A new spirit in phytosociology

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ABSTRACT. – The description of plant associations occurring in Europe was based on insufficient information, at least during the first half of this century; in the last decades a huge quantity of relevés was published but new problems appeared. Forest vegetation is sometimes interpreted as composed of associations spread over large biogeographical units, or as elementary communities reflecting the ecology of the site. Computers can help in the treatment of data but the judgment on the significance of vegetation types remains subjective. Formalized nomenclatural rules in may cases are a unnecessary complication. New developments in phytosociology are discussed in the frame of the recent evolution of basic scientific concepts.

KEY WORDS – Phytosociology, European Vegetation Survey, community theory, silvofacies, nomenclature.

1. INTRODUCTION

Phytosociology developed in the first decades of this century mainly from the activity of J. Braun-Blanquet and his colleagues and students: in the period before World War II, a large number of vegetation monographs were published based on a unitary method and language and in 1930 the "Prodromus" started. In this way, a general framework was created for the knowledge of Western European vegetation which received a first synthesis with the description of vegetation classes by Braun-Blanquet & Tüxen (1943). The main difficulty at this time was the lack of information for many parts of Europe - for instance, Italy and the Balkans. The production of monographs was continued after the war. The insufficient knowledge of the vegetation of many parts of Europe remained the main problem in this phase.

In the following years, phytosocoiology was practiced in most scientific centers of Europe and a huge quantity of information was collected mostly in the form of relevés or of tables. This activity corresponds to an almost exhaustive analysis of the European vegetation. Surveys over large areas were published by Tüxen (1937), Braun-Blanquet (1952) and by Oberdorfer (1957) but they remained for long time isolated experiences and after publication of seven issues up to 1942 the Prodromus was abandoned. In fact, in this time it slowly became evident that a new difficulty had arisen: the excessive quantity of available information (1). This is exactly the contrary of what was indicated for the previous period.

Methods for automatic data processing were experimented with (van der Maarel, Orloci & Pignatti, 1980), and the technical problems of information treatment have by now found some useful solutions by the use of computers, but this work has apparently been insufficient. In the last decades few tentative surveys have been published, and all based on the traditional procedures, which can be considered as inadequate. In addition, the unitary language in this time appears to be lost. If we compare, for instance, the treatment of alpine forest vegetation by different authors: Ellenberg & Klötzli (1972), Mayer (1984), Oberdorfer (1992), Mucina et al. (1993), and Rameau (1994), we see in many cases different representations (2). It seems that the increasing number of available relevés has not brought clarity, but on the contrary, confusion. There has been an increase of information, but hardly an increase of knowledge. Here in my opinion is one reason for the present crisis of phytosociology.

In addition, also the scenario for environmental research is difficult. The scientific interest in the last decade is progressively shifting to other subjects such as molecular biology and biophysics. At the same time, biodiversity is emerging as one of the major priorities at the global level, and this is pointed out in the final document of the Rio de Janeiro Conference (1992). Phytosociology is just the right approach for understanding biodiversity at the community and ecosystem level and for the needs of nature conservation and

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(1) I can remember a discussion at the end of the Sixties when a colleague declared he had more than 700 relevés to evaluate for a single community. At that time, relevés had to be written on normal pieces of paper, and 700 relevés are difficult to write and need two tables to be shown on. The visual comparison of the different lines and columns was practically impossible. Now we know that in many cases more than 1,000 relevés are available for a single community. This is an incredible redundancy even if, in fact, every relevé is in some form differring from any other.

