever these may be? There is an extraordinary variety of persons who either use vegetation maps or could use them to advantage. But most of these people have little or no training in reading vegetation maps nor in interpreting their content. These are handicaps. The author must overcome these handicaps

while he prepares his map if it is to be as useful as he thinks it is. A user must be attracted by the map, his interest must be aroused spontaneously or else he will lay it aside for possible future use. It is then unlikely the map will be used, and the effort of the author has largely been wasted.

For the author, the answer to the problem lies in the organization of the map content. If the content is organized in such a manner that it permits the reader to understand at once what he is looking at, and what he can expect of the map, then he becomes interested and willing to explore the possibilities of applying it to his own particular needs. The map now becomes useful and serves the purpose for which it was created. The question then arises just how should the content of the map be organized so as to make the map useful? The author must guide the reader's thinking and help him appreciate what the map has to offer. To achieve this, the author should carefully consider a number of specific points.

THE SCALE

This conference is devoted to small scale vegetation mapping. Traditionally, small scales begin with the scale of 1/1 000 000 although somewhat larger scales may be considered at this meeting as well. A small scale eliminates from vegetation maps the kind of detail that does not belong on small scale vegetation maps because it requires direct field observations. Small scale maps usually compiled from existing maps of larger scales. They may also be based on small scale aerial photographs or on satellite imagery. They are not based on sample plot procedures that are basic for large scale maps. Also, a small scale vegetation map is not simply a photographic reduction of a large scale map. Such

reductions often make maps illegible and hence practically worthless. Even though the material on a large scale map is to be utilized in the preparation of a small scale map, a new map must be prepared with new categories that are in harmony with the scale.

THE ARRANGEMENT OF UNITS

Many maps lack any kind of organization. Their legends are nothing but lists of items. Indeed, this may be quite acceptable for there is usually not much need to organize the map content when there are only a few legend items. This is not at all unusual for small scale vegetation maps, especially in many countries overseas. For instance, the new South America volume of the International Bibliography of Vegetation Maps contains 251 small maps with only six legend items or less. However, as soon as the detail increases, organization becomes desirable if not necessary.

The organization of the map content, i.e. of the legend items, implies that a simple enumeration may be inadequate. It is therefore a substantial improvement to arrange the legend items in meaningful aggregations. This permits the author to group his types and thereby indicate that certain relationships exist between different types of vegetation. The map of the natural vegetation of California offers an example of a map with a legend organization on this basis.

Going beyond such grouping, a hierarchy offers the possibility of arranging the legend items in a systematized manner. A hierarchy may be simple and include only three ranks or levels, as for instance on the vegetation map of Kansas. But it may be complex with many divisions and subdivisions. There is no need here to discuss what a hierarchy is. What is most important, however, is the manner in which the hierarchy is created. There are two ways to do this: 1) by going from the particular to the general, and 2) by going from the general to the particular. Each of these approaches offers certain advantages.

The first of these methods begins by using the material of larger scale maps just as it is. Small scale maps usually cover larger areas than large scale maps, and different maps portray the vegetation in different ways. Therefore, these various ways must be "translated" into the manner of presenting the vegetation on the small scale map. This means that a variety of methods and classifications must be expressed uniformly according to the classification selected by the author of the small scale map.

But moving from the particular to the general often forces the author

to make some agonizing choices. Moving into the next higher level of the hierarchy means he must generalize the detailed material. He must suppress certain details although they may seem important to him. Which of the details must not be shown? Some authors are almost incapable of answering this question. Sometimes they find ways to combine various details into new units. Combining several small units into larger ones may lead to the formation of complexes and, on the next higher level of the hierarchy, possibly even to complexes of complexes. This can complicate the organization enormously, and the map content can become problematical and hard to understand, not to say confusing. It may be that understanding such a map content is not really so difficult but it may take much time to decipher its various aspects and details. This will discourage many readers.

