MEETINGS OF THE BOTANICAL SOCIETY OF THE NETHERLANDS

MEETING OF THE SECTION FOR VEGETATION RESEARCH ON OCTOBER 7TH, 1967 AND MARCH 23RD, 1968

F. M. MULLER

Seedlings in vegetation types

SUMMARY

After a few remarks about collecting seedlings in the field examples are given of the occurrence of seedlings in vegetation types of a xerosere and a hydrosere in the Netherlands.

The author has collected herbarium specimens of seedlings[1] since 1959 and relates some of his experience in the field in the Netherlands.

The possibilities of collecting seedlings in the field are limited by the following causes:

1. It is difficult to visit all the various vegetation types during the limited time of the season that seedlings of most species are present. The seedlings of a few plants (e.g. weeds like *Stellaria media* and *Senecio vulgaris)* can be found almost the year round, but the vast majority germinates either in spring or in late summer and autumn. In the author's experience the *Cyperaceae*, with the exception of *Carex hudsonii*, belong to the former and the *Gramineae*, with the exception of *Elytrigia juncea*, *Ammophila arenaria* and *Elymus arenarius*, to the latter category. A germination late in the season would hardly be effective for these three grasses on account of the danger of being blown away by the winter storms.

2. In comparatively dense vegetations, like e.g. an *Arrhenatheretum*, seedlings are difficult to find, unless the vegetation is destroyed locally (f.i. mole-hills). Yet biennial species like *Daucus carota*, *Tragopogon pratensis* and *Crepis biennis* only can maintain themselves in this habitat by germinating regularly. The erect, linear, grasslike cotyledons and leaves of *Tragopogon* can be interpreted as an adaption to the environment.

3. The seedlings of quite a few plants are so small that they are hard to find in their natural habitat, e.g. those of *Tillaea muscosa* in garden gravel among *Sagina procumbens*, *Poa annua* and various mosses.

A way to obviate these difficulties is, of course, to grow the seedlings from seed.

Examples of seedlings collected in the field are given for a xerosere and a hydrosere. The former[2] starts with the dune formation on a sand beach *(Ely-*

[1]) "Seedling" is defined here as a young plant with well-developed cotyledons and at least one (but preferably two) further leaf.

[2]) A description of the vegetations of the xerosere is given by VAN DER MAAREL & WESTHOFF (1964).

trigia juncea and *Honckenya peploides)*, followed by the windward side of the outer row of dunes *(Ammophila, Salsola, Eryngium maritimum, Sonchus arvensis* and *Solanum dulcamara)*. All these plants germinate in spring and are characterized by a quick development of the root system. At the leeward side of the dunes the thicket of *Hippophaë* develops, but seedlings of this abundantly fructifying shrub are rarely met with. In the same zone *Anthyllis vulneraria* and *Cynoglossum* occur. Farther inland the *Hippophaë* thicket is replaced by other shrubs. On the island of Voorne (the chief locality where seedlings of the dune vegetation were collected) *Lithospermum officinale* and – less frequently – *Inula conyza* occur here beside *Cynoglossum*, accompanied by shrub seedlings like *Evonymus europaea, Ligustrum vulgare* and much *Rhanmus cathartica.* Seedlings of *Berberis vulgaris*, however, seem to be as rare as those of *Hippophaë* in the outer dunes.

A peculiar feature of Voorne are some areas at the inner side of the dune region with an open vegetation where at short distances of each other seedlings of *Saxifraga tridactylites, Lotus corniculatus, Potentilla tabernaemontani, Centaurium minus* and *Gentiana campestris* could be collected.

The hydrosere starts with the open water where seedlings of aquatic plants floating on the surface are extremely rare: the only example being so far *Nymphaea alba.* However, as e.g. the pioneer vegetation of the Ysselmeer polders has shown, many aquatic plants germinate quite well on wet soil above the level of the water. A striking example is *Nymphoides peltata* found in september 1964 on a usually inundated clay bank of the river Waal.

In swamp regions like NW.-Overijssel the floating masses of vegetation in the smaller lakes form a favourable environment for the germination of aquatic and marsh plants like *Carex pseudocyperus, Cicuta virosa, Sium erectum*, and *Bidens* species. The author's only find of seedlings of *Iris pseudacorus* also occurred in this vegetation type.

Seedlings are also fairly numerous in floating bogs of the *Caricetum diandrae* type and in vegetations of similar wetness belonging to the *Calthion.* These vegetations are characterized by relatively low-growing herbs, often occurring in tussocks the edges of which are favourable for germination. Seedlings of *Carex diandra* are quite common in the *Caricetum diandrae*, sometimes accompanied by those of *C. paniculata.* Also *Caltha, Comarum, Hydrocotyle, Viola palustris* and *Pedicularis palustris* are frequently met with. *Menyanthes*, although rather common in these vegetations, rarely seems to produce seedlings.

In NW.-Overijssel a narrow transition zone between the floating *Caricetum diandrae* and the higher and less wet *Cirsio-Molinietum* occurs which is characterized by the rare species *Carex buxbaumii*[1] the seedlings of which are sometimes found among the mosses which abound in this zone.
The *Cirsio-Molinietum* itself regularly yields seedlings of its typical plants like *Succisa, Valeriana dioica, Prunella vulgaris, Cirsium dissectum* and *C. palustre.* The latter two species are hardly distinguishable from each other in the seedling stage.