(2) Results obtained by different Authors (including myself) are in general largerly differing; as an example, a comparison between the vegetation of South Germany (Oberdorfer, 1992) and Austria (Mucina et al., 1994) may be instructive:

class	Vaccinio-Piceetea	Erico-Pinetea
association names only in Oberdorfer 1992	18	4
in both treatments	2	2
association names only in Mucina et al. 1994	21	17

In a total set of 63 names of associations only 4 names have been used in the same sense for the same vegetation unit. This is too little (ca. 7%), even if geographical regions considered are not the same and also the delimitation of classes was in some cases different. As a matter of fact it seems that in this case the Authors (both leading personalities in phytosociology) are not speaking the same language; fixed nomenclature rules appear rather complicating than simplifying the description of vegetation.

recovery. So, we would expect that phytosociology will play an important role in the future. On the other hand, if outdoor studies will be replaced in research and teaching by the chemical and physical approach, in a few decades there will be a great need for work in floristics and vegetation and no experts at all for these issues.

In my opinion phytosociology is at the crossroads between renewal and progress or decadence.

2. Merits and limits of phytosociology

The developments of phytosociology was mainly the work of Braun-Blanquet and Tüxen. The tradition of phytosociology to which the majority of us belongs was mainly created with the long series of Symposia lead by Tüxen in Stolzenau and Rinteln. In the face of the present crisis of phytosociology, the return to tradition is often involked and concepts such as "formal, traditional, sigmatism, orthodoxy" are used. Indeed, we should remember that phytosociology is not a religion, it is by no means a way to explain the world. Braun-Blanquet defined phytosociology very modestly as "Das Studium der Pflanzengesellschaften": this means a method, not a philosophy. And in this sense it was renamed "The Braun-Blanquet approach" by Westhoff & van der Maarel.

Let us consider what is really composing the conceptual basis of phytosociology. The starting point is, in my opinion, the non-random distribution of plants in natural vegetation. The environment results from the synergism of many factors (light, heath, water etc.), all having a continuous field of variation. Combinations among these factors describe an almost infinite variety of situations and in consequence in nature there is the possibility for infinite different arrangements of plants. In vegetation, on the contrary, it can be observed that some arrangements are "preferred" and other non existent. Vegetation is structured. This is not surprising and cannot be indicated as a metaphysical conception or a miracle. We know that living beings are self-organizing systems: the general tendency to order accumulation which is common to all living beings is the driving force for the non random disposition of plants in nature. Vegetation is in an ordered condition.

In the original definition by Westhoff (1970), vegetation is "a whole of plant individuals growing in a certain site and in their natural disposition". The synergism of environmental factors create a continuous variation in the environment, but vegetation is intrinsically discontinuous, as a consequence of interactions among plant individuals and species (3). In this sense it is possible

(3) The correspondence between species combinations and environmental factors is a matter of fact, at least in temperate climates. In consequence, hunting for species combinations has interest not only for discovering new structures, but also it is the way to gain knowledge on the

to say that vegetation is structured. Phytosociology means detecting discontinuities among the uniform variation of environment.

The study of species combinations is carried out in the field with relevés and in the laboratory with elaborations and comparisons on vegetation tables; this is the way to detect structures in vegetation, i.e. the underlying order.

Vegetation appears a good example of a self-organizing system running recursively thanks to the dissipation gradient of solar energy. Light is available as a low-entropy energetic source, plants transform a part (1-2 %) of this energy in chemical bonds and transfer organic matter and the bound energy through cells, tissues, individuals and species in steadily recursive dynamics. At a certain point, order appears (as structures and organization) and new species enter as the effect of invasion or of evolution; the turnover is steadily increasing up to a limit. This phase, when structures are emergent is the most fascinating in phytosociology. And later? In general we identify the end of this dynamics with climax, in my opinion an illusory and confusing abstraction.

