WORKING GROUP ON DRY GRASSLANDS IN THE NORDIC AND BALTIC REGION – OUTLINE OF THE PROJECT AND FIRST RESULTS FOR THE CLASS *FESTUCO-BROMETEA*

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ABSTRACT - The vegetation databank established by our working group covers the classes *Festuco-Brometea*, *Koelerio-Corynephoretea*, and *Trifolio-Geranietea sanguinei* in the Nordic and Baltic region, i.e. NE Germany, Denmark, Norway, Sweden, Finland, N Poland, Lithuania, Latvia, Estonia, and NW Russia. We aim to use these data to develop a consistent supra-national phytosociological classification of these xerothermic vegetation types in the study area and to analyse their biodiversity patterns. Up to now, we located some 12,500 relevés meeting our criteria, and more than 3,500 of them have already been included in the databank. We give an overview of the properties of these relevés as regards coverage of syntaxa and countries, source types, plot sizes, and cryptogam treatment. We also present first analyses for the basiphilous semi-dry grasslands (*Brachypodietalia pinnati*) within the *Festuco-Brometea*. For this group of communities, many

different and incompatible classification schemes have been proposed. We give an overview of the alliance and association names that have been in use for them in the study area, accompanied by a nomenclatural assessment. The relevés presently included in the databank have been tentatively assigned to those vegetation classes whose diagnostic taxa were prevailing. Accordingly, more than 2,000 relevés have been placed in the *Festuco-Brometea*. These show considerable floristic differences compared to stands of the southern temperate *Brachypodietalia pinnati* alliances *Bromion erecti*, *Cirsio-Brachypodion pinnati*, and *Agrostion vinealis*. The presence degrees of *Avenula pratensis* and *Homalothecium lutescens*, for instance, are significantly increased in the study area, and those of *Festuca rupicola* and *Euphorbia cyparissias* decreased. An analysis of the species-area relationship yielded a power function with $z = 0.09$ which is considerably lower than increments determined by nested-plot analyses of this community type, indicating the probable incompleteness of the species lists for many of the larger plots. Finally, we give an outlook on the future objectives of the working group.

KEY WORDS - Biodiversity, dry grasslands, *Festuco-Brometea*, Nordic and Baltic region, syntaxonomy, vegetation databank

INTRODUCTION

Dry grasslands are, for the most part, semi-natural plant communities commonly developed as a result of low-intensity agriculture in former times, and they are now highly endangered (Poschlod & WallisDeVries, 2002). They host a considerable proportion of Europe's biodiversity (e.g. Korneck, Schnittler, Klingenstein, Ludwig, Takla, Bohn & May, 1998). For both reasons, many dry grassland types are protected by the Habitats Directive of the European Union (European Commission, 2003).

Conservation depends on good knowledge of the objects to preserve, especially about their distribution and their ecological requirements. Besides its scientific significance, a well-founded and robust classification of dry grassland communities is thus also necessary for nature conservation. In central Europe, there is a legacy of publications dealing with the syntaxonomy of dry grasslands, whereas scientists in Fennoscandia, Denmark, and in the Baltic countries generally have paid less attention to the formal classification of these communities. This is partly due to different scientific traditions (Uppsala and Russian schools of vegetation science; see Trass & Malmer, 1973; Aleksandrova, 1973), and partly to the fact that the dry grassland communities of these regions do not 'fit' properly into the classification schemes developed farther south. For these two reasons, vegetation science and nature conservation in the Nordic and Baltic countries (with slightly better situation in Lithuania and Latvia) have largely relied on rough informal classification schemes until now. These classifications are often neither scientifically founded nor backed up by vegetation tables, and their units are rather referred to by vernacular descriptions (e.g. 'kalkrik tørreng', '*Corynephorus canescens-Koeleria glauca* variant') than by scientific names (Nordiska Ministerådet, 1984; Fremstad & Elven, 1987; Påhlsson, 1999; Rosén & Borgegård, 1999). There are some comprehensive numerical classifications on national level – Pärtel, Kalamees, Zobel & Rosén (1999) for Estonian alvar communities and Bruun & Ejrnæs (2000) for Danish dry grassland communities – but these authors did not describe their units as formal syntaxa. If formal syntaxonomic classifications have been suggested in the study

area, they were mostly regional – leading to idiosyncratic, incompatible systems. Only Dierßen (1996) developed a supraregional syntaxonomic scheme based on a selection of synoptic tables available at that time and excluding the countries at the southern margin of the Baltic Sea and Russia.

A comprehensive study (Dengler & Löbel, 2006; Dengler, Löbel & Boch, 2006) recently showed that within the basiphilous dry grasslands of shallow, skeletal soils (*Sedo-Scleranthenea*: *Alysso-Sedetalia* Moravec 1967) there is a very distinct Nordic unit, occurring in Fennoscandia and in Estonia, and comprising at least six associations. It has therefore been described as a new alliance *Tortello tortuosae-Sedion albi* Hallberg *ex* Dengler & Löbel 2006. The authors also demonstrated exceptionally high small-scale species richness of these vegetation types, which exceeds that of their temperate counterparts by more than a factor of two. For other classes of the herbaceous xerothermic vegetation, recently also separate superior syntaxa in the Nordic and Baltic region have been suggested (*Festuco-Brometea*: Dengler, Berg, Eisenberg, Isermann, Jansen, Koska, Löbel, Manthey, Päzolt, Spangenberg, Timmermann & Wollert, 2003; *Trifolio-Geranietea sanguinei*: Dengler & Krebs, 2003) but their precise circumscription, subdivision, and distribution is still largely speculative. Another interesting question is whether all types of herbaceous xerothermic vegetation show the same patterns of plant diversity and community distinctness as the *Sedo-Scleranthenea* and if these have the same causal factors (cf. Dengler *et al.*, 2006).

In this situation, we founded a working group on dry grassland vegetation in the Nordic and Baltic region, which at present comprises 18 persons from seven countries. Our basic aim is to develop a supra-national classification of the dry grassland communities of this part of Europe based on individual relevés and a uniform and consistent methodology. Furthermore, we aim at analysing the ecological gradients underlying the floristic differentiation of these dry grassland syntaxa as well as the biodiversity patterns and their causes. To achieve these goals, we build up a databank including as many relevés as possible of dry grasslands and dry forest edge communities from the region.

The present paper intends to give a short report on the concepts and present state of the databank. More specifically, we deal with one exemplary part of the dry grassland vegetation, for which the databank is already rather comprehensive, namely the basiphilous semi-dry grasslands of the order *Brachypodietalia pinnati* within the class *Festuco-Brometea*. For the communities of this syntaxon, we want

- to present an overview of the multitude of different, mostly regional classifications that have been proposed in the past and
- to give a first supra-regional assessment of the relevé data from the complete study area as regards species composition, species richness, and delimitation from related vegetation types.

Databank – outline

Geographic coverage

The study area corresponds roughly to the area that was covered by the Scandinavian ice-shield during the Weichselian glaciation (Fig. 1).

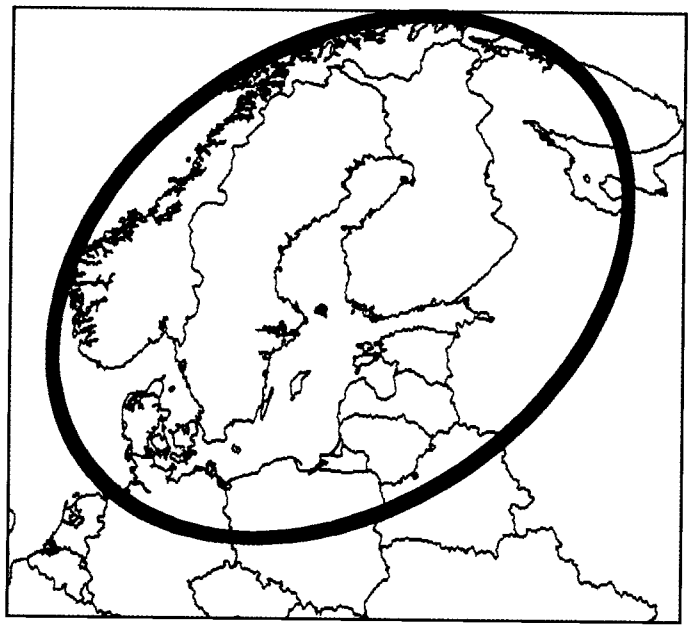

FIGURE 1 - Approximate geographic coverage of the databank.

