Syntaxonomic ranks, biogeography and typological inflation

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Abstract

To reduce the typological inflation observed in some territories where intensive phytosociological studies have been carried out and numerous descriptive papers have been published, an outline of the biogeographical amplitude of the different syntaxonomic ranks is proposed. Phytosociological classes are divided into five main vegetation clusters: 1. Zonal vegetation, determined mainly by climatic conditions; 2. Azonal coastal and saline vegetation; 3. Azonal rocky vegetation; 4. Azonal wetland and aquatic vegetation; 5. Highly disturbed anthropogenic vegetation. In each of these, the various ranks (class, order, alliance, association and subassociation) have a particular range which is expressed by the biogeographical territory in which they most likely occur. This area can refer to different respective categories: kingdom, region, province, sector and district. Some additional comments about typological inflation are made in order to focus on two phenomena: desire for fame and geographic drift.

Keywords

alliance, association, biogeographical territories, class, desire for fame, order, subassociation, typological inflation

Introduction

After an entire century of the Braun-Blanquet approach being applied to classify vegetation in several regions of the world, most intensely in Europe, it is interesting to reflect on the patterns of territorial scope in the geographic distribution of the different syntaxonomic units in order to unify criteria for their description and acceptance. In relation to this, it is convenient to highlight some observable negative aspects in the practice of describing new syntaxa lacking unified criteria. Several improvements in the application of this approach have recently been introduced (Guarino et al. 2018) and extensive information on the history and epistemology of their development has been provided. In order to avoid repetition in any of the concepts and arguments presented, the aim of this work is to refer to some specific points in order to help researchers in their decision-making and promote more consistent description of new units. The comments only concern units regulated by the International Code of Phytosociological Nomenclature (ICPN; Theurillat et al. 2021).

It is important not to forget that the application of Braun-Blanquet’s floristic-ecological approach requires a high level of knowledge of the surveyed region’s flora, which has delayed its expansion in countries outside Europe and other areas where floristic knowledge is insufficient. However, the high diagnostic value of the described units, based on their intrinsic compositional content, make it an unrivalled approach as it is based on an essential attribute of the plant community. It is also invaluable in the assessment of biodiversity and in designing accurate and scientifically sound conservation policies. In addition, a hierarchical typology (syntaxonomy) allows the use of best-fit unit ranks for different levels of territorial division.
It is essential to retain rigorous criteria in defining and describing syntaxa, which must correspond to a clear systematic arrangement. Therefore, researchers should strictly follow the criteria and definitions of the system’s founders and consider some suggested biogeographical indications. The basic conceptions on syntaxa have been extracted from the classic literature describing this topic, i.e. Braun-Blanquet (1928/1932), Braun-Blanquet and Pavillard (1928), Westhoff and van der Maarel (1978), Géhu and Rivas-Martínez (1981) and Dierschke (1994). Recently, some authors have contributed to the development of these concepts and updated others (Pignatti et al. 1995; Willner 2006, 2020; Loidi 2020).

The development of the Braun-Blanquet approach, mainly in Europe, but also in other parts of the world, has produced an enormous accumulation of information, which is now stored in large datasets, opening the way to highly efficient data management and analysis (Chytrý et al. 2016; Bruelheide et al. 2019). In addition, the production of a substantial amount of formally described syntaxa has taken place in recent decades. This is particularly observed in some regions that have been intensive-ly surveyed by phytosociological studies, such as parts of Europe and the Mediterranean area, in which a certain “saturation” of described units can be observed (Mucina et al. 2016; Rivas-Martínez et al. 2001a). Theeurillat (2000) summarized the typification of names recorded between 1987 and 1995 through a series of publications by Theu-rillat & Moravec. A total of 5066 new names were coined for the world, with the largest representation in the above mentioned areas. I believe that this increase in the number of described syntaxa, concentrated in certain areas over relatively short research periods, deserve some reflection.