If the system is self-organizing, then the entropy of the system is continuously decreasing, then climax has to correspond to the level of minimal entropy. This may appear perfectly symmetric (but with inverse sign) as systems of thermodynamics tending to the level of highest entropy, and in a certain sense may be right. When I first came in my life to a virgin forest (it was the Perucica in former Yugoslavia), I expected to find the dream-combi-

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environment and construct a reference system. Detecting a new species combination is a gain of information, not only because we know that species A occurs together with B and C, but also because this co-occurrence is bound to the external factor A_e. Species A is describing an ecological space which corresponds to its ecological needs; a link between A and factor A_e exists, but this is in general a weak link. Adding species B, C, ... the ecological space is reduced to the overlapping area and becomes more and more precisely defined. This is the true sense of looking for species combinations. An hyperspace can be described (species hyperspace), which corresponds to factors hyperspace and both can be confronted with the niche, which is also an hyperspace. When a still unknown combination is perceived, then the corresponding physical factors have to be detected. From a known combination these physical factors can be inferred.

It is possible to ask (Wilson, 1991) what may be the force producing such combinations, and this brings us to some very basic biological problems. In my opinion (but the problem is still open) a single force acting in this sense does not exist, and it appears more likely that combinations are the result of repeated selective processes. Two steps can be indicated (Pignatti, 1994): fitting in the niche (juxtaposition of needs and resources) and interaction with other species (two species describing exactly the same hyperspace, if they really exist, occupy the same niche and exclude one another). The starting point is relevant: in this case it may be identified with the available floristic stock, or, in a more concrete form, it is the seed bank. Remember the general principle that every species has the tendency to expand indefinitely up to the appearing of limiting factors. This cocktail (fitting - exclusion - expansion) is applied recursively on the floristic stock and progressively stabilizes species combinations in a condition of steady state. The driving force in the process is the dynamics of photosynthesis, as a consequence of the input of low entropy energy from the sun, i.e. a very general process. The existence of a particular force in the sense predicted by Wilson cannot be excluded, but up to the present there is no evidence of this.

nations of species, the quintessence of European vegetation. On the contrary, I found a rather disturbed community because of dead trees opening gaps in the canopy and lying on the soil producing secondary successions which can last for 100-150 years. Places which a student skilled in phytosociology would not consider interesting for a relevé. At the end the situation is ... chaotic. The climax communities are (at least under favourable conditions for plant growth) in a condition of disorder and this is probably one of the reasons why phytosociology until now was little successful in the study of climax-like vegetations as tropical forests or savanna.

Phytosociology developed in Europe because in this area secondary successions prevail and virgin vegetation, if existing is reduced to very small plots. The study of plant communities is based on structures at the edge of chaos, indeed phytosociology is looking for order but neglects chaos. This is probably the most pertinent criticism that I can make to phytosociology from inside the monastery (criticism or self-criticism).

Chaos is mostly thought of as something negative, e.g. traffic conditions in the centre of Rome in rush hours. In the study of complexity, deterministic chaos is devoid of any sense of value: it is an unpredictable condition. This means that the plant community is a self-organizing system, running in recursive cycles and producing structures which can be detected by phytosociology (or by other methods, but phytosociology is powerful) and lasts in this condition until the transition to chaos. In conclusion, the plant community is a structure at the edge of chaos and plant associations are the model, created by our mind, to interprete the order underlying vegetation.

3. The computer experience

At the end of the Sixties, it became clear that a synthesis of vegetation was strongly dependent on the solution of the technical problems of information assemblage and treatment. However, with pen and paper it would be impossible to bring order to the immense number of available relevés. The use of computers became more and more familiar in the following years, and the application of computer science in phytosociology was surely one of the very first in biology (van der Maarel, Orloci & Pignatti, 1980). The computer seems well adapted to the treatment of vegetation data sets. *Con - putare* in Latin means "consider together". This is just what we do by comparing relevés. We consider relevés which are similar or not to each other. Only, our brain has a limited capacity and errors are frequent. The computer on the contrary is exact and indefatigable.

The Working Group for data processing of the I.A.V.S. was active during the Seventies and this work provided original methods of elaboration. Nowadays, this is standardly used software. By computer the technical difficulties in the treatment of information are largely resolved (4). The necessity of investigating thousands of relevés was an unsurmountable limit by traditional methods, and is now with computers a fact of everyday life (5). The computer can compare huge amounts of information in a very short time.