It comprises 10 countries or parts of them: Germany (Mecklenburg-Vorpommern, Brandenburg, Berlin, Schleswig-Holstein, Hamburg, NE Lower Saxony), Denmark, Norway, Sweden, Finland, Poland (northern parts), Lithuania, Latvia, Estonia, and Russia (regions of Kaliningrad, Pskov, Novgorod, Leningrad, Republic of Karelia, and Murmansk). The study area thus covers some 2,000,000 km^2, which is approximately one fifth of Europe's land surface, however, dry grasslands are rare or absent in large parts of northern Fennoscandia.

Syntaxonomic coverage

We intend to compile published and unpublished relevés of the following three major phytosociological units in a comprehensive manner:

Festuco-Brometea Br.-Bl. & Tx. *ex* Klika & Hadač 1944 – basiphilous dry grasslands of colloid-rich soils (excluding the alliance *Festucion valesiacae*, Klika 1931, which occurs only locally in the southernmost parts of the study area)

Koelerio-Corynephoretea Klika *in* Klika & V. Novák 1941 – dry grassland communities of sandy and of shallow, skeletal soils (with the two subclasses *Koelerio-Corynephorenea* [Klika *in* Klika & V. Novák 1941] Dengler *in* Dengler *et al.* 2003 and *Sedo-Scleranthenea* [Br.-Bl. 1955] Dengler in Dengler *et al.* 2003)

Trifolio-Geranietea sanguinei T. Müller 1962 – forest-edge and tall-herb communities of dry, nutrient-poor sites (with the two subclasses *Trifolio-Geranienea sanguinei* [T. Müller 1962] Dengler *in* Dengler *et al.* 2003 and *Melampyro pratensis-Holcenea mollis* Passarge *ex* Dengler *in* Dengler *et al.* 2003)

If easily accessible, relevés supposedly belonging to closely related other classes will also be included in our databank but with no attempt of exhaustive coverage.

Criteria for the inclusion of data

In the 10 countries of our study, many different schemes have been applied for collecting and recording phytosociological plot data during the last century. Such differences in plot size, plot shape, spatial arrangement of plots, accuracy and completeness of species records, treatment of infraspecific taxa and of non-vascular plants, cover-abundance scales as well as in available header data may potentially have distorting effects on data analyses if all available data were treated as a whole and without previous adaptations. However, if we had set up very narrow quality criteria for the inclusion of relevés in the databank, it would have caused a great reduction in the amount of available data and – more problematically – a very unequal coverage in terms of geographic regions and syntaxonomic units. We thus decided to use only the following three essential criteria:

- Contiguous plots (i.e., no frequency data of randomly distributed subplots as often used in Nordic countries; cf. Raunkiær, 1918)
- Plot size indicated and between 1 m^2 and 100 m^2
- Cover-abundances values (i.e., not presence/absence data only)

Relevés that meet these criteria will in principle be included in the databank, but this does not mean that they also will be subjected to joint analyses. Rather we will do separate analyses for different subsets and test the effects of, for example, the consideration of cryptogams or of different plot sizes on classifications, ordinations, and other analyses, thus the information on the plot size is essential. In particular, varying plot sizes pose a serious, albeit long-neglected problem for joint analyses of relevés. Recently, Dengler (2003) and Dengler, Löbel & Dolnik (subm.) have shown the confounding effects on classifications, especially if the range of plot sizes exceeds one order of magnitude, and Otýpková & Chytrý (2006) did the same for ordinations. With this in mind, we decided to select a range of two orders of magnitude that covers the plot sizes most frequently used for the target communities in the study area. Recent proposals of standardised plot sizes for herbaceous community types in future studies by Chytrý & Otýpková (2003: 4 m^2 or 16 m^2) and Dengler (2003: 5 m^2 or 10 m^2) lie at an intermediate position in this range. Plots larger than 100 m^2 have only very seldom been used for dry grassland relevés in the study area, but their size ranges up to 2,500 m^2 (Celiński, 1953). By contrast, hundreds of relevés from plots smaller than 1 m^2, particularly such of 0.25 m^2 size, have been published. However, these originate only from few local studies (e.g. Albertson, 1946; Kleiven, 1959), and their inclusion in the databank would have caused much work but little use, not to speak of the strong geographic bias. Unfortunately, there are several major syntaxonomic studies with valuable relevés, whose authors failed to document the plot sizes, and which thus could not be used for our analyses (e.g., Krausch, 1961, 1968; Jeckel, 1984).

Standardisation within the databank

When bringing relevés from many different sources together, an adaptation to common standards is essential. For the unification of the nomenclature of plant taxa, we use the most recent floras or checklists that cover the whole study area (or nearly so):

- vascular plants: Tutin, Burges, Chater, Edmondson, Heywood, Moore, Valentine, Walters & Webb (1968-1993),

- mosses: Corley, Crundwell, Düll, Hill & Smith (1981) with the amendments of Corley & Crundwell (1991),
- liverworts: Grolle & Long (2000),
- lichens: Santesson, Moberg, Nordin, Tønsberg & Vitikainen (2004).

In some cases, it was necessary to define additional informal units above species level (aggregates). We also included cultivated, other non-naturalised or newly discovered species, hybrids, and some infraspecific taxa of potential syntaxonomic relevance that occur in the published relevés but that are not listed in the mentioned reference works. Any such additions are clearly documented in the metadata to the databank.

The 'importance values' (cover, abundance or both combined) of the many different scales in use are transformed to the closest category of the (extended) Braun-Blanquet scale: r, +, 1, 2 (2m, 2a, 2b), 3, 4, 5.

Header data

Three types of header data are included in the databank:

Essential header data:

- country
- state/province
- geographic coordinates (that allow – for example – stratified resampling)
- plot size [m^2]
- treatment of non-vascular plants: yes/no?
- treatment of non-terricolous plants: yes/no?

Optional header data:

- coverage of the different vegetation layers, of litter, bare soil, and open rock
- inclination
- aspect
- soil properties, such as pH value, organic content, or soil depth

Automatically generated header data:

- species richness (total and per taxonomic group or layer)
- biodiversity indices, such as Shannon index or evenness
- cover sum
- mean Ellenberg indicator values

Databank – current state

Technical aspects

Presently, the databank is stored in the programme SORT 4.0 (Ackermann & Durka, 1998), which allows easy handling of the relevés and fusion of data based on different taxonomic reference lists. However, when the databank becomes larger, we

will probably export it to TURBOVEG (Hennekens & Schaminée, 2001). The different analyses will predominantly be done in SORT and JUICE (Tichý, 2002).

Overview of the available data

Up to now, we have located 129 sources, which contain about 12.500 relevés corresponding to the criteria given above. Sources comprise published papers (58% of the relevés), 'grey literature' (i.e., unpublished theses and reports: 9%), unpublished original relevés on which published synoptic tables have been based (13%), and completely unpublished relevés (21%). Approximately 30% of the relevés have already been entered in the databank; another large proportion is available in a digital form (Fig. 2).

We found the largest numbers of relevés for northeast Germany, Sweden, Estonian, Latvia, and Denmark (Fig. 3). Taking into account not only relevé numbers in relation to country size but also the geographic and syntaxonomic distribution of the relevés, the present coverage can be termed good only for Germany and Latvia. In Sweden and Estonia, the alvar communities (*Festuco-Brometea*, *Sedo-Scleranthenea*) are covered well, but only few relevés of *Koelerio-Corynephorenea* and *Trifolio-Geranietea* communities are available from other regions than the islands of Öland and Saaremaa (Fig. 4). In Denmark, by contrast, the large majority of suitable relevés belongs to the *Corynephoretalia canescentis* Klika 1934, and other Koelerio-Corynephoretea orders as well as the classes *Festuco-Brometea* and *Trifolio-Geranietea* are only sparsely documented. For all other countries, additional relevés are highly desirable, especially in the case of Finland and Poland (Fig. 3 and 4).

