

**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-Brachypodium 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. 'kalkkrik tØrreng', '*Corynephorus canescens-Koeleria glauca* variant') than by scientific names (Nordiska Ministerådet, 1984; Fremstad & Elven, 1987; Pålsson, 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*: *Alyso-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, Pätzolt, 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<sup>2</sup>, 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-Corynepheretea*** Klika in Klika & V. Novák 1941 – dry grassland communities of sandy and of shallow, skeletal soils (with the two subclasses *Koelerio-Corynepherenea* [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. Raunkjær, 1918)
- Plot size indicated and between 1 m<sup>2</sup> and 100 m<sup>2</sup>
- 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<sup>2</sup> or 16 m<sup>2</sup>) and Dengler (2003: 5 m<sup>2</sup> or 10 m<sup>2</sup>) lie at an intermediate position in this range. Plots larger than 100 m<sup>2</sup> have only very seldom been used for dry grassland relevés in the study area, but their size ranges up to 2,500 m<sup>2</sup> (Celiński, 1953). By contrast, hundreds of relevés from plots smaller than 1 m<sup>2</sup>, particularly such of 0.25 m<sup>2</sup> 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<sup>2</sup>]
- 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).

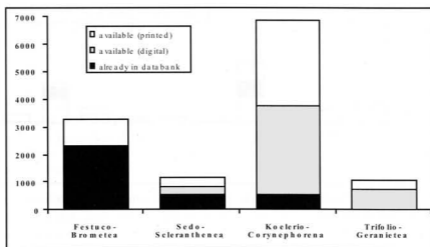


FIGURE 2 - Number of located suitable relevés per major syntaxon and differentiated according to their present status in relation to the databank. The assignment follows the classification in the source or, if none such is available, is based on a rough estimation.

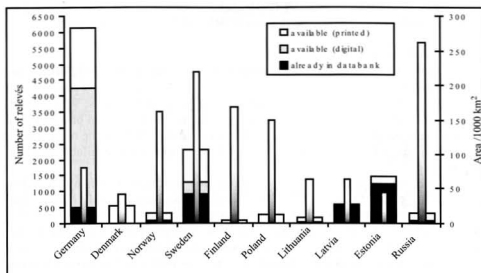


FIGURE 3 - Number of located suitable relevés per country and differentiated according to their present status in relation to the databank (wide columns). These values are related to the relative area of the countries or their relevant parts (narrow columns). For Norway, Sweden, Finland, and Russia,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

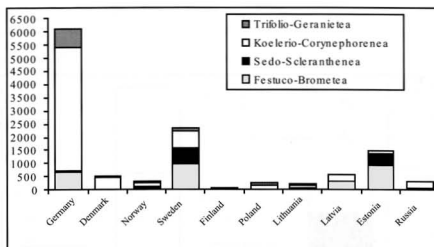


FIGURE 4 - Number of located suitable relevés per country and differentiated according to the major syntaxa (*a priori* assignment).

#### 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<sup>2</sup>, 4 m<sup>2</sup>, 9-10 m<sup>2</sup>, and 25 m<sup>2</sup> (Fig. 5).



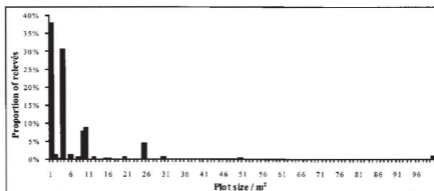


FIGURE 5 - Frequency of different plot sizes used for the relevés already included in the databank ( $n = 3,547$ ).

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 taxonomic 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-Coryneporetea* (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 20<sup>th</sup> 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 amarella-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-Phlegetum 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 syn-taxonomic 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 *Veronica 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 (Bruehlheide, 1997, 2000) would have been another possibility. However, the species group method requires equal plot sizes (Jandt & Bruehlheide (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-Coryneporenea*, *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-Arrhenatheretea* 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*, *Avena pratensis*, *Brachypodium pinnatum*, *Briza media*, *Bromus erectus*, *Campanula glomerata*, *C. sibirica*, *Campyllum chrysophyllum*, *Carex caryophylla*, *C. humilis*, *C. supina*, *Carlina vulgaris*, *Centaurea rhenana*, *C. scabiosa*, *Cirsium acule*, *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 vicifolia*, *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;  $r \rightarrow 1, + \rightarrow 2 \dots 5 \rightarrow 9$ ) 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).

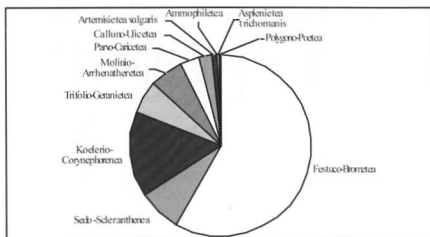


FIGURE 6 - Numerical assignment of the relevés already included in the databank to (sub-) classes ( $n = 3,547$ ). For the method used, see text.

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 led 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 caryophylla*, *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<sup>2</sup> to 100 m<sup>2</sup> 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-

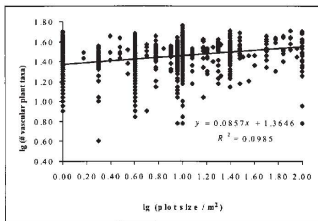


FIGURE 7 - Species-area relation for vascular plants in the *Festuco-Brometea* relevés included in the databank ( $n = 2,063$ ). The parameters of the power regression function are listed in the inset. Note that the symbols near the regression line often represent many individual relevés.

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<sup>2</sup>, 28.2 on 10 m<sup>2</sup>, and 34.4 on 100 m<sup>2</sup>.