The possibility of working with large quantities of relevés by computer is also going on the basic theory of vegetation science. On many occasions recently, it was pointed out by the most active colleagues that investigations on vegetation have to be based on as much material as possible. At this point we must ask ourselves if this brings more information or if it is only mere perfectionism. In fact, it seems that the use of the largest possible amount of information is self-evident, but this signifies that at least in theory it is possible to give an account of every relevé. However, the number of relevés presently available for Europe is of several hundred thousands, possibly one million. Every relevé can be considered as a message giving information on the ecological conditions of the site where the relevé was carried out. It is clear that the critical survey of hundreds of thousands of messages is too much for the capacities of every scientist and even of the largest possible working group. Probably it is too much even for the most powerful of computers. The need to have an investigation based on the critical review of every relevé has posed a new limit to phytosociological investigation. It is paradoxical that this limit is posed by the richness of data and the powerful machinery where previously the limits were a lack of data and insufficient machinery.

A first conclusion is that the use of the computer makes the treatment of huge amounts of information possible, and will be an irreplaceable tool in order to obtain a synthesis for the entire continent. However, it will not be sufficient to produce objective results or to give a definite answer to every problem.

4. On the inflation of higher syntaxa

Endless analysis is creating a continuum of new taxonomical units. This may appear a consequence of the need for synthesis, but in fact it makes the

(4) This will not mean that (as is often believed) a computer can produce completely objective results. The computer depends on the instructions which are given, through software and through the data; these are products of human mind and consequently the results obtained are not more objective than those found by the human mind. For instance, the computer can measure with incredible precision the differences between two relevés, but it cannot demonstrate whether these relevés belong to different associations of to different classes. This problem remains unsolved, and it appears likely that no solution exists. In consequence, syntaxonomical decisions remain always subjective ones.

(5) In addition, results of computer elaborations are often dependent from the amount of data: A problem which with the treatment of fifty relevés may appear clear, after the treatment of 500 relevés appears confused. This is exactly the contrary of what happens in experimental science where with repetitions it is possible to obtain more and more statistical significance of the results.

synthesis more and more difficult. I had the occasion to describe this tendency many years ago (Pignatti, 1975) as a process of inflation. Since this time the process has not stopped, and presently nearly every new survey brings new taxonomical units which are mainly overlapping one another and steadily increasing the redundancy of the whole (6).

In fact, what is an alliance, an order? A definition was never given. When one says that in Sicily there is *Oleo-Ceratonion* and *Quercion ilicis*, this means that, on the basis of given parameters, an ecological space can be defined. which can be divided in two portions: the first one with higher temperatures and lower rainfall (conditions existing near the coast) and the other one in the mountain, moister and not so warm. Higher syntaxa are ecological spaces which can be recognized by means of bioindicators: *Olea europaea* var. *oleaster, Ceratonia siliqua, Quercus ilex.* The system of phytosociology is composed by ecological spaces which are excluding each other, and in this sense it represents a valuable system of reference (7).

5. Association versus elementary community

After about a century of vegetational investigation and in the presence of a large redundancy of information, it might be supposed that the vegetation of Europe (at least in central Europe) was completely investigated. On the contrary, new combinations of species are continuously detected, new communities are described and consequently the total number of associations grows to thousands. This application of the phytosociological method as such can be considered as quite acceptable and correct. Every community has a variability in its floristic composition, and there are reduced surfaces in which some particular composition appears as a consequence of very local ecological conditions; if a large amount of data is available (and this is mostly the case) then by methods of multivariate analysis it is possible to detect more and more repeating examples of species combinations. Braun-Blanquet defined the association as "the atomistic unit of vegetation". An atom was meant to be the smallest thinkable portion of matter, but later the elementary particles were discovered, which are smaller than atoms. Also vegetation can be considered

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(6) I was recently studying the opinion of Authors on the mixed forests of fir and beech in South-european mountains (*Abieti-Fagetum*) which are connecting *Vaccinio-Piceetea* and *Fagion* as to species composition and ecology. The conclusion is that, if we consider them belonging to the needle lived boreal forest (Oberdorfer, 1992), they are to be included in *Abieti-Piceion* Br.-Bl. 1939, but if the component of the temperate broad lived forest is considered as prevalent (Mucina et al., 1994), then the correct unit is *Piceo-Abietion* Ellenb. & Kl. 1972. Is it thinkable that concepts having a different meaning can be founded on exactly the same indicators ?