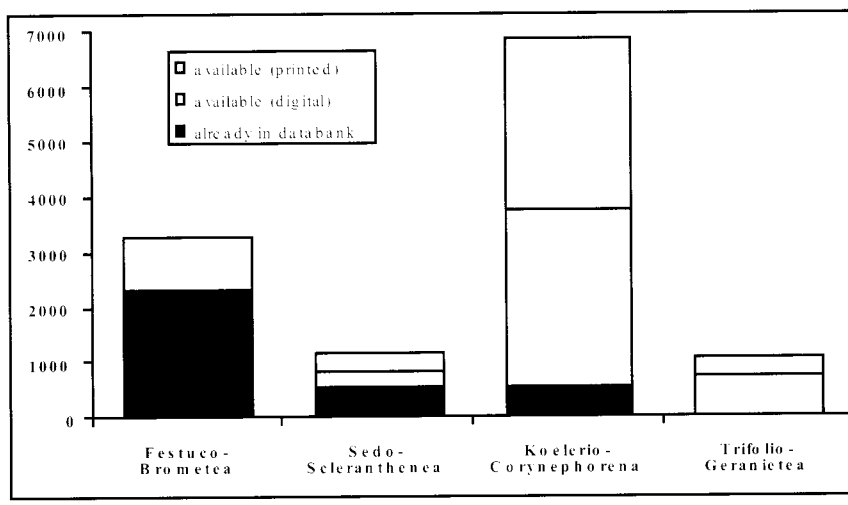

FIGURE 2 - Number of located suitable relevés per major syntaxon and differentiated according to their present status in relation to the databank. The assignment follows the classification in the source or, if none such is available, is based on a rough estimation.

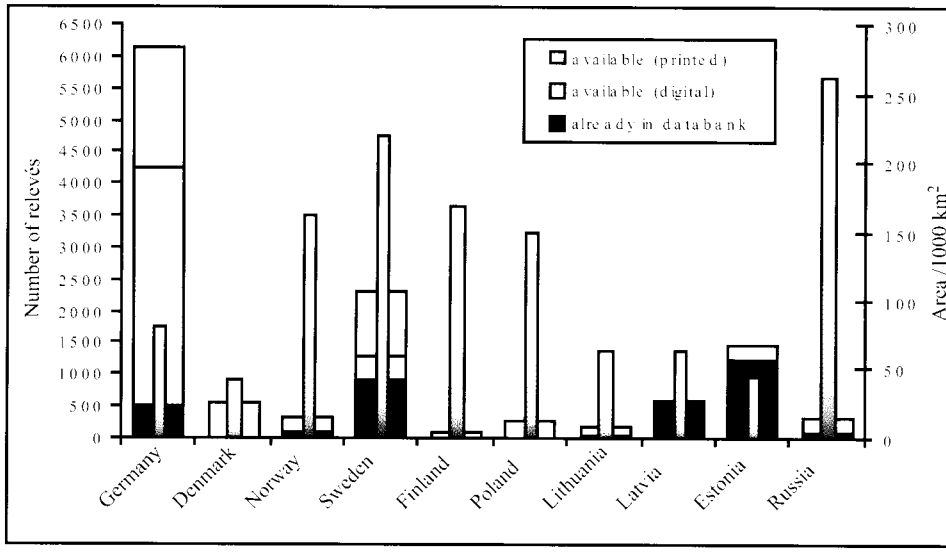

FIGURE 3 - Number of located suitable relevés per country and differentiated according to their present status in relation to the databank (wide columns). These values are related to the relative area of the countries or their relevant parts (narrow columns). For Norway, Sweden, Finland, and Russia, it is assumed that their northern halves are not suitable for xerothermic communities.

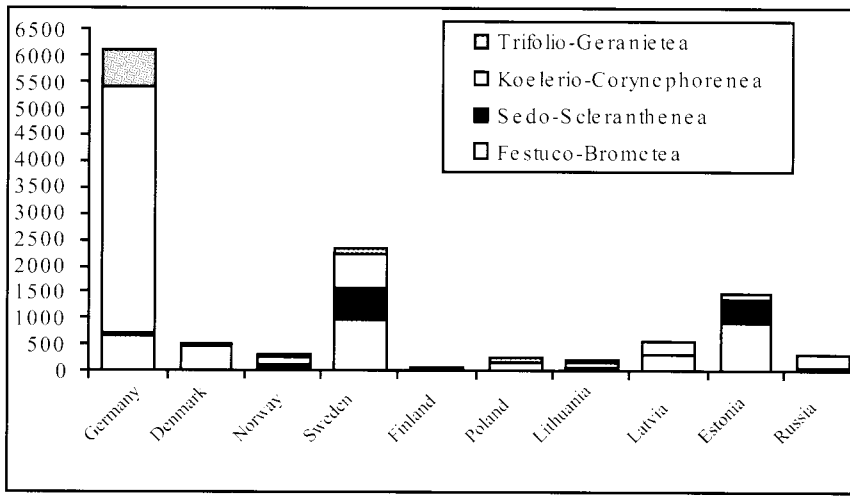

FIGURE 4 - Number of located suitable relevés per country and differentiated according to the major syntaxa (*a priori* assignment).

Data in the databank

For 1,744 of the 3,547 relevés (49%) currently in the databank, bryophytes and lichens have been recorded; for 366 of these also non-terricolous taxa have been recorded (10%). The most frequently used plot sizes were 1 m^2, 4 m^2, 9-10 m^2, and 25 m^2 (Fig. 5).

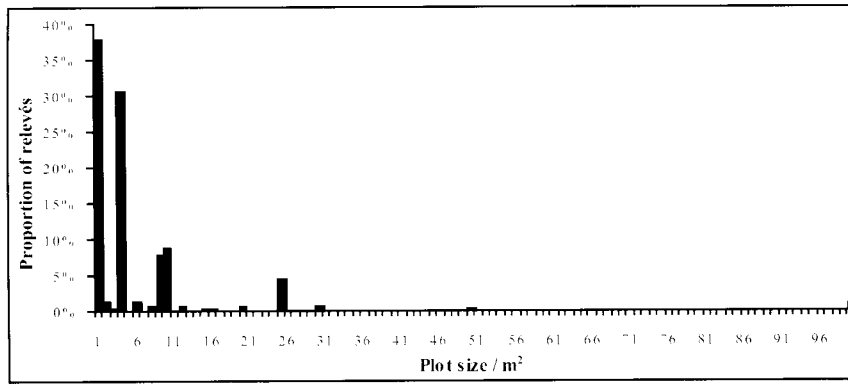

FIGURE 5 - Frequency of different plot sizes used for the relevés already included in the databank (n = 3,547).

Up to now, we have preferentially included relevés presumably belonging to the class *Festuco-Brometea* to enable partial analyses of the databank before it is comprehensive for all major syntaxa.

FESTUCO-BROMETEA – SYNTAXONOMIC TREATMENTS IN THE LITERATURE

In the following, we give an overview of classifications that have been proposed for the *Festuco-Brometea* communities (except for the *Festucion valesiacae*) in the study area. Most of the available classifications of *Festuco-Brometea* communities in the study area are local, regional or at best national (see Table 1). Few authors proposed formal classifications at a larger geographical scale, and only Willems (1982), Royer (1991), Dierßen (1996), and Dengler (2003: 200) presented synoptic tables including relevés from more than one of the relevant countries.

Our synopsis aims at being exhaustive as regards the listing of published formal syntaxon names, and mentions widespread informal names. The evaluated sources are listed in Table 1.

We assess the validity and legitimacy of the formal names according to the International Code of Phytosociological Nomenclature (Weber, Moravec & Theurillat, 2000; cited as ICPN), as a basis for a future syntaxonomic revision of the Nordic and Baltic *Festuco-Brometea* communities. For details of the presentation of syntaxon names and their nomenclatural assessment, see Dengler *et al.* (2003). The sources to the author citations occurring in this section are included in the reference list.