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<sup>2</sup>) and 0.206 for a *Cirsio-Brachypodium pinnati* community in Bavaria (S Germany; 0.01-100 m<sup>2</sup>), 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<sup>2</sup> plots originate from Estonia and nearly half of the 100 m<sup>2</sup> 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 caryophylla*, 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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## REFERENCES

- ACKERMANN W. AND DURKA W., 1998 - SORT 4.0 – Programm zur Bearbeitung von Vegetationsaufnahmen und Artenlisten – Handbuch. Manuscript, München.
- ALBERTSON N., 1946 - Österplana hed – ett alvarområde på Kinnekulle [in Swedish, with German summary]. Svenska Växtgeografiska Sällskapet, Uppasala
- ALBERTSON N., 1950 - *Der grosse südliche Alvar der Insel Öland – Eine pflanzensoziologische Übersicht*. *Sven. Bot. Tidskr.* **44**: 270-331, 4 plates.
- ALEKSANDROVA V. D., 1973 - *Russian approaches to classification of vegetation*. In: WHITTAKER R. H. (ed.), *Ordination and classification of communities*. Handbook of Vegetation Science **5**: 493-427. Junk, The Hague.
- BALEVIČIENĖ J., GUDŽINSKAS Z. AND SINKEVIČIENĖ Z., 2000 (eds.) - Red data book of Lithuania – Plant communities [in Lithuanian, with English summary]. Institute of Botany Publ., Vilnius.
- BERG C., DENGLER J. AND ABDANK A., 2001 (eds.) - Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Tabellenband. Weissdorn, Jena.
- BERG C., DENGLER J., ABDANK A. AND ISERMANN M., 2004 (eds.) - Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband. Weissdorn, Jena.
- BOCH S. AND DENGLER J., 2006 - *Floristische und ökologische Charakterisierung sowie Phytodiversität der Trockenrasen auf der Insel Saaremaa (Estland)*. *Arb. Inst. Landschaftsökol. Münster* **16** : 55-71.



- BORNKAMM R., 1960 - *Die Trespen-Halbrockenrasen im oberen Leinegebiet*. Mitt. Florist.-Soziol. Arbeitsgem. N. F. **8**: 181-208.
- BRAUN-BLANQUET J., 1950 - *Übersicht der Pflanzengesellschaften Rütiens (VI)*. Vegetatio **2**: 341-360.
- BRAUN-BLANQUET J., 1963 - *Das Helianthemo-Globularion, ein neuer Verband der baltischen Steppenvegetation*. Veröff. Geobot. Inst. Eidg. Tech. Hochsch. Stift. Rübel **37**: 27-38.
- BRAUN-BLANQUET J. and MOOR M., 1938 - *Verband des Bromion erecti*. In: COMITÉ INTERNATIONAL DU PRODROME PHYTOSOCIOLOGIQUE (ed.), *Prodromus der Pflanzengesellschaften* **5**: 1-64. S. I. G. M. A., Montpellier.
- BRAUN-BLANQUET J. and TÜXEN R., 1943 - *Übersicht der höheren Vegetationseinheiten Mitteleuropas (unter Ausschluss der Hochgebirge)*. Commun. Stn. Intern. Géobot. Méditerr. Alpine **84**: 1-11. Charité, Montpellier.
- BRUELHEIDE H., 1997 - *Using formal logic to classify vegetation*. Folia Geobot. Phytotaxon. **32**: 41-46.
- BRUELHEIDE H., 2000 - *A new measure of fidelity and its application to defining species groups*. J. Veg. Sci. **11**: 167-178.
- BRUN H. H. and EJRNÆS R., 2000 - *Classification of dry grassland vegetation in Denmark* - J. Veg. Sci. **11**: 585-596.
- CELIŃSKI F., 1953 - *Edaphische Faktoren und die xerotherme Vegetation des Grosspolnischen Nationalparks bei Poznan* [in Polish, with German summary]. Pr. Monogr. Przyn. Wielkop. Parku Nar. Poznaniem **2(8)**: 1-65 6 plates. Poznańskie Tow. Przyn. Nauk, Poznań.
- CHYTRÝ M., 2001 - *Phytosociological data give biased estimates of species richness*. J. Veg. Sci. **12**: 439-444.
- CHYTRÝ M., OTÝPKOVÁ Z., 2003 - *Plot sizes used for phytosociological sampling of European vegetation*. J. Veg. Sci. **14**: 563-570.
- CORLEY M. F. V. and CRUNDWELL A. C., 1991 - *Additions and amendments to the mosses of Europe and the Azores*. J. Bryol. **16**: 337-356.
- CORLEY M. F. V., CRUNDWELL A. C., DILL R., HILL M. O. and SMITH A. J. E., 1981 - *Mosses of Europe and the Azores - an annotated list of species, with synonyms from the recent literature*. J. Bryol. **11**: 609-689.
- DENGLER J., 1994 - *Flora und Vegetation von Trockenrasen und verwandten Gesellschaften im Biosphärenreservat Schorfheide-Chorin*. Gleditschia **22**: 179-321.
- DENGLER J., 2003 - *Entwicklung und Bewertung neuer Ansätze in der Pflanzensoziologie unter besonderer Berücksichtigung der Vegetationsklassifikation*. Arch. Naturwiss. Diss. **14**: 1-297. Galunder, Nümbrecht.
- DENGLER J., 2004 - *Klasse: Koelerio-Corynephoretea Klika in Klika & V. Novák 1941 - Sandtrockenrasen und Felsgrusfluren von der submeridionalen bis zur borealen Zone*. In: BERG C., DENGLER J., ABDANK A. and ISERMANN M. (eds.), *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung - Textband: 301-326*. Weissdorn, Jena.
- DENGLER J., 2005 - *Zwischen Estland und Portugal - Gemeinsamkeiten und Unterschiede der Phytodiversitätsmuster europäischer Trockenrasen*. - Tuexenia **25**: 387-405.
- DENGLER J. and JANDT U., 2005 - *Arbeitsgruppe „Trockenrasen“ gegründet - Bericht von der ersten Jahrestagung unter dem Motto „Trockenrasen als Biodiversitätshotspots“*. Tuexenia **25**: 375-378.
- DENGLER J. and KREBS J., 2003 - *Zwei neue Saumassoziationen der Klasse Trifolio-Geranietea sanguinei aus dem norddeutschen Tiefland*. Drosera **2003**: 11-32.
- DENGLER J. and LÖBEL S., 2006 - *The basiphilous dry grasslands of shallow, skeletal soils (Alyso-Sedetalia) on the island of Öland (Sweden), in the context of North and Central Europe*. Phytocoenologia **36**: 343-391.
- DENGLER J., BERG C., EISENBERG M., ISERMANN M., JANSEN F., KOSKA I., LÖBEL S., MANTHEY M.,

