CLASSIFICATION OF GRASSY FORMATIONS BY THE STRUCTURE OF THE VEGETATION

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SUMMARY

The original system of classification presented here is based on a method of analyzing the structure of the vegetation and on a special understanding of phytogeographical classifications, brought out in other sources. The author specifies first the determined criteria, in terms of the objective of the classification. The structure of the classification is then described. One table gives the classification plan, whose final form shows several thousand combinations. The problem of naming grassy formations is then considered, the conclusion being the need for redefining, at the international level, a system of terms based on a precise definition of vegetation types.

Upon examining, from the standpoint of the structure of vegetation, the organization and the difficulties of phytogeographical classification, we have developed a relatively original idea based on the so-called "open" principle of classification (Descoings, 1975).

The intent here is to present an example of this idea of open and structural phytogeographical classifications. This example only concerns herbaceous formation, but by definition covers them all. The objective of the proposed classification is first of all phytogeographical, and is set forth on an overall level.

We must remember that starting from the same basic data, the "open" classification system permits constructing a large number of classifications by simply varying the choice and ranking of criteria. The classification given below establishes only one proposal among the many possibilities.

1. Ranking of criteria

The structure criteria reserved for classification are those that we have used in the field for describing herbaceous formations (1). The essential work of classification is limited, on the one hand, to the eventual choice of operating within these criteria, and on the other, to establishing a ranking among these same criteria. This is the crux of the matter, because the interest and the value of the classification depend on this choice and ranking. The precision in the construction, particularly its homogeneity of definition and its symmetry, are automatically ensured by the standardization applied to descriptive criteria.

1.1. Our classification has as its basic unit vegetation types, that is, vegetal formation. From that basis, the principal method in ranking criteria will be the physiognomy of the vegetation, which leads to developing structural criteria having more physiognomical information.

What attracts the observer's attention in the classical herbaceous formation is the presence or absence of woody plants, whatever the type of growth. Within the graminaceous group, it is the nature of the dominant biomorphological types that impresses its general appearance on the herbaceous cover: a basic herbaceous formation of cespitous hemicryptophytes will be very different from a basic formation of single-stemmed annuals. After this overall look, the general size of the graminaceous grouping is an important characteristic that indicates the extremes in the value of the landscape, either low (sparse vegetation) or high (dense vegetation).

In the woody group, the first criteria involves stratification and size. On the physiognomical plan, size as well as stratification, especially in tropical regions, is a distinguishing factor. And as stratification of the woody group is codified in the vegetation survey, it is easy to combine the two aspects.

In the graminaceous group, the stratification is pronounced only in a limited number of cases, given the general size of herbaceous plants. But in the woody group, where the sizes range from .5 metres to more than 30 metres, stratification becomes an important factor. An herbaceous formation, solely shrubby (2-8 metres high) is easily distinguished from a shrub- and tree-like formation (higher than

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(1) See Descoings "Method for the Study of the Structure of Tropical Grass-Type Vegetation" in this volume, and Descoings 1971.

8 metres). Secondly, we consider the criteria of the crown covering, which is very important when the density of the woody plants determines the use of the term "sparse forest" for true herbaceous formations.

1.2. Relative to the existing classifications, and setting aside the construction of the classification itself, the principal innovation is the use of biomorphological types (for the graminaceous plants (2) as descriptive and discriminating criteria, and the place reserved for them in the ranking of criteria.

(2) With regard to morphological and biomorphological types of graminaceous plants, see Descoings 1975.

Table 1

Table of the structural classification of herbaceous formations

1. HERBACEOUS COVER

1	2	3	4
Herbaceous carpet present by itself = non-wooded herbaceous formation (or simple) Herbaceous carpet and woody group together = wooded herbaceous formation (or complex)	Dominant biomorphological types in the graminaceous group (1 TBM higher than or equal to 90 percent of the biovolume or 2 co-dominant TBM). Non-limited list. T/C H/G T/U C/R T/G Ph/C H/C . H/U .	Size of the upper graminaceous layer whose covering is greater than or equal to 10 percent. a : 0- 25 cm : very low b : 25- 50 cm : low c : 50-100 cm : raised d : 100-200 cm : high e : > 200 cm : very high	Total covering of graminaceous plants. a : 0-25 percent : very thin b : 25-50 percent : thin c : 50-75 percent : sparse d : 75-100 percent : dense e : > 100 percent : very dense

Read cols 1, 2, 3 (herbaceous carpet), then 4 and 5 (woody grouping).

2. WOODY GROUP

5	6
Stratification/size (note all the layers of woody group) a : 0-2 m : bushlike b : 2-8 m : woody shrub c : more than 8 m : tree-like d : a + b + c e : a + b f : a + c g : b + c	Total covering of woody group. a : 0-25 percent : very thin b : 25-50 percent : thin c : 50-75 percent : sparse d : 75-100 percent : dense. e : > 100 percent : very dense

N.B.: Every interval includes its lower limit and excludes its upper limit.