General concepts of the class

The traditional, and still the most widespread, way of subdividing the class *Festuco-Brometea* into orders is a splitting along the continentality gradient. The bipartition of the class into a subatlantic order, *Brometalia erecti* W. Koch 1926, and a subcontinental to continental order, *Festucetalia valesiacae* Br.-Bl. & Tx. ex Br.-Bl. 1950, dates back to Braun-Blanquet & Tüxen (1943) and has been adopted by many supra-regional overviews from the study area (Passarge, 1964; Matuszkiewicz, 1980; Pott, 1995; Ellenberg, 1996; Wilmanns, 1998; Schubert, Hilbig & Klotz, 2001;

Rennwald, 2002). This approach was also essentially followed by Royer (1991) in his Eurasian synthesis of the *Festuco-Brometea*, who added some geographically founded orders from outside the present study area (similarly in Rodwell, Schaminée, Mucina, Pignatti, Dring & Moss, 2002). More recently, a different approach has become more prominent. This suggests to unite the floristically and ecologically similar mesophytic subunits of the *Festuco-Brometea* in one order of basiphilous 'semi-dry' grasslands, and to confront this to several geographically disjunct xerophytic orders. The correct name of such a mesophytic order would also be *Brometalia erecti* W. Koch 1926, despite a very different content. Dengler *et al.* (2003) thus proposed this name to be rejected by the Nomenclature Commission as a *nomen ambiguum* and to be replaced by the next younger valid name *Brachypodietalia pinnati* Korneck 1974. This concept has been followed explicitly in the syntaxonomic overviews of Dierßen (1996), Passarge (2002), and Berg, Dengler, Abdank & Isermann (2004). Some other authors place all their *Festuco-Brometea* communities from the study area within the order *Brometalia erecti* but it remains unclear which of the two alternative concepts they follow (Rašomavičius, 1998; Jermacāne & Laiviņš, 2001; Lawesson, 2004).

The situation is complicated by the order *Koelerio-Phleetalia phleoidis* Korneck 1974 with the alliance *Koelerio-Phleion phleoidis* Korneck 1974, both proposed by Korneck (1974) within the *Festuco-Brometea* and including dry grasslands of base-rich siliceous soils. For the study area, this concept has been (partly) accepted by Pott (1995), Passarge (2002), and Rodwell *et al.* (2002). As these communities largely correspond to the order *Trifolio arvensis-Festucetalia ovinae* Moravec 1967 of the class *Koelerio-Corynephoretea* (see Dengler, 2004) and the respective relevés have mostly been placed within the latter class by our preliminary classification (see below), we do not treat them in the following. The xerophytic alliance *Festucion valesiacae* which is unquestionably placed in the order *Festucetalia valesiacae* and which occurs locally in northeastern Germany and northern Poland, has also been excluded from this presentation.

Alliances of basiphilous 'semi-dry' grasslands in the study area

In the beginning of the 20th century, all types of basiphilous dry grasslands were placed in a single alliance, *Bromion erecti* (cf. Braun-Blanquet & Moor, 1938). From the 1940s onwards, when a subdivision of the *Festuco-Brometea* into several alliances and orders had first been proposed, a multitude of different alliances was suggested for the communities of the study area (Table 2 and 3).

The communities of northwestern Germany (Schleswig-Holstein), Denmark and the Swedish mainland have mostly been placed in the subatlantic *Bromion erecti s.str.* (= *Meso-Bromion*), whereas those of northeastern Germany (Brandenburg) and Poland have been included in the subcontinental *Cirsio-Brachypodion pinnati*. However, the exact delimitation of these two alliances is controversial, and even recently communities from Brandenburg, Lithuania and Latvia have been assigned to the southwestern *Bromion erecti/Meso-Bromion* (Rašomavičius, 1998; Balevičienė *et al.*, 2000; Jermacāne & Laiviņš, 2001; Passarge, 2002). Royer (1991) established an additional alliance *Agrostio-Avenulion schellianae* as a more continental counterpart of the *Cirsio-Brachypodion*, occurring mainly in Ukraine and western Russia but also indicated from Lithuania.

Several authors have pointed out that the *Festuco-Brometea* communities at the northern distributional range of the class (British Isles, Denmark, Fennoscandia, Baltic countries) hold a distinct floristic position (e.g. Willems, 1982; Dierßen, 1996; Diekmann, 1997). On the one hand, they lack some diagnostic species of the *Festuco-Brometea* and their subunits that are frequent farther south. On the other hand, several differential species (e.g., mesophilous and slightly acidophytic taxa, mosses, and fruticose lichens) become more prominent northwards (Dierßen, 1996; Dengler *et al.* 2006). An assignment of stands from the mentioned regions to the alliances described from central Europe seems thus problematic. Braun-Blanquet (1963) was the first to establish a separate Nordic alliance, *Helianthemo-Globularion*, which according to him should be endemic to the islands of Öland and Gotland. However, *Helianthemo-Globularion* is to be considered as a *nomen dubium* as Braun-Blanquet (1963) used too large and too inhomogeneous plots for the description, which consisted of a mosaic of *Festuco-Brometea* and *Sedo-Scleranthenea* communities (Krahulec *et al.* 1986, Dengler *et al.* 2003). Similarly, Sunding (1965) and Marker (1969) assumed a separate Scandinavian *Festuco-Brometea* alliance (*Anthyllido-Artemision campestris*) based on their studies in the proximity of Oslo (Norway). Willems (1982) presented a supra-national synoptic table of *Meso-Bromion* communities. According to his analyses, the central European communities are well separated from a northwest European group, which could be further subdivided into a British Isles subgroup (United Kingdom, Ireland) and a south Scandinavian subgroup (Denmark, Swedish mainland). Royer (1991) adopted this concept with slight modifications by proposing a northwestern alliance, *Gentianello amarellae-Avenulion pratensis* (British Isles, N France, Denmark, SW Sweden), and including the northeastern communities in an enlarged *Helianthemo-Globularion* (SE Swedish mainland, Öland, Gotland, Estonia, Finland). In Dengler *et al.* (2003), the new alliance *Filipendulo vulgaris-Helictotrichion pratensis* was published to replace the latter *nomen dubium*, and now also the *Festuco-Brometea* stands in southwest Sweden, Denmark, and the northernmost parts of Germany (mainly Schleswig-Holstein and Mecklenburg-Vorpommern) were included in this alliance.

Associations and equivalent informal units

At least 38 formal association names have been used for *Brachypodietalia pinnati* communities in the study area, variants in orthography and author citations not counted (Table 4). Of these names, 15 are invalid or illegitimate and further three are in widespread use for very different communities from various countries and thus should preferably be rejected as *nomina ambigua* by the Nomenclature Commission. Seventeen associations have been validly described based on relevés from the study area; however, the nomenclatural types of three of these rather belong to other orders than the *Brachypodietalia pinnati*. Only few of these valid names have been applied for communities in more than one country, namely the *Adonido-Brachypodietum pinnati*, *Pulsatillo-Phleetum phleoidis*, and *Solidagini-Helictotrichetum* (Table 4). The *Veronico spicatae-Avenetum*, which occurs on the alvars of Öland and possibly also of Gotland and Västergötland, is now widely accepted as an association (Krahulec *et al.*, 1986; Dierßen, 1996; Löbel, 2002; Dengler *et al.*, 2003) but still has no valid name. Remarkably, in the Baltic countries also association names such as *Agrostietum vinealis*, *Aveno pubescentis-*

Medicaginetum falcatae or *Meso-Brometum* are applied, which refer to associations described from regions far away (Ukraine, Netherlands, Switzerland) and not known from the countries in between (Table 4).

The lack of a supra-national overview, lead different authors to give their syntaxonomic units only preliminary, informal names. For example, Dierßen (1996) distinguished five *Brachypodietalia pinnati* units at the rank of associations in the Nordic countries but only named three as associations and two as informal communities (*Stipa pennata* comm., *Helictotrichon pratensis-Festuca ovina* comm.). Löbel (2002), besides the *Veronico spicatae-Avenetum*, accepted three equivalent units in southern Öland (*Phleum bertolonii-Saxifraga granulata* comm., *Trifolium montanum-Medicago falcata* comm., *Adonis vernalis-Ononis arvensis* comm.). Other authors due to the unclear and controversial delimitation of the superior *Festuco-Brometea* syntaxa in the study area even refrained from definitively placing their basic units within alliances. Boch & Dengler (2006) found one *Festuco-Brometea* association on the Estonian island of Saaremaa but could not decide whether it belongs to the *Filipendulo-Helictotrichion* or the *Cirsio-Brachypodion* and thus named it as *Helictotrichon pratensis*-[*Brachypodietalia pinnati*] community, and Jermacāne & Laiviņš (2001) subordinated their *Medicago falcata* community directly to the class.

