NORDIC VEGETATION SURVEY - A STATUS OF PROGRESS AND FUTURE OUTLOOK

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ABSTRACT - Progress in the Nordic Vegetation Survey network is summarised. The project includes institutions in the Faroe Islands, Norway, Sweden, Iceland, Denmark and Finland. A Nordic software platform with standardised species nomenclature (for vascular plants, bryophytes and lichens), and a data sampling, treatment and analysis protocol, has been developed. The network has resulted in a number of scientific publications, such as treatments of Nordic beech forests and Danish salt marsh communities. Also more ecological papers contributing to new theories have emerged, such as papers on character displacement along a geographical transect, test of Ellenberg indicator values in Nordic vegetation types and modelling of plant communities.

A handbook on the concepts for vegetation studies in the Nordic countries is in progress, and will be published by the Nordic Council of Ministers in year 2000.

KEY WORDS - network, vegetation and community ecology, forest, monitoring.

INTRODUCTION

The Nordic Vegetation Survey (NVS) is a network of institutions in the Nordic countries, i.e. within the political entity consisting of Denmark, Sweden, Norway, Finland, Faroe Islands, Iceland and Greenland, all represented in the Nordic Council.

The NVS began in 1996, when realising the great need to co-ordinate the studies of vegetation ecology in the Nordic countries, and promote the Nordic ecological view in a broader European context. In the recent decades, plant ecology in the Nordic countries had focused little on community ecology, but more on population biology of plants, and experimental, genetic and physiological plant ecology (cf. van der Maarel, 1990; Lawesson, 1998). At the onset of the NVS, plant community ecology

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in the Nordic countries faced a number of problems, such as little co-operation between neighbouring countries and hardly any exchange of data or joint studies or treatments of vegetation types had occurred. Moreover, there were only sporadic contacts with vegetation ecologists from Central Europe.

To face this challenge, the representatives in the Nordic Vegetation Survey network agreed upon a common concept of data-storage, data quality control and data analysis, ensuring a common and transferable set of data formats and procedures. This included ways of sampling (sample size, cover scale, sampling intensity, sample location) and data transformation, both of which are of crucial importance when analysing vegetation data with distribution-dependent methods. Together with the database platform, we also developed a uniform set of statistical and geographical tools for analysis, enabling us to make comparable vegetation-environment analyses when of interest. During a number of workshops (Oslo, 1996; Uppsala, 1997; Torshavn, 1997; Rome, 1998; Akureyri, 1998; Rome, 1999; Bilbao, 1999) the group developed a strategy and protocol for vegetation studies.

In a previous paper (Lawesson *et al.*, 1997) the concepts and perspectives of the Nordic Vegetation Survey project were described. Now, after the first 3 years of work, it seems justified to evaluate the progress, and sketch the future development of Nordic scientific collaboration within the field of vegetation science.

PROGRESS IN THE NORDIC VEGETATION SURVEY

The Nordic version of TURBOVEG (Hennekens, 1996) with complete species lists of Nordic vascular plants, bryophytes and lichens was elaborated initially. It has been made available to any interested in the Nordic countries, and is now the nomenclature basis for data entries in each of the participating countries at several institutions.

DESCRIPTIVE STUDIES

A significant scientific achievement of the NVS network was the first comprehensive multivariate analysis of beech *(Fagus sylvatica)* forest communities in the Nordic countries (Diekmann *et al.*, 1999). Beech forests are among the dominant vegetation types in the nemoral parts of southern Scandinavia, in particular in Denmark, and a modern treatment was highly needed. More than 2000 sample plots were compiled in the study, partly from literature, partly from new and unpublished data. The material included more than 20 studies of beech forests, often recorded by different non-standardised sampling designs. The cluster analysis resulted in 15 syntaxa, divided into a *Fagus sylvatica-Fraxinus excelsior-Stachys sylvatica* group on basic and fertile soils; a *Fagus sylvatica-Corylus avellana-Galium odoratum* group on moderately fertile and acid soils, and a *Fagus sylvatica-Sorbus aucuparia-Deschampsia flexuosa* group on very acid and oligotrophic soils. Moreover, the primary significance of soil acidity and nutrient status for community differentiation was confirmed.

Another important vegetation type in the nemoral and boreo-nemoral parts of the Nordic countries, the oak forests, were treated in an overview by Lawesson (1999a), in which knowledge about *Quercus* in Northern Europe was summarised. In particular *Quercus robur* is remarkable for its wide ecological amplitude, occurring from mild, humid and oceanic settings on dunes and ledges to drier, cooler continental conditions on gravel, sand, clays and moraines. The review demonstrated the importance of oak forest types in Denmark, Norway, Sweden and to some extent also in SW Finland, represented by *Cladonia-Quercus, Deschampsia flexuosa-Quercus,* and *Vaccinium myrtillus-Quercus* communities on oligotrophic soils, and *Melica-Quercus, Quercus robur-Ulmus glabra-Tilia cordata,* and *Quercus robur-Fraxinus excelsior* communities on eutrophic soils. A particularly interesting type is the xerophile *Vincetoxicum-Quercus* community in southern Sweden and Denmark. It was shown by means of Ellenberg indicator values, that the main division of the Nordic *Quercus* forest types appears to be related to edaphic conditions.

Among further spin-offs from the Nordic Vegetation Survey could be mentioned a revision of the Danish salt marsh communities (Nygaard & Lawesson, 1998). Moreover, a new classification of Danish forest types (Lawesson, 1999b) includes hitherto unnoticed *Carpinus betulus* and *Tilia cordata* forests. Two reviews of past and present phytosociological and terrestrial ecological research in Denmark (Lawesson & Krienke, 1996; Lawesson, 1998) have also been elaborated. Moreover, studies of Nordic dry grasslands and birch forests, under the direction of Martin Diekmann, Gävle, and Odd Eilertsen, Oslo, respectively, are in progress.