- PÄZOLT J., SPANGENBERG A., TIMMERMANN T. AND WOLLERT H., 2003 - *New descriptions and typifications of syntaxa within the project 'Plant communities of Mecklenburg-Vorpommern and their vulnerability'* - Part I. Feddes Repert. **114**: 587-631.
- DENGLER J., LÖBEL S. AND BOCH S., 2006 - *Dry grassland communities of shallow, skeletal soils (Sedo-Scleranthenea) in northern Europe*. Tuexenia **26**: 159-190+ 6 tables.
- DENGLER J., LÖBEL S. AND DOLNIK C., - *Constancy values depend on plot size - a problem for vegetation classification and how it can be solved*. J. Veg. Sci. *subm.*
- DIKMANN M., 1997 - *The Differentiation of Alliances in South Sweden*. Folia Geobot. Phytotaxon. **32**: 193-205.
- DIERBEN K., 1996 - *Vegetation Nordeuropas*. Ulmer, Stuttgart.
- DIERBEN K., GLAHN H. VON, HÄRDITL W., HÖPER H., MIERWALD U., SCHRAUTZER J. AND WOLF A., 1988 - *Rote Liste der Pflanzengesellschaften Schleswig-Holsteins - 2. Aufl.* Schriftenr. Landesamtes Naturschutz Landschaftspflege Schleswig-Holstein **6**: 1-157. Kiel.
- DU RIETZ G. E., 1925 - *Gotländische Vegetationsstudien*. Sven. Växetsociol. Sällsk. Handlingar **2**: 1-65. Uppsala.
- ELLENBERG H., 1996 - *Vegetation Mitteleuropas mit den Alpen in ökologischer, dynamischer und historischer Sicht*. 5th ed. Ulmer, Stuttgart.
- EUROPEAN COMMISSION, 2003 (ed.) - *Interpretation Manual of European Union Habitats - EUR25*. European Commission, Brussels.
- FARTMANN T., 1997 - *Die Vegetation der Trockenrasen und des Feuchtgrünlandes im Naturpark Märkische Schweiz (Ostbrandenburg)*. Verh. Bot. Ver. Berl. Brandenb. **130**: 43-78, 2 tables.
- FREMSTAD E. AND ELVEN R., 1987 (eds.) - *Units for vegetation mapping in Norway* [in Norwegian, with English summary]. Økoforsk Utredning **1987(1)**: 1-180. Univ. Trondheim, Trondheim.
- GROLLE R. AND LONG D. G., 2000 - *An annotated check-list of the Hepaticae and Anthocerotae of Europe and Macaronesia*. J. Bryol. **22**: 103-140.
- HALLBERG H. P., 1971 - *Vegetation auf den Schalenablagerungen in Bohuslän, Schweden*. Acta Phytogeogr. Suec. **56**: 1-136 + supplement. Svenska Växtgeografiska Sällskapet, Uppsala.
- HENNEKENS S. M. AND SCHAMINÉE J. H. J., 2001 - *TURBOVEG, a comprehensive data base management system for vegetation data*. J. Veg. Sci. **12**: 589-591.
- JANDT U. AND BRUELHEIDE H., 2002 - *Magerrasen auf Gips im West-Ost-Klimagefälle des Südhazeres (Exkursion C)*. Tuexenia **22**: 107-125.
- JECKEL G., 1984 - *Syntaxonomische Gliederung, Verbreitung und Lebensbedingungen nordwestdeutscher Sandtrockenrasen (Sedo-Scleranthetea)*. Phytocoenologia **12**: 9-153.
- JERMACANE S. AND LAIVIŅŠ M., 2001 - *List of syntaxa described in Latvia* [in Latvian, with English summary]. Latv. Veg. **4**: 115-132.
- KLEIVEN M., 1959 - *Studies on the Xerophile Vegetation in Northern Gudbrandsdalen, Norway*. Nytt. Mag. Bot. **7**: 1-60.
- KLIKA J., 1933 - *Studien über die xerotherme Vegetation Mitteleuropas. II. Xerotherme Gesellschaften in Böhmen*. Beih. Bot. Centralbl., 2. Abt., **50**: 707-773.
- KLIKA J. AND HADAČ E., 1944 - *Rostlinná společenstva střední Evropy. (Dokončení)* [in Czech]. Příroda **36**: 281-295.
- KÖCH W., 1926 - *Die Vegetationseinheiten der Linthebene unter Berücksichtigung der Verhältnisse in der Nordostschweiz*. Zollikofer, St. Gallen.
- KORNECK D., 1974 - *Xerothermvegetation von Rheinland-Pfalz und Nachbargebieten*. Schriftenr. Vegetationskd. **7**: 1-196, 158 tables. Bundesforschungsanstalt für Naturschutz und Landschaftsökologie, Bonn.
- KORNECK D., SCHNITTLER M., KLINGENSTEIN F., LUDWIG G., TAKLA M., BOHN U. AND MAY R., 1998 -