Festuco-Brometea – first analyses of the data

Subdivision into classes

Preceding the analyses, we had to 'extract' the *Festuco-Brometea* relevés from the databank. Several solutions for this purpose have been taken into consideration: (1) The original syntaxonomic assignment in the respective publication would not have been a good criterion for this selection since the differences in the syntaxonomic concepts of various authors are nearly as large on class level as on the levels below, and many of the relevés in the databank have not at all been assigned to classes by their authors. (2) The subdivision could have been done by manual 'table work' but this would have been quite time-consuming, error-prone (due to the large size of the table, only a very small section can be seen on the screen at one time), and not repeatable, at least not in exactly the same manner. (3) A selection by the species group method (Bruelheide, 1997, 2000) would have been another possibility. However, the species group method requires equal plot sizes (Jandt & Bruelheide (2002: 120). Moreover, its application can potentially result in relevés assigned to more than one class and usually leaves a considerable proportion of relevés unclassified – both situations not intended by us.

Thus, we decided to apply a different approach: We compiled lists of diagnostic taxa of the relevant (sub-) classes based on as comprehensive as possible, preferentially statistically based analyses from the study area (Dierßen, 1996; Berg, Dengler & Abdank, 2001; Rūsiņa, 2005; Boch & Dengler, 2006; Löbel & Dengler, subm.). Not only for the high rank syntaxa primarily covered by our project (*Festuco-Brometea*, *Sedo-Scleranthenea*, *Koelerio-Corynephorenea*, *Trifolio-Geranietea*) did we create such lists, but also for all floristically and ecologically closely related class-

es of the herbaceous vegetation, relevés of which potentially could have been included in the databank. These are: *Ammophiletea* Br.-Bl. & Tx. *ex* Westhoff *et al.* 1946, Artemisietea vulgaris Lohmeyer *et al. ex* von Rochow 1951, *Asplenietea trichomanis* (Br.-Bl. *in* Meier & Br.-Bl. 1934) Oberd. 1977, *Calluno-Ulicetea* Br.-Bl. & Tx. *ex* Klika & Hadač 1944, *Molinio-Arrhenathheretea* Tx. 1937, *Parvo-Caricetea* den Held & Westhoff *in* Westhoff & den Held 1969 *nom. cons. propos.*, *Polygono-Poetea annuae* Rivas-Martínez 1975, and *Stellarietea mediae* Tx. *et al. ex* von Rochow 1951 (including the *Sisymbrietea* Korneck 1974 *nom. cons. propos.*).

For the *Festuco-Brometea*, for example, we used the following 51 taxa: *Adonis vernalis*, *Anthyllis vulneraria*, *Aster linosyris*, *Astragalus danicus*, *Avenula pratensis*, *Brachypodium pinnatum*, *Briza media*, *Bromus erectus*, *Campanula glomerata*, *C. sibirica*, *Campylium chrysophyllum*, *Carex caryophyllea*, *C. humilis*, *C. supina*, *Carlina vulgaris*, *Centaurea rhenana*, *C. scabiosa*, *Cirsium acaule*, *Dianthus carthusianorum*, *Entodon concinnus*, *Filipendula vulgaris*, *Gentianella germanica*, *Helianthemum nummularium*, *Homalothecium lutescens*, *Hypochoeris maculata*, *Koeleria pyramidata*, *Leontodon hispidus* subsp. *hispidus*, *Lophocolea minor*, *Lotus corniculatus*, *Medicago lupulina*, *M. sativa* subsp. *falcata*, *Onobrychis viciifolia*, *Ononis arvensis*, *O. spinosa*, *Orchis militaris*, *O. morio*, *O. ustulata*, *Plantago media*, *Polygala comosa*, *Potentilla cinerea*, *P. heptaphylla*, *Prunella grandiflora*, *Ranunculus bulbosus*, *Salvia pratensis*, *Sanguisorba minor*, *Scabiosa columbaria*, *Senecio jacobaea*, *Stachys recta*, *Thuidium philibertii*, *Thymus pulegioides*, *Trifolium montanum*.

For each relevé, we calculated importance values for all 12 named (sub-) classes by summing up the ordinal transform values (van der Maarel, 2005; r → 1, + → 2 ... 5 → 9) corresponding to the cover-abundance values of all their diagnostic taxa. The relevé was then subordinated to the class with the highest score. Accordingly, nearly two thirds of the relevés belong to the *Festuco-Brometea*, a smaller proportion to the two other studied classes, and some relevés to 'non-xerothermic' classes (Fig. 6).

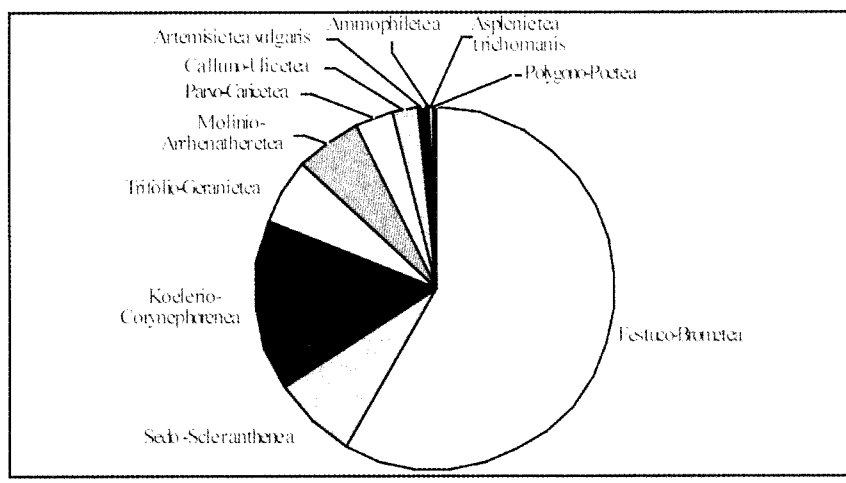

FIGURE 6 - Numerical assignment of the relevés already included in the databank to (sub-) classes (n = 3,547). For the method used, see text.

This method is (nearly) unaffected by both different plot sizes and the question whether cryptogams are treated or not. The first application of this method lead to a rather convincing result with high coincidences of our classification with the original assignment of the relevés, for most of those studies that were based on comprehensive data analyses.

Species combination

Table 5 shows the most frequent taxa in the Nordic and Baltic *Brachypodietalia pinnati* relevés (not corrected for different plot sizes or spatial clumping). This preliminary list indicates many similarities but also some substantial differences to *Brachypodietalia pinnati* communities in other European regions. We compared the presence degrees with the mean of the three southern temperate alliances *Bromion erecti*, *Cirsio-Brachypodion pinnati*, and *Agrostion vinealis*, using a synoptic table based on 19 associations and some 3,600 relevés (Dengler unpubl., cf. excerpt in Dengler, 2003: 200). There is a significant frequency decrease in the Nordic and Baltic compared to the southern syntaxa for taxa such as *Asperula cynanchica*, *Brachypodium pinnatum* agg., *Carex humilis*, *Euphorbia cyparissias*, *Festuca rupicola*, *Koeleria macrantha*, *Medicago sativa* subsp. *falcata*, *Potentilla cinerea*, *Salvia pratensis*, and *Sanguisorba minor*. By contrast, for example, *Avenula pratensis*, *Campanula rotundifolia*, *Carex caryophyllea*, *Festuca ovina*, *F. rubra* agg., *Galium album*, *G. boreale*, *Homalothecium lutescens*, *Hypnum cupressiforme*, and *Thymus serpyllum* show a comparably increased frequency in the study area. Note that in both cases only the most frequent taxa with a more than twofold change in presence degree are listed.