**The typological inflation**

Some time ago, the phenomenon of intense publication of new units, often in local studies, was termed “typological inflation” by Pignatti (1968) and was discussed in the 1963 symposium of IVV (Internationale Vereinigung für Vegetationskunde, today’s IAVS) in Stolzenau. The inflation affected various phytosociological ranks, but comments were provided mostly about the higher ones. Several recommenda-tions were made to control this phenomenon, essentially calling for international collaboration and the development of a European Prodromus of the vegetation of the whole continent (almost fifty years later accomplished by Mucina et al. 2016). As part of this discussion, Tüxen (1967) addressed this issue by dividing vegetation studies into three categories: (1) local, (2) regional and (3) global or encompassing the highest rank units. He suggested that only well documented general surveys with a wide scope should propose formal new syntaxa. The studies on lev-els 1 and 2 should refrain from doing that, as they cannot have a general view of the high rank taxonomic units.

It has become clear that these recommendations were not optimally followed, and the description of new syntaxa has not been controlled by objective and universal criteria. This was the case both in many descriptive local surveys and in some of the checklists summarizing the plant communities of certain regions. Unfortunately, this tendency still continues in some regions, leading to the humorous note that *more associations than species* have been described.

Since phytosociology seeks to establish a universal typology of plant communities, it is necessary to respect homogeneity of the criteria when describing new syntaxa, as was recommended by Tüxen (1967). Any syntaxon, and specifically the association, must have a defined and clear characteristic in the following aspects: floristic, statistical, ecological, dynamic, biogeographical (chorological) and historical (Géhu and Rivas-Martínez 1981).

Two main reasons can be highlighted for this inflation-ary trend:

**Desire for fame.** Authors who describe a new syntaxon are “rewarded” with the authorship of the described unit at the end of its name, giving satisfaction to a certain vanity, which is not a rare feeling among scientists (Pignatti 1968; Mucina 1997). The ICPN (Theurillat et al. 2021) recommends (Rec. 46A) that the “name of each syntaxon should be accompanied by the author citation” at least once in every publication. However, avoiding repeated citing of the authorship of syntaxa could be a remedy of the appetite for describing new units. Citing it only once in each pa-per, as a way of presenting the original description (proto-logue) and the typus of each syntaxon, must be sufficient.

**Geographic drift.** This phenomenon could also explain a part of the inflation. Within the geographic range of an association, there may be subareas in which particular taxa occur that are absent in others. If these plants are forming distinct species combination of the syntaxon, there is the possibility to describe a local subassociation or even a new association separated from the original one. However, these geographically distinct taxa might have the optimum of occurrence in other vegetation types and appear only as companions in our surveyed sub- or association. It is the case of using stenochorous species of the seral stages, scrub or grassland communities, as differential species of a new forest association. One example of this could be the recently published forest association *Glandoria diffusa-Quercetum fagineae* (Cantoral et al. 2023) in which a typical scrub species, *Glandora diffusa*, is used to characterize a new local association. Moreover, there are even cases in which climatic variability has been used as an argument to create new associations. As Guarino et al. (2018) indicate, “In some schools, such as the Latin one, secondary attributes of vegetation, such as climate, biogeography or successional position have been profusely used, sometimes to the extent of overcoming the primary attribute of the floristic composition.” Therefore, to avoid flaws such as these, distinguishing an association or alliance must be based on taxa which provide a good diagnosis of the vegetation type concerned. For instance, to accept a new forest association, it must be based on a unique combination of typical forest species. Defining a syntaxon based on some accompanying taxa, maybe of endemic or local distribution, but typical for other vegetation types (scrub or grassland) occurring in a
certain part of the association’s range, should be avoided. These accompanying taxa should be considered as having a lower diagnostic value to coin the new syntaxon and should not be used for their characterization.

For the coherence of the hierarchical system that describes the vegetation of a given territory, we should seek for a broad consensus on the conditions that the units of different rank must meet in order to be accepted by the scientific community. The criteria set out in the aforementioned literature should dominate this process, avoiding the unnecessary description of units outside the orthodoxy of the method. To reinforce these criteria, some indications are given about the biogeographical arguments that should be considered. This additional biogeographical perspective aims to achieve a homogeneity in the criteria for establishing and accepting new units.

### Principal syntaxonomic ranks and their biogeographical range

In Table 1, the biogeographical range of the syntaxonomic ranks of the main European vegetation types is summarized.