- Warum verarmt unsere Flora? – Auswertung der Roten Liste der Farn- und Blütenpflanzen Deutschlands. In: KLINGENSTEIN F. AND LUDWIG G. (eds), *Ursachen des Artenrückgangs von Wildpflanzen und Möglichkeiten zur Erhaltung der Artenvielfalt*. Schriften. Vegetationskd. 29: 299-444. Bundesamt für Naturschutz, Bonn.
- KRAHULEC F., ROSÉN E. AND MAAREL E. van der, 1986 - *Preliminary classification and ecology of dry grassland communities on Ölands Stora Alvar (Sweden)*. Nord. J. Bot. 6: 797-809.
- KRAUSCH H.-D., 1961 - *Die kontinentalen Steppenrasen (Festucetalia valesiaceae) in Brandenburg*. Feddes Repert. Beih. Specierum Nov. Regni Veg. 139: 167-227.
- KRAUSCH H.-D., 1968 - *Die Sandtrockenrasen (Sedo-Scleranthetea) in Brandenburg*. Mitt. Florist.-Soziol. Arbeitsgem. N. F. 13: 71-100.
- LAASIMER L., 1965 - *Vegetation of the Estonian S. S. R.* [in Estonian, with English summary]. Valgus, Tallin.
- LAWESSON J. E., 2004 - *A Tentative Annotated Checklist of Danish Syntaxa*. Folia Geobot. 39: 73-95.
- LIBBERT W., 1933 - *Die Vegetationseinheiten der neumärkischen Staubeckenlandschaft unter Berücksichtigung angrenzender Landschaften – 2. Teil*. Verh. Bot. Ver. Prov. Brandenb. 75: 230-348.
- LOBEL S., 2002 - *Trockenrasen auf Öland: Syntaxonomie – Ökologie – Biodiversität*. Diploma thesis, Inst. für Ökologie und Umweltchemie, Univ. Lüneburg.
- LOBEL S. and DENGLE J., subm. - *Floristic and ecological characterisation, diversity and distribution of dry grasslands on southern Öland*. Acta Phytogeogr. Suec.
- LUNDBERG A., 1987 - *Sand dune vegetation on Karmøy, SW Norway*. Nord. J. Bot. 7: 453-477.
- MAAREL E. VAN DER, 2005 - *Vegetation ecology – an overview*. In: MAAREL E. VAN DER (ed.), *Vegetation Ecology*: 1-51. Blackwell Publishing, Oxford.
- MARKER E., 1969 - *A Vegetation Study of Langöya, Southern Norway*. Nytt Mag. Bot. 16: 15-44, Oslo.
- MATUSZKIEWICZ W., 1980 - *Synopsis und geographische Analyse der Pflanzengesellschaften von Polen*. Mitt. Florist.-Soziol. Arbeitsgem. N. F. 22: 19-50.
- MATUSZKIEWICZ W., 1981 - *Przewodnik do oznaczania zbiorowisk roślinnych Polski* [in Polish]. Państwowe Wydawnictwo Naukowe, Warszawa.
- MORAVEC J., 1967 - *Zu den azidophilen Trockenrasengesellschaften Südwestböhmens und Bemerkungen zur Syntaxonomie der Klasse Sedo-Scleranthetea*. Folia Geobot. Phytotaxon. 2: 137-178.
- MÜLLER T., 1966 - *Die Wald-, Gebüsch-, Saum- und Halbtrockenrasengesellschaften des Spitzbergs*. In: LANDESSTELLE FÜR NATURSCHUTZ UND LANDSCHAFTSPFLEGE BADEN-WÜRTTEMBERG (ed.), *Der Spitzberg bei Tübingen*. Nat.-Landschaftsschutzgeb. Bad.-Württemb. 3: 278-475. Landesstelle für Naturschutz und Landschaftspflege Baden-Württemberg, Ludwigsburg.
- NORDISKA MINISTERRÅDET, 1984 (ed.) - *Vegetationstyper i Norden* [in Swedish]. Nordiska Ministerrådet, København.
- OTÝPKOVÁ Z. AND CHYTRÝ M., 2006 - *Effects of plot size on the ordination of vegetation samples*. J. Veg. Sci. 17: 465-472.
- OBERDORFER E., 1949 - *Die Pflanzengesellschaften der Wutachschlucht*. Beitr. Naturkd. Forsch. Südwestdschl. 8: 22-60, Karlsruhe.
- PAAL J., 1998 - *Rare and threatened plant communities of Estonia*. Biodiversity Conserv. 7: 1027-1049.
- PÄKTEL M., KALAMEFS R., ZOBEL M. AND ROSÉN E., 1999 - *Alvar grasslands in Estonia: variation in species composition and community structure*. J. Veg. Sci. 10: 561-568.
- PÄHLSSON L., 1999 (ed.) - *Markanvändningsformer och vegetationstyper i nordiska odlingslandskap* [in Swedish, with English summary]. TemaNord 555: 1-301. Nordisk Ministerråd, København.