[1]) For a description of this and the other vegetations of the hydrosere the reader is referred to SEGAL (1966).

ACKNOWLEDGEMENTS

The author is indebted to Dr. M. J. Adriani, Director of the Biological Station "Weeversduin" at Oostvoorne and his staff and to Mr. S. Segal of the University of Amsterdam for their valuable aid.

REFERENCES

MAAREL, VAN DER, E. & V. WESTHOFF (1964): The vegetation of the dunes near Oostvoorne (the Netherlands) with a vegetation map. *Wentia* **12**: 1–61.

SEGAL, S. (1966): Ecological studies of peat-bog vegetation in the North-Western part of the province of Overijssel (the Netherlands). *Wentia* **15**: 109–139.

MEETING OF THE SECTION FOR VEGETATION RESEARCH ON DECEMBER 20TH, 1968.

H. DOING *(Laboratorium voor Plantensystematiek en -geografie, Wageningen)*

Sociological species groups

For a quick recognition of vegetation types in the field a classification is necessary.

If floristic composition of the communities is to be used effectively as a basis for this classification, a fair amount of simplification and generalisation of the species lists is desirable at an early stage.

However, omission of species without first investigating their importance is unacceptable. In its original form the Braun-Blanquet school has tried to solve this problem by attaching different weights to different categories of species, e.g. faithful species of classes, orders, alliances and associations, differential, accompanying and accidental species. Strictly speaking, the many species not fitting into one of the units of this rigidly hierarchical classification should all be called accompanying species. They form an extremely heterogeneous group. Among them are species with an amplitude and an indicator value equivalent to those of faithful species. "Differential species" are used for the distinction of certain pairs of vegetation units because these species have a common limit of occurrence at some convenient place in the classification, but otherwise they also form heterogeneous groups. In case of a revision of part of the classification, which may be necessary when new data become available, usually a number of species change their status as faithful species from one level to another, from faithful to differential or to accompanying species or vice versa. It is clear that species are not as closely linked to communities as was thought originally in the Braun-Blanquet school, and that the attachment of various weights to species, based on the supposed links, is not justified. All species should be regarded as equivalent in principle. The amplitude, even of a widely spread species, is always small compared with the total range of communities within a region.

As an intermediate category to bridge the gap between the species and the vegetation unit, "sociological species groups" (SCAMONI & PASSARGE 1959, DOING 1962, 1963, 1966) may be used. Their purpose is to serve as focal points for arranging all species into groups of similar distribution in the vegetation continuum. Their ecological value can be greatly increased by limiting their use to the communities within a "chief formation" (DOING 1957, 1962, PASSARGE & HOFMANN 1968) and within a phytogeographical region. In principle their validity is not restricted (SCAMONI *c.s.* 1965), but there are gradual shifts in their composition as the just mentioned limits are crossed. The groups are based on coincidence of occurrence between species (instead of that between species and certain vegetation units). This is expressed by similarity of actual (not necessarily potential) sociological amplitude and optimum.

The term "sociological" as an opposite to *e.g.* "ecological" indicates that floristic composition of the communities, and not an environmental factor (or combination of factors), is used as the basis of the grouping.

Ideally the groups are established as follows. A series of plots is analysed. These should cover: a. all existing types of vegetation within the chosen limitations of formation and area, and b. each species in its complete amplitude of occurrence and quantitative development. The size of the plots should be adapted to the minimal areas of the vegetation types or to the size of the plants, patches or populations of each species. The number of plots should be sufficiently large to justify calculation of affinities between all species pairs. These calculations should be based on presence/absence as well as on quantities of the species. A number of pairs or clusters of species showing close affinities will emerge. These are used as points of departure for the arranging of all species into groups. Although the distinction of groups of 1 species only cannot be ruled out, this should be avoided as much as possible, especially with uncommon species. On the other hand, very large groups often can be split up into several smaller ones. The size of the groups depends on the desired degree of detail of the classification and on the complexity of the situation. No statistical method exactly following this procedure is known to the author, but LAMBERT & WILLIAMS' (1962) "nodal analysis", the methods of DE VRIES *c.s.* (1954) and of IVERSEN (1954), and the discussion of the problem by JANSSEN (1967) may serve as a guide.

In practice there will always be species on which the number of records is insufficient to allow statistical treatment. Here, incidental observations, personal experience and literature data, including distribution and general sociological and ecological behaviour of the species, may be used to determine its position in one of the groups. Even for common species there is not always an uninterrupted range of observations. In addition, it is difficult, even if computer methods are used, to take full account of the variation in quantities of species. Trial and error and the "method of successive approximation" will be indispensible in all cases to come to conclusions on the grouping of the species. Since all species have a certain distribution curve in the total range of communities and a definite ecological amplitude and indicator value, and since any species may prove to be important for a reason perhaps not yet known, it is essential that all species be grouped. An essential trait of the method is also that each species should be placed into one group only, except if there is a strong suspicion that it consists of several smaller taxa which should be placed into different groups. Strictly speaking, instead of the term "species" in this paper "taxa" should be read.