The main biogeographical units considered here are as follows: Kingdom, Region, Province, Sector and District. Subordinate units such as Subkingdom, Subregion, Subprovince, Subsector and Subdistrict may be considered, too. They have been established based on their floristic (Mattick 1964; Meusel et al. 1965–1992; Good 1974; Takhtajan 1986; Rivas-Martínez et al. 2001b, 2017; Cox et al. 2016) and vegetation (Braun-Blanquet 1922, 1951; Loidi 2021) content.

### Table 1. Scheme of the approximate biogeographic amplitude of the syntaxonomic ranks within each vegetation type in the western European vegetation (Rivas-Martínez et al. 2001a; Mucina et al. 2016).

<table>
<thead>
<tr>
<th>Syntaxonomic rank</th>
<th>Vegetation types</th>
<th>Biogeographic rank</th>
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The categories for the vegetation types are:

1. **Zonal vegetation:** Determined mainly by climatic conditions.

1a. **Potential vegetation and associated units:** natural climatic forests, woodlands and grasslands, woody and herbaceous forest mantles. Carici rupestris-Kobresietea bellardii, Crataego-Prunetea, Cytisetea scopario-striati, Elyno-Seslerietea, Festucetalia indigestae, Juncetalia trifidi, Juniper-Pinetea, Nardetalia strictae, Quercetalia ilicis, Quercro-Fagetalia, Salicietalia herbaceae, Trifolio-Clusieta sanguinei, Vaccinio-Piceetalia.


2. **Azonal coastal and saline vegetation:** Ammophiletalia, Cakiletea, Crtithmo-Staticetalia, Helichryso-Crucianetalia, Junceetalia maritimi, Ruppietalia maritimae, Salicornietalia fruticosae, Spartinetalia maritimae, Therosalicornietalia, Zosteretalia.


4. **Azonal wetland and aquatic vegetation:** Alnetalia glutinosae, Nerio-Tamaricetalia, Bidentetalia, Isoko-Nonjuncetalia, Lemnetalia, Littorelletalia uniflorae, Monto-Cardaminetalia, Oxycoco-Sphagnetalia, Phragmito-Magnocaricetalia, Potamogetonietalia, Salicetalia purpureae, Schuchterio palustris-Caricetalia fuscae.
Association

The association is the fundamental unit of the system, similar to the species in botanical systematics. It is recognised by the characteristic species combination (charakteristische Artenkombination) and mainly by its characteristic species, as stated by Flahaut and Schröter (1910), Braun-Blanquet (1928) and Braun-Blanquet and Pavillard (1928). The definite species combination is defined as the group of species more or less constant in the average association individual (i.e., its typical relevés). These authors also noted the diagnostic value of the differential taxa for distinguishing species-poor associations. Accepting the “characteristic species combination” concept entails the possibility that none of the involved taxa are character species in a strict sense, but rather the typical combination of occurring taxa is the essential diagnostic ‘character’ of the unit (Westhoff and van der Maarel 1978; Willner 2006).

Each association must correspond to a habitat type occupying a well-defined biotope in a clearly defined territory (biogeography). Its characteristic species combination should be restricted to the plants that essentially constitute the community, looking for diagnostic purposes, plants originating from other vegetation types occurring in the vicinity and entering the plot as companions. Elements not belonging to the considered vegetation type (e.g., deciduous wood in relation to fringe vegetation or grasslands) should not be considered good diagnostic taxa.

In the last decades, most of the described and accepted associations, mainly in Europe, are based on the characteristic species combination, rarely on characteristic taxa (Westhoff and van der Maarel 1978; Willner 2006). Proposals from the mid-20th century to use geographical races, distinguishing between local, regional and general association (Oberdorfer 1968), have not been followed. This has resulted in the description of many associations of narrow geographical distribution in areas with intense floras, have a large distribution, usually a province or region (associations of Phragmites-Magnocaricetea: Typhetum angustifoliae, Potametea: Nupharetum pumilae, etc.). Similarly, vegetation types associated with water, such as fens, have a large distribution, usually a province or region (associations of Molinia-Artenatheretea: Malvo moschatae-Arrhenatheretum bulbosi, Galio-Urticetea: Aegopodo-Menhetetum longifoliae, etc.). This is proportional to the abundance of stenochorous taxa in each of the environments concerned. The Mediterranean scrubs, cliffs and screes are rich in endemics, while aquatic habitats and severely disturbed anthropic communities rarely host such species. This is likely related to the isolation phenomena, the ancestors of the former floristic groups experienced in their evolutionary history, combined with their poor dispersal abilities.