The procedure ends as soon as the generalization has progressed to the point that the new units can be shown at the small scale. Even though these units represent one of several levels of a hierarchy, only this last level is shown on the map. It is the highest level to which the hierarchy was constructed.

The method of moving from the particular to the general can result in maps of considerable detail and accuracy, provided the author is very experienced and informed. If he is not, his map will be less valuable than it might have been.

Some of the problems encountered above disappear when using the second approach to creating a hierarchy, i.e. when moving from the general to the particular. When the mapper begins with the general, he establishes a small number of major classes. These are the categories of the highest rank in the hierarchy. They are divided into smaller units can then be subdivided. The process is continued until small categories are established that are still within the framework of the scale. The hierarchy has now reached its lowest level because further subdivisions would lie outside this framework. Usually, a hierarchy should not exceed four levels on small scale vegetation maps. Only exceptionally complex map contents will justify a fifth or even a sixth level.

In the map legend, this lowest level of the hierarchy is shown, as well as two or more levels immediately above. This approach to the organization of the map content can therefore show more of the hierarchy than the other one.

The ranks of the hierarchy should always be made very clear to the reader. This is achieved by appropriately numbering the categories: I, II, III, etc. for the highest level, A, B, C, etc. for the next lower level, 1, 2, 3, etc. for the next level, divisions of which are numbered a, b, c, etc. The legend can be organized so that the rank with the

largest number of items is numbered consecutively 1,2,3,etc. through the entire length of the legend. These numbers should appear in the legend as well as on the face of the map. This ties the map to the legend and prevents confusion when some of the colors are difficult to distinguish from one another. Many interesting maps lose some of their value because certain colors on the map can not be readily identified in the legend. If such numbering is omitted, the reader may have difficulties in appreciating the organization of the map content because he can not readily see where a category fits into the hierarchy. Many large scale vegetation maps suffer from this weakness. In addition, the numbering forces the author to clarify his own thinking which is often desirable and which then helps him guide the reader. Numbering strengthens the organization and assists the reader in appreciating what the map has to offer.

The advantage of going from the general to the particular lies in the simple logic of its divisions and subdivisions, the ease with which it can be fitted into the requirements of the scale, and the absence of complexes. The results of this method are neither more nor less detailed than the results of the other method because they are essentially the same, at least in theory. The lowest rank of this hierarchy is the same as the highest rank of the method to move from the particular to the general. Both are adjusted to the scale regardless whether they were constructed by dividing higher categories or by combining lower ones.

A clearly numbered hierarchical order greatly facilitates the work of the reader. But this does not mean that the map content must be organized in the form of a hierarchy. I need only remind you of the manner in which the great master of vegetation mapping, Henri GAUSSEN, proceeded. He divided the vegetation into series, and these into facies. This is not unlike the simple organization of the vegetation of California into physiognomic formations, divided into floristic units.

But GAUSSEN went much further. He brought the natural vegetation as well as the cultural vegetation. By the skillful manipulation of colors, patterns, symbols and statistical values, he enriched his map content to such an extent that his success has never been matched. indeed, GAUSSEN presented so much information that it would be quite impossible to show it all on one map if he had not developed the most ingenious form of organizing the map content. I know of no vegetation mappers who have applied such a vivid imagination to their product.

It is clear that the richer the map content, the more tightly must it be organized. I should urge vegetation

mappers to study the ways and means by which their predecessors and current colleagues have proceeded and then develop the most appropriate manner of organizing their own material. This will help them to avoid the weaknesses we find so often on vegetation maps, such as colors difficult to distinguish and without numbers, divisions and subdivisions without reference to the remainder of the map content, etc. Nobody expects a vegetation mapper to display GAUSSEN's imaginative genius, but it seems reasonable to expect that today's vegetation mappers learn from their great teachers.

VEGETATION AND ITS TERMINOLOGY

Mappers who are accustomed to a particular tradition or school of thought often find it difficult if not impossible to accept a different tradition when this is necessary because of the larger territory covered by the small scale map. Mappers must think in terms of the larger area even though they may not be familiar with some sections of it. To think in terms of only a part of the area and apply them to the entire area can lead to major problems.