(7) Indeed, groups can be also based on the presence of species with low value as indicators, and in this case some groups will overlap, and some ecological spaces will remain uncovered. That is just what happens with the CORINE Biotopes Classification.

at two different levels, i.e. as an association or as an elementary community (8). It seems that the relationships between these two levels may be considered as a parallel to the relationships between atom and elementary particles. We will return to this point in the following section.

Vegetation is a message which can be read at two levels: the association and the elementary community (9). Differences lie only in the possibility of using the one or the other for scientific purposes. Description at the level of association (coarse graining) is useful for large biogeographical comparisons, for the understanding of evolutionary processes of plant species, for the regional description of vegetation, landscape ecology and for vegetation cartography. The level of the elementary community (fine graining) is useful for applied purposes like rehabilitation or reforestation and for an understanding of vegetation dynamics and successions. There is no reason to consider one of them more "true" than the other.

6. Coarse graining and fine graining

The position of the scientific community on these problems seems to be the consequence of what can be called a "residual Newtonian mentality". It is well known that Newton created the basis of modern science with the heaven mechanics, the "Big Theory". His followers, mainly in the 19th century, believed in the possibility of giving a mechanistic explanation of every phenomenon. The world view of the scientist was a deterministic one. The relativistic theory introduced by A. Einstein called this view into question. However, Einstein himself kept the Newtonian view. The principle of indetermination of W. Heisenberg stated the impossibility of studying at the same

(8) In the spruce forest of the Alps we know that to have a good sample of vegetation it is necessary to investigate at least 100 to 250 square meters, but on a single spot (10 or 20 meters) some species can occur more densely: here *Oxalis acetosella*, there *Vaccinium myrtillus*. With many repetitions of relevés in which *Oxalis acetosella* is dominant, or *Vaccinium myrtillus*, then we obtain a uniform table and the elementary community is interpreted as a distinct association. This is not an error, but in this way the analysis of different configurations becomes an endless task, at least for climax-like forest communities. The same phenomenon can be observed in time instead of space also in the herbaceous vegetation far from the climax (van der Maarel & Sykes 1993).

(9) For the problem of the atomistic unity (association of elementary subunits) Oberdorfer (1992) in his latest volume on the forest vegetation of Southern Germany uses a concept of association which is rather large, but for the most important and widespread associations he also indicates the possibility of having different regional and ecological articulations (Ausbildungen). In this form the variability of the association is described in a very understandable form. The single Ausbildung completely corresponds to elementary units or to the very "associations" by Mayer (1984). Independently from Oberdorfer but in a quite similar way, Rodwell (1991) gives for every community several examples characterized by different frequencies of some key species, forming a sub-community. In the same way Rameau (1994) described "silvofacies" for the woody vegetation in France.

time with infinite precision all parameters characterizing the trajectory of one particle. This situation depends on the quantum structure of the universe. Following the principle of indetermination it can be excluded that what results from the scientific investigation can be considered as the objective reality. In a quantum universe it is impossible to have a completely deterministic process. Physicists became convinced of the necessity to overtake the Newtonian view of the world with the quantum theory some decades ago. The biologists in this sense show the usual delay in relation to the physicists and are still fighting against problems which for physicists are no longer in existence.