Apart from the results of plot analysis (which are always somewhat uncertain because they may vary with the size of the plots), species patterns within the plots as well as total distribution of the species within the reference area are taken into account.

On this basis, the following types of groups can occur:

a. There are two or more common species with pronouncedly positive mutual affinities and nearly equal amplitudes and optima. Often some less common species (sometimes larger in number) can be grouped around these "central" species.
b. There are several uncommon species, statistically not showing pronounced mutual affinities, but with similar sociological and ecological optima and amplitudes. If they cannot be fitted into one of the groups of type a, they may form a separate group.
c. The centre of a group is formed by one species, which is much more common and abundant and often also has a wider amplitude than the peripheral species.
d. There are two or more species that tend to dominate in local communities and do not easily mix with each other, but may nevertheless be united into one group because they tend to occur as elements in a frequency recurring mosaic, in which significant primary or secondary differences of environment are not likely to be present, and because they occur together with the same combination of minor species.

Some of the advantages of the sociological species groups over the groups usually distinguished in tables of phytosociological relevés are:

1. Adjustment of the overestimation of the importance of presence or absence of individual species: these are now "anonymous" within the groups.
2. The groups are much more homogeneous.

3. The groups, and the species within the groups, can be arranged in a definite order, so that all tables can be easily compared and criticised, and a synoptic table, showing the composition of a great number of communities, can be prepared (DOING 1966).
4. Fragments and mixtures of communities as well as vegetation continua can be interpreted much more easily. A classification based on sociological groups can be more flexible.
5. In an undescribed region the distinction of faithful species is impossible, but tentative groups may be established at an early stage of a survey, even without plot analyses.

The disadvantages of "ecological groups" are:

I. If environmental factors are used as a starting-point, no progress is possible until these have been measured. In addition, it is not always obvious which are the most important factors, and the number of factors that can and will be measured is limited. Floristic composition of communities can be directly observed, and the number of sociological groups is limited only by the total number of species. Once established, they can be used to trace and to evaluate the importance of the environmental factors, which may greatly help to make a research programme more promising and efficient.

II. Ecological species groups based on single factors are not homogeneous because species that have the same requirements or tolerances for one factor may react differently to another. In addition, they are not suitable as a basis for a classification or for the arrangement of floristic tables, because one species may occur in different groups.

III. The distinction and selection of certain "environmental factors" is always partly determined by opinions on the irimportance, by the way they are measured and by research opportunities. The validity of single factors is limited because the same physiological responses of the plants may be brought about by many different combinations of factors.

Ecological species groups can be extremely useful for practical purposes, but they are not suitable for a general classification of plant communities. On the other hand, sociological groups should be given an ecological content by prolonged study of their environmental relations. Finally, structural-physiognomical characters should also be used for classification, in particular as a basis for the grouping of stands.

REFERENCES

DOING, H. (1957): De natuurlijke standplaats van Cornus mas L. *20e Jaarb. Nederl. Dendrol. Ver.* 169–201. (also published as *Belmontia* **2**, 1.).

— (1962): Systematische Ordnung und floristische Zusammensetzung niederländischer Wald- und Gebüschgesellschaften. *Wentia* **VIII**. (also published as *Belmontia* **II**, 8.)

— (1963): Übersicht der floristischen Zusammensetzung, der Struktur und der dynamischen Beziehungen niederländischer Wald- und Gebüschgesellschaften. *Meded. Landb. hogeschool Wageningen* **63** (2). (also published as *Belmontia* **II**, 9.)

—(1966): Beschrijving van de vegetatie der duinen tussen IJmuiden en Camperduin. *Meded. Landb. hogeschool Wageningen* **66** (13). (also published *Belmontia* II, 13.)

IVERSEN, J. (1954): Über die Korrelationen zwischen den Pflanzenarten in einen grönländischen Talgebiet. *Vegetatio* **V–VI**: 238–246.

JANSSEN, C. R. (1967): A floristic study of forests and bog vegetation, Northwestern Minnesota. *Ecology* **48**: 751–765.

LAMBERT, J. M. & W. T. WILLIAMS (1962): Multivariate methods in plant ecology. IV. Nodal analysis. *J. Ecol.* **50**: 775–802.

PASSARGE, H. & G. HOFMANN (1968): Pflanzengesellschaften des nordostdeutschen Flachlandes II. *Pflanzensoziologie* **16**: Jena.

SCAMONI, A. & H. PASSARGE (1959): Gedanken zu einer natürlichen Ordnung der Waldgesellschaften. *Arch. f. Forstwesen* **8**: 386–426.

— H. PASSARGE & G. HOFMANN (1965): Grundlagen zu einer objektiven Systematik der Pflanzengesellschaften. *Feddes Repert.* Beih. **142**: 117–132.

VRIES, D. M. DE, J. P. BARETTA & G. HAMMING (1954): Constellation of frequent herbage plants, based on their correlation in occurrence. *Vegetatio* **V–VI**: 105–111.