In identifying vegetation units one can always use one or both of these features: structure and floristic composition. The structure of vegetation is defined as the spatial distribution pattern of the growth forms, whereas the floristic composition refers to the taxa of which the category is composed. Both can be presented in any degree of detail, hence at any scale, and both apply to any and all types of vegetation on earth, there is no exception to the rule. To use growth forms and taxa to describe and define vegetation units is clear and direct and leaves no doubt in the mind of the reader. The vegetation is described exclusively by its own features which is logical. It is also useful where controversy is to be avoided.

Problems can arise as soon as additional terms are introduced. Attention has been drawn above to the fact that the author of small scale vegetation maps must think in terms of the entire area. The problems arise when terms which are meaningful locally, i.e., on large scale maps, are used on small scale maps. This was illustrated during recent discussions of a new vegetation map of Europe. For example, Czech phytocenologists described vegetation categories with thermophil species. Thermophil means that the species require more heat than the other species of that area if they are to survive and compete successfully. But what may be a useful terminology in some sections of Czechoslovakia becomes meaningless on a map of Europe. For instance, in Sweden, beeches (*Fagus sylvatica*) may be thermophil. In central Germany, they are not. In southern Italy,

they indicate relatively low temperatures as in the higher altitudes of Mount Etna. During the same discussions, another example described certain Polish forests as being extremely arid. However, there is no forest anywhere in Poland that is nearly as arid as the forests of southeastern Spain. Compared with these, the so-called extremely arid forests of Poland are wet, and while a Polish terminology meets Polish needs, it does not fit a vegetation map of Europe. The author of small scale vegetation maps must therefore be extremely careful when compiling his map from larger scale maps of smaller regions. He must realize that some, if not much of the terminology used on large scale maps may not apply to his small scale map.

The mapper must not forget that a well organized legend can be spoiled by using poor terms. This is illustrated on the recently published vegetation map of western Europe showing beech forests with a Belgian sector, an Armorican sector, etc. Such terms are fine for some specialists but meaningless to the vast majority of the users of the map. If there is a difference between such sectors, then that difference should be spelled out in vegetational terms, be they structural or floristic. If the difference between sectors can not be expressed in vegetational terms, then it should not be shown on the map. As indicated at the beginning, it is the user of these maps who is the final judge, not the author or a few of his fellow experts.

CONSISTENCY

It is not necessary for the organization of the map content that all legend items are presented in a consistent manner. But consistency surely helps the reader greatly, thus making the map much more useful. On a consistently organized vegetation map, the identification of all vegetation units is based on the

same criteria, thus making them comparable. This assists the reader in understanding the author's presentation and to quickly grasp what kind of information he may expect to find. There are no unanswered questions.

On a consistently organized vegetation map, it is inadmissible to show oak-pine forests here and meadows there, to indicate the height of the vegetation or the dominant species or the wealth of epiphytes in one category and not in the others. The mapper must apply the selected criteria uniformly throughout the legend or lay himself open to a host of questions. For example, if the height of a forest is given in one category but not in others, how tall are the trees where their height is not mentioned? If one type is said to have many epiphytes which are not mentioned elsewhere, does this mean there are no epiphytes elsewhere? Where questions remain unanswered, the reader becomes dissatisfied with the map and may not use it even though it might have served him well in some respects.

The classical example of a vegetation map lacking consistency is the map of the United States by SHANTZ and ZON. It is a remarkably fine map, considering the vast territory involved and that it had been completed long before World War I. It is quite accurate in what it shows but quite inconsistent. Vegetation categories are identified by species, by genera, by growth forms, by regional affinities, or by ecological controls. The approach is descriptive but it makes a comparison of any one part with another impossible.

The content of many of the finest vegetation maps is organized consistently. Undoubtedly, this contributes to the high quality of the map. From the point of view of the user of small scale vegetation maps, consistency is such an advantage that the mapper should always consider this very seriously when organizing his map content.