Species-area relation (SAR)

For the number of vascular plants in the *Festuco-Brometea* stands, we analysed the SAR (Fig. 7). The relationship between species richness and plot size within the range from 1 m^2 to 100 m^2 is best described by a power law, i.e. a straight line in the log-log space with an increment (z value) of 0.09. The regression is highly sig-

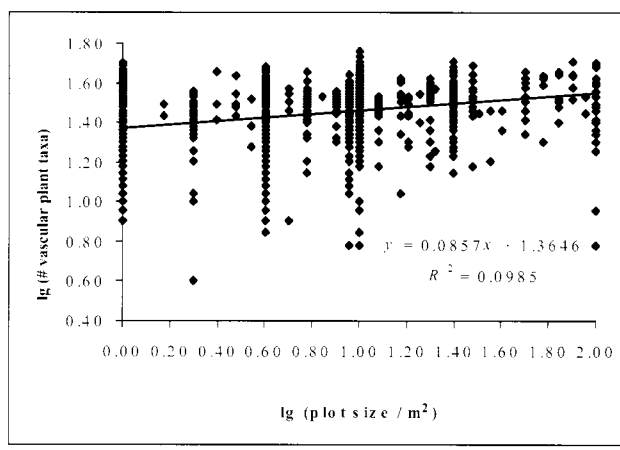

FIGURE 7 - Species-area relation for vascular plants in the *Festuco-Brometea* relevés included in the databank (n = 2,063). The parameters of the power regression function are listed in the inset. Note that the symbols near the regression line often represent many individual relevés.

nificant ($p < 0.001$) though differences in plot size explain only 10% of the variance in species richness. According to the regression function, there are on average 23.2 vascular plant taxa on 1 m^2, 28.2 on 10 m^2, and 34.4 on 100 m^2.

The determined z value is considerably lower than the values typically yielded by nested-plot studies in *Brachypodietalia pinnati* communities. Dengler (2005) gives 0.216 for the *Veronico spicatae-Avenetum* on Öland (Sweden; 0.01-9 m^2) and 0.206 for a *Cirsio-Brachypodion pinnati* community in Bavaria (S Germany; 0.01-100 m^2), and Boch (unpubl.) found a value of approximately 0.2 for the *Brachypodietalia pinnati* community on Saaremaa (Estonia). In all cases, the z values were nearly scale-invariant despite the large range of analysed plot sizes. Thus, the increase of species richness as recorded in the plots of the databank is much lower than it should be expected. Certainly, this result could be caused by systematic differences in geographic position and/or ecological site conditions between large and small plots. However, most of the 1 m^2 plots originate from Estonia and nearly half of the 100 m^2 plots stems from Latvia and Lithuania, which are geographically close in relation to the dimension of the whole study area. Thus, such effects can probably only partly account for the low z value. We can rather assume that the larger the plot sizes, the more incomplete the species lists are on average. Chytrý (2001) found similar effects in the Czech vegetation databank where in some syntaxa the documented average species richness even decreased above a certain plot size.

Festuco-Brometea – conclusions

For the study area, we found a great diversity of largely incompatible, local, regional, and national classification schemes for basiphilous semi-dry grasslands on all syntaxonomic levels. Many associations and a number of alliances of such vegetation types have been published from the Nordic and Baltic region. Nevertheless, up to now, many authors rather tend to use names that are informal, invalid or that have been described from regions far away, or to describe new syntaxa rather than to subordinate their relevés to a syntaxon described from an adjacent country. This finding clearly shows the necessity of a broadly based supra-national classification for the study area.

The *Brachypodietalia pinnati* communities of the Nordic and Baltic region are very clearly floristically distinguished from their southern counterparts. This corresponds to the situation in the *Alysso-Sedetalia* (*Sedo-Scleranthenea*) shown by Dengler & Löbel (2006) and discussed for other syntaxa by Dengler *et al.* (2006). Even these first results indicate that a separate alliance for *Brachypodietalia pinnati* communities in the study area most probably will be justified. However, many additional analyses are to be done to determine its precise delimitation against the southern alliances and its subdivision into associations.

We also cannot presently decide whether the small-scale species richness is increased in the Nordic and Baltic *Brachypodietalia pinnati* stands compared to their southern counterparts in a similar way as in the *Alysso-Sedetalia*. From the first comparisons (see above), it is, however, obvious that not only mesophilous, generalist taxa become more abundant in the basiphilous semi-dry grasslands of the region, as one might assume, but also some 'typical' dry grassland species such as *Avenula pratensis*, *Carex caryophyllea*, and *Thymus serpyllum*.

OUTLOOK

Our databank will continuously be completed. In doing so, we closely cooperate with the German Dry Grassland Databank (cf. Dengler & Jandt, 2005) and SynBioSys Europe (cf. Schaminée & Hennekens, 2001).

We will start with definitive analyses in the near future, beginning with the *Festuco-Brometea* and including syntaxonomy, methodology (e.g., effects of plot size and cryptogam treatment on results; different classification approaches), and biodiversity patterns. Beforehand, the automatic subdivision of the relevés into classes needs to be optimised, for example, by alterations of the diagnostic species lists and by accepting certain taxa to be diagnostic for more than one class. In the analyses, amongst others, solutions have to be developed for the strong geographic nestedness of plots and the fact that geobotanists from different countries preferred different plot sizes.

Anyone having community compositional data from dry grassland and related forest-edge communities within the Nordic and Baltic region is invited to contribute them and to join our working group.

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TABLE 1 - List of the evaluated syntaxonomic treatments and some important other classifications of *Festuco-Brometea* communities in the study area, arranged by countries and within these alphabetically. In the last column, we indicate whether original tables (OT) or synoptic tables (ST) are included.

No.	Reference	Geographic range	Geographic coverage	Syntaxonomic coverage	Type of study	Tab.
1	Willems (1982)	international	W Europe	*Meso-Bromion*	syntaxonomic overview	ST
2	Royer (1991)	international	Eurasia	*Festuco-Brometea*	syntaxonomic overview	ST
3	Dierßen (1996)	international	DK, FI, NO, SE	all syntaxa	syntaxonomic overview	ST
4	Påhlsson(1999)	international	DK, FI, NO, SE	synanthropic vegetation	informal classification	–
5	Dengler *et al.* (2003)	international	Europe	selective	nomenclatural revision	–
DE1	Krausch (1961)	regional	DE: Brandenburg	*Festuco-Brometea*	original study	OT
DE2	Passarge (1964)	regional	DE: Brandenburg and Mecklenburg-Vorpommern	all syntaxa	syntaxonomic overview	ST
DE3	Dierßen *et al.* (1988)	regional	DE: Schleswig-Holstein	all syntaxa	syntaxonomic overview	ST
DE4	Dengler (1994)	local	DE: Brandenburg: biosphere reserve 'Schorfheide-Chorin'	xerothermic vegetation	original study	OT, ST
DE5	Fartmann (1997)	local	DE: Brandenburg: Sächsische Schweiz	grassland vegetation	original study	OT
DE6	Berg *et al.* (2001 (2004)	regional	DE: Mecklenburg-Vorpommern	all syntaxa	syntaxonomic overview	ST
DE7	Schwarz (2001)	local	DE: Mecklenburg-Vorpommern: Randow valley	xerothermic vegetation	original study	–
DE8	Passarge (2002)	regional	DE: Brandenburg and Mecklenburg-Vorpommern	all syntaxa	syntaxonomic overview	ST
DK1	Willems *et al.* (1981)	national	DK	*Festuco-Brometea*	original study	OT
DK2	Bruun & Ejrnæs (2000)	national	DK	dry grasslands	numerical classification	ST
DK3	Lawesson (2004)	national	DK	all syntaxa	checklist	–
NO1	Tüxen (1967)	regional	NO: Rogaland and Vest-Agder	dune vegetation	original study	OT
NO2	Marker (1969)	local	NO: Telemark: Langöya	all syntaxa	original study	OT, ST
NO3	Fremstad & Elven (1983)	national	NO	all syntaxa	informal classification	–
NO4	Lundberg (1987)	local	NO: Rogaland: Karmoy	dune vegetation	original study	OT
SE1	Albertson (1946)	local	SE: Västergötland: Kinnekulle	alvar vegetation	original study	OT
SE2	Albertson (1950)	local	SE: Öland: Great Alvar	alvar vegetation	original study	OT
SE3	Braun-Blanquet (1963)	regional	SE: Öland	selective	original study	OT
SE4	Hallberg (1971)	regional	SE: Bohuslän	vegetation on shell deposits	original study	OT
SE5	Krahulec *et al.* (1986)	local	SE: Öland: Great Alvar	alvar vegetation	original study	OT