- PASSARGE H., 1959 - *Pflanzengesellschaften zwischen Trebel, Grenz-Bach und Peene (O-Mecklenburg)*. In: ROTHMALER W. and SCAMONI A. (eds.) - *Beiträge zur Vegetationskunde – Band III*. Feddes Repert. Specierum Nov. Regni Veg. Beih. **138**: 1-56, plates 1-2.
- PASSARGE H., 1964 - *Pflanzengesellschaften des nordostdeutschen Flachlandes I*. Pflanzensozologie **13**: 1-324. Fischer, Jena.
- PASSARGE H., 1979 - *Die Xerothermrassen im Seelower Odergebiet*. Gleditschia **7**: 225-250.
- PASSARGE H., 2002 - *Pflanzengesellschaften Nordostdeutschlands 3 – III. Cespitosa und Herbosa*. Cramer, Berlin.
- POSCHLOD P. and WALLISDEVRIES M., 2002 - *The historical and socioeconomic perspective of calcareous grasslands – lessons from the distant and recent past*. Biol. Conserv. **104**: 361-376.
- POTT R., 1995 - *Die Pflanzengesellschaften Deutschlands*. 2nd ed. Ulmer, Stuttgart.
- RAŠOMAVIČIUS V., 1998 (ed.) - *Vegetation of Lithuania 1 – Meadows*: Cl. *Asteretea tripolii*, Cl. *Molinio-Arrhenatheretea*, Cl. *Festuco-Brometea*, Cl. *Trifolio-Geranietea*, Cl. *Nardetea* [in Lithuanian, with English summary]. Šviesa, Kaunas.
- RAUNKJÆR C., 1918 - *Recherches statistiques sur les formations végétales*. K. Dan. Vidensk. Selsk. Biol. Medd. **1(3)**: 1-80. Høst & Søn, København.
- RENNWALD E., 2002 [„2000“] (ed.) - *Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands – mit Datenservice auf CD-ROM*. Schriftenr. Vegetationskd. **35**: 1-800 + CD-ROM. Bundesamt für Naturschutz, Bonn.
- RODWELL J. S., SCHAMINÉE J. H. J., MUCINA L., PIGNATTI S., DRING J. and MOSS D., 2002 - *The Diversity of European Vegetation – An overview of phytosociological alliances and their relationships to EUNIS habitats*. Rapp. EC-LNV **2002/054**: 1-168. National Reference Centre for Agriculture, Nature and Fisheries, Wageningen.
- ROSEN E. and BORGEGÅRD S.-O., 1999 - *The open cultural landscape*. RYDIN H., SNOEDS P. and DIEKMANN M. (ed.) - *Swedish plant geography – Dedicated to Eddy van der Maarel on his 65<sup>th</sup> birthday*. Acta Phytogeogr. Suec. **84**: 113-134. Opulus, Uppsala.
- ROYER J.-M., 1991 - *Synthèse eurosibérienne, phytosociologique et phytogéographique de la classe des Festuco-Brometea*. Diss. Bot. **178**: 1-296, 8 tables. Cramer, Berlin.
- RŪSIŅA S., 2003 - *Dry calcareous grassland communities (Filipendula vulgaris-Helictotrichon pratense) in western and central Latvia*. Ann. Bot. (Roma) **N. S. 3**: 91-104.
- RŪSIŅA S., 2005 - *Diagnostic species of mesophylous and xerophylous grassland plant communities in Latvia*. Acta Univ. Latv., Earth Environ. Sci. **685**: 69-95.
- SANTESSON R., MOBERG R., NORDIN A., TÖNSBERG T. and VITIKAINEN O., 2004 - *Lichen-forming and lichenicolous fungi of Fennoscandia*. Museum of Evolution, Uppsala.
- SCHAMINÉE J. H. J. and HENNEKENS S. M., 2001 - *TURBOVEG, MEGATAB und SYNBIOSSYS: neue Entwicklungen in der Pflanzensozologie*. Ber. R.-Tüxen-Ges. **13**: 21-34.
- SCHUBERT R., HILBIG W. and KLOTZ S., 2001 - *Bestimmungsbuch der Pflanzengesellschaften Deutschlands*. Spektrum, Heidelberg.
- SCHWARZ J.-H., 2001 - *Die Trockenrasengesellschaften des mittleren Randowtales – Vorpommern*. MV-Verl., Greifswald.
- STRAZDAITĖ J., JANKEVIČIENĖ R. and LAZDAUSKAITĖ Z., 1974 - *Floristical and Geobotanical Characteristics of Flood-Plains of the Virvytė River (I. Geobotanical Review)* [in Russian, with English summary]. Lietuvos TSR Mokslų Akad. Darbai, C Ser. **68(4)**:3-14.
- SUNDING P., 1965 - *Trockenwiesen- und Waldsaum-Gesellschaften am inneren Oslofjord*. In: INTERNATIONALE PFLANZENSOZIOLOGISCHE VEREINIGUNG (ed.), Exkursionsführer für die Exkursion der „Internationale Pflanzensoziologische Vereinigung“ durch SO-Norwegen vom 5. bis 11. Juli 1965: 34-39 + table 3. Manuscript, Vollebakk.