In recent literature (Mehra, 1973; Gell Mann, 1994) a sharp distinction is made between a fine graining and a coarse graining view of reality. The scientific investigation gives a world view which is coarsely grained, i.e. it gives only approximate descriptions without reaching particulars. The need to reach a fine grained knowledge is unobtainable. This means renouncing the "Big Theory" of Newton. It is impossible to give an explanation for everything, but only to give approximate descriptions of phenomena. It should be pointed out that this is the conclusion of more than 200 years of development of the so-called "exact science," dealing with extremely simple phenomena such as the movement of elementary particles. What about such complex things as plant associations?

The idea that every relevé, meaning every plant population, is the consequence of environmental conditions and can give information which is generalizeable, comes at least in a subconscious form from a mechanistic concept of the world.

In the Galilean and Newtonian philosophies, science is the research of truth. From the point of view of coarse graining we have to conclude that this truth, if existent, cannot be reached by the experimental method. What can be reached are only different histories of the single objects which can give an explanation, but it remains impossible to construct a unique theory embracing every event.

In the studies of the period of the development, only tables with a few relevés were published and the minor differences among them were not considered important. However, with increasing numbers of relevés it is possible to obtain tables on which such differences are magnified, and eventually distinct types of elementary communities can be recognized.

In the previous sections it was possible to point out that general limits in knowledge exist and that the use of computers cannot overtake these limits for understanding vegetation. This condition cannot be interpreted only as a negative one but as also having positive aspects. In fact, some possible answers to these problems were proposed by different authors and give a practical method for reaching a synthesis. The elementary communities resulting in the recent treatments by Rodwell (1991) and Oberdorfer (1992) represent the tentative steps toward proceeding from the coarse grained to the fine grained structure, but it is clear that it is possible to expand the investigation to a finer and finer level without exhausting the variability of vegetation. Every elementary community has a particular history and will have different historical developments in the future.

7. Conclusion

The discussions on points 1-6 gives the convinction that the present crisis can be resolved by developing new concepts and methods of work. The publication of the "Survey" as a conclusion of the analysis of European vegetation can solve many problems and at the same time it can be a solid basis for further developments. The theoretical and technical premises as well as competent collaborators are available. The "Survey" should include most of Western Europe and give a concise treatment in few volumes of the (coarse grained) associations occurring in this area.

This synthetic outlook will need a large effort and some sacrifices for all components of the scientific community but at this moment it can be achieved in a reasonable time. In ten or twenty years this will not be possible any more because of the worsening scientific policy, and because many scientists of today will no longer be active. In this sense, the need for a European survey may be interpreted as a tentative step to transferring the information accumulated until the present time for the future. I quoted some problems (basic concepts, community), other difficulties are funding, collaboration, etc., but I believe it depends on us to undertake and struggle to reach success.

Epilogue. Some guidelines for the "European vegetation survey"

a. Synoptic tables versus relevés

The investigation of every possible relevé is the tentative step to reach a level of fine graining but this is premature because we still do not have a clear level of coarse graining. We have to renounce this task and describe vegetation with synoptic tables which give a coarse grained view of vegetation. This reduces the work necessary for a general overview by a factor of 10-30. The material which has to be investigated is reduced from about a million relevés to possibly 15-50.000 lists of frequency which can be concentrated in 500-1.000 synoptic tables. This appears a realistic goal for a well-organized working group with the use of improved software in the future.

b. Is syntaxonomy a useful tool?

Syntaxonomy was in the beginning a response to the general need for a system to bring order to the data recollected with the analysis of vegetation. It is a need clearly bound with the analysis at the coarse grained level. The big confusion arising in the last decades is probably caused by the tendency to use syntaxonomy also to give a response to the problems posed by the analysis at the fine grained level.

c. *Nomenclature*

The Codex is written in analogy with the International Code of Taxonomical Nomenclature, but it was neither discussed nor accepted by a Congress of the IAVS and consequently it remains a proposal. Indeed, most of the recent literature, at least in Europe, is based on the experimental application of the rules indicated by the Code. The experiment in my opinion was unsuccesful.