No.	Reference	Geographic range	Geographic coverage	Syntaxonomic coverage	Type of study	Tab.
SE6	Löbel (2002)	regional	SE: Öland	dry grasslands	original study	OT, ST
PL1	Libbert (1933)	regional	PL: 'Neumark'	all syntaxa	original study	OT
PL2	Matuszkiewicz (1981)	national	PL	all syntaxa	checklist	–
LT1	Strazdaitė *et al.* (1974)	local	LT: Virvytė valley	flood plain vegetation	original study	OT
LT2	Rašomavičius (1998)	national	LT	grassland vegetation	syntaxonomic overview	ST, OT
LT3	Balevičienė *et al.* (2000)	national	LT	endangered syntaxa	red list	OT
LV1	Jermacāne & Laiviņš (2001)	national	LV	all syntaxa	checklist	–
LV2	Rūsiņa (2003)	regional	LV: western and central parts	selective	original study	OT
LV3	Rūsiņa (2005)	national	LV	grassland vegetation	syntaxonomic overview (class level)	ST
EE1	Laasimer (1965)	national	EE	all syntaxa	syntaxonomic overview	–
EE2	Zobel (1987)	national	EE	alvar vegetation	syntaxonomic overview	OT
EE3	Paal (1998)	national	EE	endangered syntaxa	red list	–
EE4	Pärtel *et al.* (1999)	national	EE	alvar vegetation	numerical classification	ST
EE5	Boch & Dengler (2006)	regional	EE: Saaremaa	dry grasslands	original study	ST
RU1	Znamenskiy *et al.* (2006)	local	RU: Leningrad: Izhora plateau	alvar vegetation	numerical classification	ST

TABLE 2 - Overview of the alliance names that are used for basiphilous semi-dry grasslands of the study area, and their nomenclatural assessment (no entry in this column means that a name is legitimate and valid). When different author citations are in use, only the correct one is given. All names are orthographically corrected according to the ICPN. Epithets that are not used in the original diagnosis but whose addition is permitted according to Recommendation 10C ICPN are included in square brackets. Names that are invalid, illegitimate, dubious or ambiguous are marked in the second column. In the column "Origin", the geographic range of the syntaxon as it is given in the respective original diagnosis is listed by use of the ISO country codes (states or provinces may be added in brackets). Uncertain occurrences are indicated with "?". The origin of the type element is set in bold face.

Syntaxon	Nomenclatural assessment	Nomenclatural type	Type selection	Origin	Remark
Agrostio [vinealis]-Avenulion schellhanae Royer 1991		*Agrostio-Avenuletum schellhanae* Royer 1991	holotype	RU (**southern part**), LT, UA	
Anthyllido [vulnerariae]-Artemision campestris Sunding *ex* Marker 1969	*nom. inval.* [Art. 3b]			NO, DK?, SE?	partly belonging to the *Sedo-Scleranthenea*
Bromion erecti W. Koch 1926		*Meso-Brometum erecti* W. Koch 1926	holotype	**CH**	
Cirsio-Brachypodion pinnati Hadač & Klika *in* Klika & Hadač 1944		*Seslerio calcariae-Cirsietum pannonici* Klika 1933	lectotype, selected by Hadač (in Toman, 1981: 569)	**CZ**	
Filipendulo vulgaris-Helictotrichion pratensis Dengler & Löbel *in* Dengler *et al.* 2003		*Fragario-Helictotrichetum* Hallberg 1971	holotype	SE (**Bohuslän**), DE, DK, PL?, LT?, LV?, EE?, RU?	
Gentianello amarellae-Avenulion pratensis Royer 1991	*nom. inval.* [Art. 3b]			DK, FR (north coast)?, GB, IE, SE (only Bohuslän and Skane)	
Helianthemo [oelandici]-Globularion [vulgaris] Br.-Bl. 1963	*nom. dub.* [Art. 38] (cf. Dengler *et al.*, 2003)	*Phleo phleoidis-Veronicetum spicatae* Br.-Bl. 1963 nom. dub. (see **Table 4**)	holotype	SE (only **Öland** and Gotland)	partly belonging to the *Sedo-Scleranthenea*
Meso-Bromion [erecti] Oberd. 1949		*Aveno pratensis-Viscarietum vulgaris* Oberd. 1949	holotype	DE (**Baden-Württemberg**, Bavaria)	

TABLE 3 - Use of different alliance names in syntaxonomic treatments of the study area since 1960. The sources are numbered according to Table 1. Uncertain occurrences are indicated with "?".

Syntaxon	DE (Northeast)	DK	NO	SE (mainland)	SE (Öland, Gotland)	FI	PL (North)	LT	LV	EE	RU (Northwest)
Agrostio-Avenulion schellianae								2			
Anthyllido-Artemision campestris		NO2?	NO2	NO2?							
Bromion erecti	DE2, DE4, DE8	3, DK3	3?	3, SE3	3	3?		LT3	LV1		
Cirsio-Brachypodion pinnati	2, DE1, DE2, DE5, DE6, DE7, DE8						2, DE6, PL2			EE5?	
Filipendulo vulgaris-Helictotrichion pratensis	5, DE6	5, DE6	DE6	5, DE6	5, DE6	DE6	5?, DE6	5?, DE6	5?, DE6	5?, DE6, EE5?	5?, DE6
Gentianello amarellae-Avenulion pratensis		2		2	SE6						
Helianthemo-Globularion				2	2, SE3	2				2	
Meso-Bromion	DE2, DE3, DE5	1, DK1		1, SE4				LT2			

TABLE 4 - Overview of the association names that are in use for basiphilous semi-dry grasslands of the study area, and their nomenclatural assessment (no entry in this column means that a name is legitimate and valid). When different author citations are in use, only the correct one is given. All names are orthographically corrected according to the ICPN. Epithets that are not used in the original diagnosis but whose addition is permitted according to Recommendation 10C ICPN are included in square brackets. Names that are invalid, illegitimate, dubious or ambiguous are marked in the second column. In the column "Origin", the geographic range of the syntaxon as given in the respective original diagnosis is listed by use of the ISO country codes (states/provinces may be added in brackets). Uncertain occurrences are indicated with "?". The origin of the type element is set in bold face. In the column 'Also indicated from' are those regions within the study area listed from which the associations have been recorded by later works. The relevant sources are abbreviated as in Table 1.