- TICHÝ L., 2002 - JUICE, *software for vegetation classification*. J. Veg. Sci. **13**: 451-453.
- TOMAN M., 1981 - *Die Gesellschaften der Klasse Festuco-Brometea im westlichen Teil des böhmischen Xerothermgebietes* – 3. Teil. Feddes Repert. **92**: 569-601.
- TRASS H. and MALMER N., 1973 - *North European approaches to classification*. In: WHITTAKER R. H. (ed.), *Ordination and classification of communities*. Handbook of Vegetation Science **5**: 529-574. Junk, The Hague.
- TÜXEN R., 1962 - *Antennaria hibernica auch in Norwegen*. Mitt. Florist.-Soziol. Arbeitsgem. N. F. **9**: 18-19.
- TÜXEN R., 1967 - *Pflanzensoziologische Beobachtungen an südnorwegischen Küsten-Dünengebieten*. Aquilo, Ser. Bot. **6**: 241-272.
- TUTIN T. G., HEYWOOD V. H., BURGESS N. A., MOORE D. M., VALENTINE D. H., WALTERS S. M. and WEBB D. A., 1968 (eds.) - *Flora Europaea – Volume 2: Rosaceae to Umbelliferae*. Cambridge University Pr., Cambridge.
- TUTIN T. G., HEYWOOD V. H., BURGESS N. A., VALENTINE D. H., WALTERS S. M. and WEBB D. A., 1972 (eds.) - *Flora Europaea – Volume 3: Diapensiaceae to Myoporaceae*. Cambridge University Pr., Cambridge.
- TUTIN T. G., HEYWOOD V. H., BURGESS N. A., VALENTINE D. H., WALTERS S. M. and WEBB D. A., 1976 (eds.) - *Flora Europaea – Volume 4: Plantaginaceae to Compositae (and Rubiaceae)*. Cambridge University Pr., Cambridge.
- TUTIN T. G., HEYWOOD V. H., BURGESS N. A., VALENTINE D. H., WALTERS S. M. and WEBB D. A., 1980 (eds.) - *Flora Europaea – Volume 5: Alismataceae to Orchidaceae (Monocotyledones)*. Cambridge University Pr., Cambridge.
- TUTIN T. G., BURGESS N. A., CHATER A. O., EDMONDSON J. R., HEYWOOD V. H., MOORE D. M., VALENTINE D. H., WALTERS S. M. and WEBB D. A., 1993 (eds.) - *Flora Europaea – Volume 1: Psilotaceae to Platanaceae*. 2nd ed. Cambridge Univ. Pr., Cambridge.
- WEBER H. E., MORAVEC J. and THEURILLAT J.-P., 2000 - *International Code of Phytosociological Nomenclature*. 3<sup>rd</sup> edition. J. Veg. Sci. **11**: 739-768.
- WILLEMS J. H., 1982 - *Phytosociological and geographical survey of Mesobromion communities in Western Europe*. Vegetatio **48**: 227-240.
- WILLEMS J. H., DELFT J. M. E. VAN, RIJKE M. J. DE, 1981 - *Observations on North-West European limestone grassland communities – IV. Phytosociological notes on chalk grasslands in Denmark*. Folia Geobot. Phytotaxon. **16**: 391-406.
- WILMANN O., 1998 - *Ökologische Pflanzensoziologie*. 6th ed. UTB 269: 1-405. Quelle & Meyer, Wiesbaden.
- WOLLERT H., 1964 - *Die Grasheiden Mecklenburgs – II. Die Vegetationsverhältnisse auf dem Heidberg bei Terow*. Arch. Freunde Naturgesch. Mecklenb. **10**: 73-101, 3 tables.
- ZNAMENSKIY S., HELM A. and PÄRTEL M., 2006 - *Threatened alvar grasslands in NW Russia and their relationship to alvars in Estonia*. Biodiversity Conserv. **15**: 1797-1809.
- ZOBEL M., 1987 - *The Classification of Estonian Alvars and their Plant Communities*. LAASIMER L. and KULL, T. (eds.), *The Plant Cover of the Estonian SSR – Flora, Vegetation and Ecology*: 28-45. Valgus, Tallinn.