It can be argued whether nomenclatural rules in vegetation science are necessary at all. The examples of botanical (and zoological) nomenclature are not pertinent (10). On the contrary, it is possible to mention a large number of natural sciences which flourish without a formalized nomenclature for their object of study: pedology, geology, geomorphology etc. Chemistry is dealing with many more objects than plant associations described in Europe, but the formalized nomenclature is rarely used: in the chemist's shop one asks for aspirin, not for acetylsalicilic acid.

Nomenclature is not the final goal of phytosociology but only a tool; if it is useful it should be applied but if it is not useful it can be bypassed and association names can be done by other methods (11). A revision and simplification of the Code appears necessary.

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(10) Analogy with plant taxonomy is simply nothing more than an analogy, because it is not dealing with the foundations of the logical system. In fact, species are identified by their typus, which is a dried specimen conserved in some public herbarium; this specimen is a true representative of the aspect of the species, contains genetic material which is belonging only to this species and consequently, the identification of a species through its typus is completely assured (at least in theory). Associations on the contrary are typified by a written relevé and are always submitted to a certain degree of arbitrium: the relevé may be a fragment, or a complex of different communities; species occurring in the margins may have been excluded, others may have been misidentified. It cannot be stressed enough that, the association, as it was stated before, is not consisting of species, but of a species combination, i.e. a condition of equilibrium based on competition, which in the written relevé is not present, but can be only supposed by the expert scientist. Summarizing, the typus of a species contains the material features of the species itself, the proposed typus of the association not: it would be necessary to give under nature conservation the exact site where the typus relevé was carried out, but also in this case, vegetation will change in time as an effect of natural succession. A true typification of vegetation is impossible. The consequence of this situation is that the application of the rules given by the Code leads to a discussion on what was the real meaning of the author of the earliest description of the type. In taxonomical nomenclature, on the contrary, the discussion is dealing with the concrete features of a plant specimen. Formalized phytosociological nomenclature opens a slippery discussion on opinions of others and this has nothing to do with plant ecology.

(11) The principle of priority is only a convention and is not binding. The rules for forming

d. Exploring elementary communities

The information available at the moment is mostly dealing with the coarse-grained structure of vegetation. For the study of the coarse-grained structure of vegetation the method of normal relevés in the Braun-Blanquet style is adequate, and the main problem for the future is to give an ordered representation of the existing material, rather than to collect more relevés. The analysis of elementary communities on the contrary largerly remains a task for the future. It is possible that this task will need improved methods of analysis in the field, e.g. pattern analysis, spatial structures and repetitions of relevés in time. Even new methods of synthesis and evaluation of data have to be created.

e. The use of Ellenberg's indexes and a new synecology

A powerful tool for the ecological evaluation of vegetation was introduced by Ellenberg (1974) with his indexes for the flora of Germany. These indexes have now been extended to the whole of Italian flora as well - approximately 6,000 species, i.e. more than half of the flora of Europe. The use of this opportunity is still at the beginning, but what we know is sufficient to say that many problems in the interpretation of vegetation may have in this an adequate response. The indexes of Ellenberg are computerized and can be applied automatically to phytosociological data; mean values can be calculated for every association. With this procedure the ecological spaces corresponding to higher syntaxa can have an unambiguous definition based on numerical values and character species can be substituted by indicators.

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names, such as "first the name of herbs followed by names of trees" are only recommendations for the future and need not be considered as retroactive. In my opinion the "Survey" may accept names which are commonly in use (even if an older synonim exists), geographical or ecological denominations, or shortened names (Curvuletum for Caricetum curvulae). Denominations in the form "Community of .." can be used if this is necessary. Emphasis should be given to names which have been used in monographic treatments; the only condition is that such names have a good semantic value. Authors may be mentioned only as a literature quotation, without the necessity to mention the Author having priority in the use of the name (is anyone interested to know who has priority for the name Aspirin?). A codified nomenclature may be used only as a parallel of such better known names as an optional reference.

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