The subassociation is comparable to the subspecies and it is also defined by a species combination and distinguished only by differential species. There can be geographic and ecological (transitional) subassociations. Their range can correspond to a district or sector.

Alliance

The associations having evident floristic-ecological affinities and occupying similar habitats in neighbouring territories form an alliance. As a broader unit than association, alliances have an evolutionary and biogeographical meaning as they have characteristic species (at least one) (Willner 2020). For instance, the Quercion roboris comprises acidophilous oak forest associations in temperate Europe. Alliances have a broader distribution, often a province in the case of zonal vegetation, and a region in other types.

Order

The order gathers similar alliances and has a broader scope in terms of ecology and area. It has a higher number of characteristic taxa than the alliances. For instance, the order Fagetalia gathers several alliances of deciduous temperate forests in Europe. The distribution of an order is broader, often a province or group of provinces (region), or even a kingdom in coastal vegetation. It may be considered that the criteria for defining an order are similar to those for the class (Pignatti et al. 1995). For instance, the orders Fagetalia or Arabidetalia caeruleae expand across the Eurosiberian region.
Class

It is the supreme rank of the system that gathers one or several orders, characterised by a set of characteristic plant taxa. In the European tradition, there is an implicit consensus to maintain the traditional class typology as far as reasonably possible. Thus, general vegetation studies are quite conservative on this point (Theurillat et al. 1995; Rivas-Martínez et al. 2001a; Willner and Grubberr 2007; Costa et al. 2012; Mucina et al. 2016; Chytrý et al. 2017). Its geographic distribution is large, usually the region or group of regions (kingdom) in the case of zonal vegetation. Examples include the Vaccinio-Piceetea, Quercetalia ilicis, Querco-Fagetea, Cisto-Lavanduletalia and Festuco-Brome for the Holarctic kingdom. For azonal wet and disturbed anthropic vegetation types, classes can expand to several kingdoms (subcosmopolitan) as in the case of Phragmito-Magnocaricetea, Potametea, Polygono-Poetalia annuae, Stellarietea mediae or Orzyetalia sativae.

The class is the most controversial unit of synsystematics, and several contributions have tried to clarify what a phytosociological class is (Pignatti et al. 1995; Guarino et al. 2018; Loidi 2020). As the highest floristic unit of the vegetation hierarchical system, units above the class could only be distinguished by non-floristic criteria, e.g. on the basis of a physiognomic approach or analysis of life forms, and they would not necessarily be characterised by any diagnostic species. Nevertheless, these non-floristic approaches have been progressively considered over the last decades (Guarino et al. 2018). Furthermore, the class has a certain biogeographical-evolutionary meaning (Guarino et al. 2018), as its core species set (characteristics of the class and its subordinate units) would result from a unitary speciation process (Pignatti et al. 1995). The set of species characterising a class have likely originated in a specific evolutionary episode that took place in a particular geographical area and under particular environmental conditions. It is hypothesised as a sort of “community of origin” and a “cohabitation along a certain period of the evolutionary history” in the characteristic flora of the class (Loidi 2020). This concept gives the class a profound evolutionary meaning.

Conclusion

The problem of inflation in syntaxonomy comes from an often narrow perspective that does not take biogeographical context into account when describing new vegetation types. This is particularly important in areas which have had intensive surveys over a long period of time. Sometimes, this excessive numerosity of defined syntaxa is a reflection of rash and ill-considered decisions or a lack of comparative phytosociological data. It is therefore important for future phytosociological studies, besides maintaining excellent research standards and high quality data sampling and management, to provide not only a reliable and accurate species composition and ecology when defining new vegetation units, but also to take into account the biogeographical aspects of the newly defined syntaxa.

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