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 alphabeticaly. 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	<i>Meso-Bromion</i>	syntaxonomic overview	ST
2	Royer (1991)	international	Eurasia	<i>Festuco-Brometea</i>	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 selective	informal classification	-
5	Dengler <i>et al.</i> (2003)	international	Europe		nomenclatural revision	-
DE1	Krausch (1961)	regional	DE: Brandenburg	<i>Festuco-Brometea</i>	original study	OT
DE2	Passarge (1964)	regional	DE: Brandenburg and Mecklenburg-Vorpommern	all syntaxa	syntaxonomic overview	ST
DE3	Dierßen <i>et al.</i> (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 <i>et al.</i> (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 <i>et al.</i> (1981)	national	DK	<i>Festuco-Brometea</i>	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: Karmøy	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 <i>et al.</i> (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 <i>et al.</i> (1974)	local	LT: Virvytėvalley	flood plain vegetation	original study	OT
LT2	Rašomavičius (1998)	national	LT	grassland vegetation	taxonomy overview	ST, OT
LT3	Balevišienė <i>et al.</i> (2000)	national	LT	endangered syntaxa	red list	OT
LV1	Jermacīne & 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	taxonomy overview (class level)	ST
EE1	Laasimer (1965)	national	EE	all syntaxa	taxonomy overview	-
EE2	Zobel (1987)	national	EE	alvar vegetation	taxonomy overview	OT
EE3	Paal (1998)	national	EE	endangered syntaxa	red list	-
EE4	Pärtel <i>et al.</i> (1999)	national	EE	alvar vegetation	numerical classification	ST
EE5	Boch & Dengler (2006)	regional	EE: Saaremaa	dry grasslands	original study	ST
RU1	Znamenskiy <i>et al.</i> (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
<i>Agrostio</i> [vinealis]- <i>Avenulion</i> <i>schellhaniae</i> Royer 1991		<i>Agrostio-Avemuletum</i> <i>schellhaniae</i> Royer 1991	holotype	<b>RU</b> (southern part), LT, UA	
<i>Anthyllido</i> [vulnerariae]- <i>Artemision</i> <i>campestris</i> Sunding ex Marker 1969	nom. inval. [Art. 3b]	--	--	NO, DK?, SE?	partly belonging to the <i>Sedo-</i> <i>Scleranthenea</i>
<i>Bromion erecti</i> W. Koch 1926		<i>Meso-Brometum</i> <i>erecti</i> W. Koch 1926	holotype	<b>CH</b>	
<i>Cirsio-</i> <i>Brachypodium</i> <i>pinnati</i> Hadač & Klika in Klika & Hadač 1944		<i>Seslerio calcariae-</i> <i>Cirsietum pannonicum</i> Klika 1933	lectotype, selected by Hadač (in Toman, 1981: 569)	<b>CZ</b>	
<i>Filipendulo</i> <i>vulgaris-</i> <i>Helictotrichion</i> <i>pratensis</i> Dengler & Löbel in Dengler et al. 2003		<i>Fragario-</i> <i>Helictotrichetum</i> Hallberg 1971	holotype	<b>SE</b> ( <b>Bohuslän</b> ), DE, DK, PL?, LT?, LV?, EE?, RU?	
<i>Gentianello</i> <i>amarulliae-</i> <i>Avenulion</i> <i>pratensis</i> Royer 1991	nom. inval. [Art. 3b]	--	--	DK, FR (north coast)?, GB, IE, SE (only Bohuslän and Skåne)	
<i>Helianthemo</i> [oelandici]- <i>Globularion</i> [vulgaris] Br.-Bl. 1963	nom. dub. [Art. 38] (cf. Dengler et al., 2003)	<i>Phleo phleoidis-</i> <i>Veronicetum spicatae</i> Br.-Bl. 1963 nom. dub. (see Table 4)	holotype	<b>SE</b> (only <b>Öland</b> and Gotland)	partly belonging to the <i>Sedo-</i> <i>Scleranthenea</i>
<i>Meso-Bromion</i> [erecti] Oberd. 1949		<i>Aveno pratensis-</i> <i>Viscarietum vulgaris</i> Oberd. 1949	holotype	<b>DE</b> ( <b>Baden-</b> <b>Württemberg</b> , 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)
<i>Agrostio-Avenulion schellianae</i>								2			
<i>Anthyllido- Artemision campestris</i>		NO2?	NO2	NO2?							
<i>Bromion erecti</i>	DE2, DE4, DE8	3, DK3	3?	3, SE3	3	3?		LT3	LV1		
<i>Cirso- Brachypodion pinnati</i>	2, DE1, DE2, DE5, DE6, DE7, DE8						2, DE6, PL2			EE5?	
<i>Filipendulo vulgaris- Helictotrichion pratensis</i>	5, DE6	5, DE6	DE6	5, DE6	5, DE6	DE6	5?, DE6	5?, DE6	5?, DE6	5?, DE6, EE5?	5?, DE6
<i>Gentianello anarellae-Avemulion pratensis</i>		2		2	SE6						
<i>Helianthemo- Globularion</i>				2	2, SE3	2				2	
<i>Meso-Bromion</i>	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
<i>Alopecurus jernstedii</i> - <i>Brachypodium pinnatis</i> (Libbert 1933) Krausch 1961		Libbert, 1933: tab 20, rel. 6)	holotype (Art. 27a)	DE (Brandenburg), PL ("Neumark")	DE (Mecklenburg-Vorpommern, DfB, Df7), PL (lowlands grassl. PL2)	basinony: <i>Stipa capillata</i> - <i>Poastridium arvense</i> - <i>Brachypodium pinnatis</i> Libbert 1933 (see below)
<i>Ignotetum rivanisii</i> Hultög- Svanvik et al. 1986	not checked (source not available)	?	?	UA	LT (LT2, LT3)	
<i>Alchemilla glaucocoma</i> - <i>Anthyllidion foeniculorum</i> Hallberg & Jönsson ex Dierfeldt 1996	non. inval. [Art. 5, 7] et diag. [Art. 29c]	-	-	SE (Bohuslän, Skåne)	-	
<i>Alchemilla glaucocoma</i> - <i>Fenacotum Hallberg</i> 1971		?	lectotype to be selected	SE (Bohuslän)	-	
<i>Anthyllido foeniculorum</i> - <i>Trifolietum arvense</i> Kitzsch in Kalkemäcker 1996	non. inval. [Art. 5, 7]	-	-	LT	-	
<i>Arabis hirsuta</i> - <i>Brassecum arven</i> Passarg 2002	non. inval. [Art. 5, 7]	-	-	DE (Bavaria, Brandenburg)	-	
<i>Asterion alpinum</i> Albertson 1950 (= <i>Asterion pratense</i> - <i>Setaria coerulescens</i> - <i>Compositae lanuginosa</i> - <i>Aca. Albertson</i> 1950)	non. illeg. [Art. 34a or 34c], non. amb. propos.	?	lectotype to be selected	SE (Öland)	EE (EE4)	
<i>Asterion pratense</i> Albertson 1946	non. amb. propos.	?	lectotype to be selected	SE (Västergötland)	-	
<i>Avena pratensis</i> - <i>Cetrarietum islandiae</i> Du Roi 1925	non. inval. [Art. 3d (Principle 2, Sect. 2)]	-	-	SE (Gotland)	-	
<i>Avena pratensis</i> - <i>Vaccarietum vulgare</i> Oberd. 1949	non. amb. propos. (cf. Dengler et al., 2003: 608)	Oberdorfer, 1949: tab. 9, rel. 3)	<i>Axistopax noviflora</i>	DE (Baden-Württemberg, Bayern)	DE (Schleswig-Holstein, DL3)	the selection of rel. 2 as lectotype by Dengler et al. (2003: 608) does not conform to Art. 16 ICPN (i.e. <i>Avena pratensis</i> is missing in the rel.2) and thus is replaced here by the only possible other choice
<i>Avena pratensis</i> - <i>Melchiorietum filicoides</i> du Loup in de-Sil. & Moret 1938		?	neotype to be selected	NL	LT (LT2), LV (LV1)	partly belonging to the <i>Koeleria-Corynephorum</i>
<i>Campylopus alpinus</i> - <i>Stemon sylvaticus</i> Passarg 1979		Passarg, 1979 tab. 8, rel. 6)	holotype	DE (Brandenburg)	-	
<i>Carex flacca</i> - <i>Stemon sylvaticus</i> Strandberg et al. 1974		?	lectotype to be selected	LT	-	
<i>Carex montana</i> - <i>Saxifragetum montanum</i> Paul 1989	non. inval. [Art. 7]	-	-	EE	-	
<i>Carex vulpina</i> - <i>Prunella compressa</i> Sunding 1963	non. inval. [Art. 1]	-	-	NO	-	
<i>Cirsium juncidis</i> - <i>Trifolietum montanum</i> Wulker 1964		Wulker, 1964: tab. R, rel. 19 - serial no. 16)	lectotype selected by Dengler et al. (2003: 608)	DE (Mecklenburg-Vorpommern)	-	
<i>Polygonella hexapetala</i> - <i>Setaria arvense</i> - <i>Carex montana</i> Laxmayer 1965	non. inval. [Art. 7] et diag. [Art. 34c]	-	-	EE	-	
<i>Polygonella hexapetala</i> - <i>Trifolietum montanum</i> Laxmayer 1965	non. inval. [Art. 7]	-	-	EE	-	