We have assigned them this importance for their own value as expressive physiognomic criteria, and also because they always have value in the ecological plan. These qualities assure them serious consideration in solving problems of nomenclature.

2. Organization of classification

The structural classification of herbaceous formations is shown in its entirety in Table 1.

Here there appears to be a basic diagram whose

complete development; quite large, represents about 6,000 combinations. In actuality, that is, in nature, numerous combinations do not exist because certain aspects of certain criteria are not observed.

Table 1 is set up for general and detailed classification and, as a result, the different columns summarize the scales and the terminology used in describing herbaceous formations according to our method of structural analysis (Descoings 1971).

2.1. If the herbaceous formation is comprised only of an herbaceous carpet, and all woody groups are absent, the herbaceous formation is said to be "non-wooded" or "simple"; its definition and classification are shown in the first three columns (1, 2, 3). If a woody group is present, the herbaceous formation is called "wooded" or "complex"; its definition and classification are seen by reading the first three columns, for the herbaceous carpet, then the next two (4 and 5), which deal with the woody group.

Column 1 gives a list of biomorphological types, (T.B.M.) which are indicated on the most commonly encountered T.B.M. Therefore, this list is not restrictive. What is more, the dominant combinations of T.B.M. can be found. For the choice of dominant T.B.M., the T.B.M. providing at least 90 percent of the total biovolume (or biomass) of the graminaceous group will be considered. In the other cases, the two T.B.M. showing the greatest biovolumes (or biomasses) will be considered.

Columns 2 and 3 give the scales used in the descriptive code for herbaceous formations. In column 2, the height obtained by the upper layer whose crown covering is greater than 10 percent is considered. This precision is not intended to overestimate the size of a diverse formation because of the presence of a few plants that tower over the herbaceous carpet: one only considers the size of the vegetal sub-layer in the case of the basiphylls T.B.M.

In column 3, you will note the total crown covering for the entire herbaceous carpet, including the graminaceous group, as well as the other non-graminaceous grass-like plants.

The stratification and size of the woody group are indicated in column 4. The layers are codified according to a scale of size. The number of existing layers is also shown: that is, a single layer, bush-like, woody shrub, or tree-like, or several layers of possible combinations.

In column 5, the total woody covering is considered in its entirety.

2.2. Reading the table means simply going from the first to the third or to the fifth column, whichever the case, and taking from each column the reading corresponding to what is observed in the formation under study. This method uses 3 or 5 terms for describing the formation.

Thus, for example, in the case of a non-woody formation: "a T/U+H/C low, sparse, non-woody formation". In other words, this indicates that the grassy formation contains no woody plants, that its graminaceous formation contains no woody plants, that its graminaceous formation is essentially made up of single-stemmed annuals and cespitous hemicryptophytes types, that its height is between 25 and 30 cm, and that its covering is 50 to 75 percent of the total herbaceous carpet.

For a formation where woody plants are present, the description would be, for example, "a sparse, wooded, tree-like, and shrubby... herbaceous formation". This means that the woody group has a total covering of 25 to 50 percent and that it is made up of two layers, one 2 to 8 metres high and the other more than 8 metres high.

2.3. Organized in this way, the classification goes into great detail and permits distinguishing between closely related vegetal units. Given this principle, you can see that the classification can be rendered even more discriminating, either by adding new criteria or by making the value assigned to the criteria more detailed. Inversely, it is quite possible to set up simpler classifications, providing fewer possibilities, using fewer criteria, and limiting the number of values assigned to the criteria, through more condensed scales.

By way of comparison, let us remember that the part of the Yangambi classification devoted to herbaceous formations (thin forests, tropical grasslands, steppes, prairies) only offers 12 possibilities while using 6 different structural and non-structural criteria.

3. Naming of herbaceous formations

In the absence of world-wide agreement, phytogeographical nomenclature remains a very complex question. In continental Africa, the Yangambi classification was a good attempt (Descoings 1973, 1975 c), in spite of some imperfections concerning herbaceous formations. Moreover, in the general phytogeographical classifications, each proposes a nomenclature in direct relation to the classification system adopted.

In practice, the phytogeographers are confronted with an intricate system, as shown in Table 2. The table contains only the most important applied general terms. It can be seen that for terms as well known as tropical grassland, steppe, and prairie, the initial definition is ecological for the UNESCO (1969) classification. The definition is structural according to different criteria (covering, size), for example, in the Fosberg classification (1967) and the Yangambi classification (C.S.A. 1956).

This is not the time or place to broach the subject of proposing definitions. We will limit ourselves to showing what the structural study of vegetation and structural classifications can offer, if not in immediate solutions, at least in methods of approach.