Syntaxon	Nomenclatural assessment	Nomenclatural type	Type selection	Origin	Also indicated from	Remark
Adonido [vernalis]-Brachypodietum pinnati (Libbert 1933) Krausch 1961		Libbert, 1933: tab. 20: rel. 6)	holotype (Art. 27a)	DE (Brandenburg): PL (**'Neumark'**)	DE (Mecklenburg-Vorpommern: DE6, DE7); PL (lowlands general: PL2)	basionym: *Stipo capillatae-Potentilletum arenariae brachypodietosum pinnati* Libbert 1933 (see below)
Agrostietum vinealis Shelyag-Sosonko *et al.* 1986	not checked (source not available)	?	?	**UA**	LT (LT2, LT3)	
Alchemillo [glaucescentis]-Anthyllidetum [vulnerariae] Hallberg & Ivarsson *ex* Dierßen 1996	*nom. invalid.* [Art. 5, 7] *et illeg.* [Art. 29c]			SE (Bohuslän, Skåne)		
Alchemillo [glaucescentis]-Festucetum Hallberg 1971		?	lectotype to be selected	SE (**Bohuslän**)		
Anthyllido [vulnerariae]-Trifolietum montani Kaziene *in* Rašomavičius 1998	*nom. invalid.* [Art. 5, 7]			LT		
Arabido hirsutae-Brometum erecti Passarge 2002	*nom. invalid.* [Art. 5, 7]			DE (Berlin, Brandenburg)		
Avenetum alvarense Albertson 1950 (= *Avena pratensis-Festuca coerulea-Camptothecnum lidoscens-*Ass. Albertson 1950)	*nom. illeg.* [Art. 34a or 34c]; *nom. amb. propos.*	?	lectotype to be selected	SE (**Öland**)	EE (EE4)	
Avenetum pratensis Albertson 1946	*nom. amb. propos.*	?	lectotype to be selected	SE (**Västergötland**)		
Avena pratensis-Cetrarietum islandicae Du Rietz 1925	*nom. inval.* [Art. 3d (Principle 2, Sect. 2)]			SE (Gotland)		
Avena pratensis-Viscarietum vulgaris Oberd. 1949	*nom. amb. propos.* (cf. Dengler *et al.*, 2003: 608)	Oberdorfer, 1949: tab. 6, rel. 3)	*lectotypus hoc loco*	DE (**Baden-Württemberg**, Bavaria)	DE (Schleswig-Holstein: DE3)	the selection of rel. 2 as lectotype by Dengler *et al.* (2003: 608) does not conform to Art. 16 ICPN (*Lychnis viscaria* is missing in the releve) and thus is replaced here by the only possible other choice
Avena pubescentis-Medicaginetum falcatae de Leeuw in Br.-Bl. & Moor 1938		?	neotype to be selected	**NL**	LT (LT2), LV (LV1)	partly belonging to the *Koelerio-Corynephorenea*
Campanulo vibriciae-Brometum erecti Passarge 1979		Passarge, 1979: tab. 8, rel. 6)	holotype	DE (**Brandenburg**)		
Carici flaccae-Brizenum mediae Strazdaite *et al.* 1974		?	lectotype to be selected	**LT**		
Carici montanae-Seslerietum [caerulae] Paal 1998	*nom. invalid.* [Art. 7]	-		EE		
Carlino [vulgaris]-Poetum compressae Sunding 1965	*nom. invalid.* [Art. 1]			NO		
Cirsio [acaulis]-Trifolietum montani Wollert 1964		Wollert, 1964: tab. 8, rel. 19 = serial no. 16)	lectotype selected by Dengler *et al.* (2003: 608)	DE (**Mecklenburg-Vorpommern**)		
Filipendula hexapetala-Sesleria coerulea-Carex montana assotsiatsioon Laasimer 1965	*nom. invalid.* [Art. 7] *et illeg.* [Art. 34c]	-		EE		
Filipendula hexapetalae-Trifolietum montani Laasimer 1965	*nom. invalid.* [Art. 7]			EE		

Syntaxon	Nomenclatural assessment	Nomenclatural type	Type selection	Origin	Also indicated from	Remark
Fragario [viridis]-Helictotrichetum [pratensis] Hallberg 1971		?	lectotype to be selected	SE (**Bohuslän**)		
Gentiano-Koelerietum [pyramidatae] R. Knapp ex Bornkamm 1960		?	lectotype to be selected	DE (**S Lower Saxony**)	DE (Schleswig-Holstein: DE3)	
Gentiano [baltica]-Pimpinelletum saxifragae Tx. & Westhoff *in* Tx. 1962		Trixen. 1962: p. 18)	holotype	NO (**Rogaland**)	NO (West-Agder: NO1)	originally placed in the *Koelerio-Corynephorenea*; partly also belonging to the *Trifolio-Geranietea*
Helictotricho pubescentis-[Filipendulietum vulgaris Balevičienė *in* Rašomavičius 1998		Rašomavičius, 1998: tab. 9, rel. 6)	holotype	**LT**		originally placed in the *Molinio-Arrhenatheretea*
Helictotrichetum pratensis Zobel 1987	*nom. invalid.* [Art. 14, Sect. 3] *et illeg.* [Art. 32b]			FI		
Helictotricho [pratensis]-Koelerietum pyramidatae Dengler ex Schwarz 2001		Schwarz (2001): p. 31)	holotype	DE (Brandenburg, **Mecklenburg-Vorpommern**)		
Lino [cathartici]-Polygonatietum odorati Sunding 1965	*nom. invalid.* [Art. 1]			NO		mostly belonging to the *Trifolio-Geranietea*
Melampyro nemorosi-Scorzonerietum humilis Laasimer 1965	*nom. invalid.* [Art. 7]			EE		partly belonging to the *Trifolio-Geranietea* and the *Parvo-Caricetea*
Meso-Brometum erecti Br.-Bl. & Scherrer *in* W. Koch 1926	*nom. ambig. propos.*	Koch, 1926: p. 121)	*lectotypis hoc loco*	**CH**	LT (LT2)	the named relevé is the only one that could be selected as lectotype according to Art. 19a ICPN
Onobrychido viciifoliae-Brometum [erecti] T. Müller 1966		?	lectotype to be selected	DE (**Baden-Württemberg**)	DE (Brandenburg: DE5); LT (LT3)	
Phleo phleoidis-Helictotrichetum pubescentis Strajdattė *et al.* 1974	*nom. invalid.* [Art. 7]			LT		
Phleo phleoidis-Veronicetum spicatae Br.-Bl. 1963	*nom. dub.* [Art. 37] (cf. Dengler *et al.*, 2003)	?	lectotype to be selected	SE (Öland)		partly belonging to the *Sedo-Scleranthenea*
Poo alpinae-Anthyllidetum vulnerariae Marker 1969		Marker, 1969: tab. 4, rel. 36)	lectotype selected by Dengler *et al.* (2006a)	NO (**Telemark**)		partly belonging to the *Sedo-Scleranthenea* (including the type) and the *Trifolio-Geranietea*
Poetum compressae Kiziené *in* Rašomavičius 1998		Rašomavičius, 1998: tab. 14, rel. 6)	holotype	**LT**		
Prunello grandiflorae-Avenochloetum pratensis Passarge 1979		Passarge, 1979: tab. 9, rel. 6)	holotype	DE (**Brandenburg**)		
Pulsatillo [pratensis]-Phleetum phleoidis Passarge 1959		Passarge, 1959: tab. 16, rel. 5)	lectotype selected by Passarge (2002: 52)	DE (**Mecklenburg-Vorpommern**)	DE (Brandenburg: DE2, DE8); LT (LT2)	mostly belonging to the *Koelerio-Corynephorenea* (including the type)
Solidagini [virgaureae]-Helictotrichetum pratensis Willems *et al.* 1981		Willems *et al.*, 1981: tab. 1, rel. 7)	holotype	DK (**Nordjylland**, Mon)	DE (Berlin, Brandenburg, NE Lower Saxony and Mecklenburg-Vorpommern: DE6); PL? (DE6)	
Stipo capillatae-Potentilletum arenariae brachypodietosum pinnati Libbert 1933		Libbert, 1933: tab. 20, rel. 6)	lectotype selected by Dengler, 1994: 263)	PL (**'Neumark'**)		the *Stipo capillatae-Potentilletum arenariae typicum* belongs to the *Festucion valesiacae*
Trifolio montani-Brizetum [mediae] Botch *et al.* 1992	not checked (source not available)	?	?	RU (NW)		
Veronico spicatae-Avenetum [pratensis] Krahulec *et al.* 1986	*nom. invalid.* [Art. 3b]			SE (**Öland**)	SE (Gotland and Västergötland: 3)	

TABLE 5 - The most frequent taxa occurring in more than one third of the relevés of the Nordic and Baltic *Brachypodietalia pinnati* communities (n = 2,063) and their presence degrees (not corrected for different plot sizes). The values of non-vascular plants are calculated for the subset of relevés in which these groups have been considered (n = 1,097).

Achillea millefolium agg.	72%	*Anthyllis vulneraria*	44%
Festuc ovina agg.	67%	*Lotus corniculatus*	43%
Galium verum agg.	64%	*Poa pratensis* agg.	43%
Avenula pratensis subsp. *pratensis*	57%	*Medicago lupulina*	42%
Briza media subsp. *media*	56%	*Hypnum cupressiforme*	40%
Pimpinella saxifraga	54%	*Festuca rubra* agg.	40%
Plantago lanceolata	53%	*Carex caryophyllea*	39%
Hieracium pilosella agg.	51%	*Thymus serpyllum* subsp. *serpyllum*	37%
Homalothecium lutescens	49%	*Centaurea jacea* agg.	35%
Filipendula vulgaris	45%	*Dactylis glomerata* subsp. *glomerata*	34%
Linum catharticum	45%		