ECOLOGICAL STUDIES

The agglomeration of Nordic species and vegetation data has made it possible for members of the NVS to investigate environmental affinities of selected indicator species, and how the realised environmental niche-occupation may change when competition is released, or more generally, by character displacement. This was done by Diekmann & Lawesson (1999) in: Shifts in ecological behaviour of herbaceous forest species along a transect from northern central to north Europe. Here the ecological behaviour of four closely related species pairs *(Melica nutans, M. uniflora; Primula veris, P. elatior; Veronica chamaedrys, V. montana; Viola riviniana, V. reichenbachiana)* along a transect was studied. The second-mentioned species of each pair is confined in its geographical distribution to the southern parts of the studied transect. The wide range species appeared to have broader ecological amplitudes on the northern margins of their distributional ranges, especially in boreo-nemoral Sweden, than in the southern parts of the study area, and these shifts are probably caused by changes in the competitive relationships between the species.

With associated data on flora and environment, stored in the Nordic database, we have been able to study the validity of Ellenberg indicator values (Ellenberg *et al.*, 1992) for parts of the Nordic flora. So was done in Denmark (Lawesson & Mark, 2000) where the correlation between Ellenberg reaction values and measured pH values was reviewed for 158 plant species occurring in Danish forests, and used to improve the original indicator values proposed by Ellenberg. In total 30 species differed with 2 units, and 6 species with 3 units. Moreover, several species, without indicator values in Ellenberg's system, were assigned Danish indicator values.

The building of a Nordic vegetation database system also provided the frame for managing large amounts of vegetation data in the Indicator of Nature Quality project (Dahl *et al.*, 1997; Nygaard *et al.*, 1999) which developed into the a database called DanVeg, counting some 25.000 Danish releves. The concept of nature quality lends itself to the fact that in order to preserve and improve biological quality of terrestrial biotopes, local and governmental authorities need new methods for assessing the nature quality. The nature quality concept combines management and continuity factors, so that natural areas of e.g. forest or meadows with low management impact and long continuity have a high nature quality. Simple lists of species, or number of species, are not enough. Biota with a high number of species may be severely damaged or disturbed, while low-diversity areas may be unique and worthy conservation or particular management. Some of the scientific progress has been communicated by Mark & Lawesson (2000), in which indicators of nature quality were identified by means of direct comparison, canonical correspondence analysis, and tree based neural modelling, each method relating nature quality to species occurrences.

Altogether, 23 positive indicator species and 26 negative indicator species emerged from the analyses as predictors of nature quality, partly in accordance with other studies of indicators of ancient forest or natural forest (Hermy *et al.*, 1999). The results support the notion that care should be taken when using indicators and comparing indicators, with respect to regions and methodology (type of forests compared, inventory scale, etc.).

APPLICATIONS AND OUTLOOK

The network has led to the formulation of new research projects, such as the project: "Vegetation zones in relation to climatic parameters in some Faeroes mountains and ecological behaviour of selected plant species" in the Faroe Islands, between the Danish and Faroese representatives of NVS (Fosaa & Lawesson, 1999).

Initially, it was believed that a common Nordic database, with vegetation data from all the Nordic countries stored and management at one place would be optimal. However, we soon realised that the options of either to establish one common Nordic Database, individual single country databases or institute databases raised a number of questions connected to quality insurance. With the limited resources available, it was decided that the project only could provide the common grounds in terms of concepts and nomenclature for the participating countries, while the actual building and maintenance of vegetation databases had to be the responsibility of each individual country and institution.

In order to address the needs of a gradient oriented view in modern vegetation research and ecological monitoring, a handbook on the concepts for vegetation studies in the Nordic countries is in progress. The Nordic Council of Ministers will publish it in 2000 under the title: A concept for vegetation studies and monitoring in the Nordic countries. The book will include chapters on background and traditions of vegetation science in each of the Nordic countries, sampling design, data editing and treatment, data analysis, modelling and presentation, and the application of vegetation studies in environmental monitoring. The Nordic Vegetation Survey has agreed upon common concepts of data storing, data quality control and data analysis, ensuring a common and transferable set of data formats and procedures. This includes ways of sampling (sample size, cover scale, sampling intensity, sample location) and data transformation, both of which are of crucial importance when analysing vegetation data. Together with a common database platform, we also present a uniform set of statistical and geographical tools for analysis, making comparable vegetation-environment analyses possible.

The Northern concept of data-formats, standards and treatment of data in a consistent and stringent way is promoted by the members of the NVS in international forums, such as the European Vegetation Survey and will hopefully widen the application of the Nordic concepts.

Conclusion

Definitive progress has been made according to the initial aims of the Nordic Vegetation Survey project. A Nordic software platform with standardised species nomenclature and a methodology protocol has been developed and implemented in most of the Nordic countries and in several institutions nationally. We have published a number of scientific papers on important trans-national vegetation types and ecological aspects in plant ecology, new projects have been the spin-off from the NVS network, and more are being planned.

We believe that the conceptual and institutional results from NVS represent the most promising point of departure for Nordic research in vegetation science. This concerns both in classical disciplines such as classification and description, but even more so in analytical and ecological studies of plant species, communities and ecosystems, within fields like spatial distribution at different scales; effects of climatic changes; plant species diversity and mobility; interactions and plant community structure; and disturbance dynamics in temperate forests.

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