3.1. It appears, through analysis, that the principal difficulties in phytogeographical nomenclature stem from two sources.

The first is the absence of a true systematic organization of vegetation units (3). It is, in fact, very characteristic that the "vegetal formation", considered as the basic unit, is found in the three classifications we have cited at different levels with relationship to the same scale of criteria. This is related to what, in practice, is a given classification: the level corresponding to the basic unit as defined by the author of the classification in terms of his objectives. Logically, however, the taxonomic order given in a classification to established subdivisions ought to be determined by reference to a pre-established system. The essentially physiognomical definition of the "vegetal formation" which permits applying this term to units of very different orders, is certainly useful.

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(3) Aubreville's proposal (1965) brings out nothing new, because it only relies on the Yangambi classification.

Table 2

Concept of more developed units for grass-like or herbaceous/grass-like formations in the phytogeographical classifications of Yangambi, Fosberg, and UNESCO

Unit names	Yangambi	Fosberg	UNESCO
Tropical grassland	Herbaceous carpet : > 80 cm in height	Herbaceous carpet : 80-100 percent of covering	Tropical and sub-tropical regions
Steppe	Herbaceous carpet : < 80 cm in height	Herbaceous carpet : 20-80 percent of covering	Temperate regions
Prairie	Not defined		= Steppe
Meadow			Temperate and sub-polar regions
Desert		Herbaceous carpet : 0-20 percent of covering	
Criteria considered	Size (structure)	Covering (structure)	Climate (ecology)

The second point, and without a doubt the more important, touches on definitions of terms in the phytogeographical nomenclature. In the basipetal classifications (Fosberg, UNESCO), the nomenclature is fixed to the framework of the classification. Such and such a term corresponds to such and such a level of the subdivisions, and it takes its definition from the contents of the table. This is shown in Table 2 : a new meaning for every term in each classification. An arrangement of basifugal classifications like Yangambi's is more logical, for it tries to specify the contents assigned to each term before sorting them out.

But after all, in one case after another, the terms listed remain poorly defined, due to the use of criteria that are too heterogeneous, diversely chosen by each author and not ranked. The names can only describe the classifications from which they originate (4). A flexible system of structural classifications of the type we have proposed for herbaceous formations can contribute to establishing a rational nomenclature. First it allows for the establishment, for all terms, of standard and comparable definitions expressed in structural types, and then assigns specific limits to these terms.

3.2. In this perspective, it is still necessary to separate the terminology of vegetal formations into three levels : general terms, local terms, and complementary terms.

For grass-like formations, local terms such as esobé, bowal, lousséké, miombo, patana, campos cerrados, etc., are taken into account. These terms correspond, in their original habitat, to already well classified vegetal types. They are worth maintaining, even after a precise and objective definition is given to them through studying the structure of the vegetal types that they denote.

(4) See the analysis of the classification of Yangambi, Fosberg and UNESCO (Descoings 1973, 1975c, 1975d, 1975e).

By " general terms " we mean tropical grassland, steppe, prairie, sparse forest, etc., universally used in very different ways. Definition by example, as in the preceding case, hardly appears possible, because limits are not well defined and numerous contradictory meanings exist.

The complementary terms, widely used in rather precise ways, complete a term by stressing a physiognomical aspect, for example, protected tropical grassland, thorny tropical grassland, palm grove, etc. A structured analysis of the contents of these terms would permit them to be better defined and preserved.

3.3. In the framework of a structural classification of grasslike formations, these different terms can be placed in an order according to the different forms.

Local and complementary terms, defined in a specific way from a structural point of view, are inserted into the classification according to their structural features. For the general terms, one solution is to define in the structural classifications certain parts that we consider as structurally definitive for the terms in question. The main difficulty is in the choice of limits for the section of classification whose structural characteristics must correspond as closely as possible to the physiognomical features of the term considered.

This redefinition of phytogeographical terms on the structural plane and the insertion of the term in a general structural classification must conform to certain rules in order to result in a coherent whole. It would be advisable, in the first place, to avoid creating or bringing back certain terms, and to be certain that all the areas of the classification are covered by one term or another. In fact, at the level of the local terms there is the risk of overlapping as well as of creating gaps. It would be desirable that some adjustment be made to bring such terms into agreement and to make their limits contiguous.

Nevertheless, at the same time it is necessary to set up a ranking in the nomenclature based closely

on the characteristics used in the classifications. For example, the general terms tropical grassland steppe and prairie would be defined at the T.B.M. level of the graminaceous group. Within these general terms, the local terms could be placed at different levels corresponding to the criteria listed in each column. On the same subdivision level, several terms could share the different values expressed by the indicated scale.

In this way, with a homogeneous nomenclature defined on solid structural bases, a systematic organization of vegetation units could take shape.

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