Synonym	Nomenclatural assessment	Nomenclatural type	Type situation	Origin	Also indicated from	Remark
<i>Pagania [varia] (Helictotrichum) (graminis)</i> [Lindberg 1971]	?		lectotype to be selected	SE (Bolskulin)		
<i>Gastonia-Koeleriana (graminis)</i> [R. Knapp et Beckmann 1960]	?		lectotype to be selected	DE (N Lower Saxony)	DE (Schleswig-Holstein: DE1)	
<i>Gastonia (Andros)</i> , <i>Pinguiculae variegata</i> Tx. & Wachtoff in Tx. 1962	Tuxen, 1962: p. 18		holotype	NO (Rogaland)	NO (Vest-Agder: NO1)	originally placed in the <i>Koeleria-Corynephorus</i> ; partly also belonging to the <i>Trifolium-Geranietum</i>
<i>Helictotricha pubercentis-Pilgerodolium vulgare</i> Bolevinská in Ralstonová 1998	Ralstonová, 1998: tab. 9, rel. 6		holotype	LT		originally placed in the <i>Malva-Arachnoidetum</i>
<i>Helictotrichum pratense</i> Zobel 1987	nom. nov. [Art. 14 Sect. 3] et alig. [Art. 32b]	–	–	EE		
<i>Helictotricha (pratense)-Koelerietum pyramidalis</i> Dengler et Schwarz 2001	Schwarz (2001: p. 31)		holotype	DE (Brandenburg, Mecklenburg-Vorpommern)		
<i>Lera (varietaria)-Corynephorietum adnatum</i> Staudig 1965	nom. nov. [Art. 1]	–	–	NO		mostly belonging to the <i>Trifolium-Geranietum</i>
<i>Molygopus nemorosus-Saxatocnemum insulare</i> Lauterer 1965	nom. nov. [Art. 7]	–	–	EE		partly belonging to the <i>Trifolium-Geranietum</i> and the <i>Parus-Caricetum</i>
<i>Musa-Stomatum etaei</i> He-Bl & Scherrer in W. Koch 1926	nom. nov. prop. Koch, 1926: p. 121		lectotypes <i>ex loco</i>	CB	LT (L72)	the named relevé is the only one that could be selected as lectotype according to Art. 19a ICPN
<i>Oxytrichoides incifolius-Brometum (graminis)</i> T. Müller 1966	?		lectotype to be selected	DE (Hessen-Württemberg)	DE (Brandenburg: DE5), LT (L73)	
<i>Phlox phloxoides-Helictotrichetum pubercentis</i> Staudig et al. 1974	nom. nov. [Art. 7]	–	–	LT		
<i>Phlox phloxoides-Vernonietum spicatum</i> He-Bl, 1963	nom. abt. [Art. 37] (cf. Dengler et al., 2003)	?	lectotype to be selected	SE (Öland)		partly belonging to the <i>Trifolium-Geranietum</i>
<i>Pro-siphus-Androsidolium vulvariae</i> Marker 1969	Marker, 1969: tab. 4, rel. 30		lectotype selected by Dengler et al. (2006a)	NO (Telemark)		partly belonging to the <i>Trifolium-Geranietum</i> (including the type) and the <i>Trifolium-Geranietum</i>
<i>Prostria compressa</i> Kitzsch in Ralstonová 1998	Ralstonová, 1998: tab. 14, rel. 6		holotype	LT		
<i>Prunella grandiflora-Achilleetum pratense</i> Passarge 1979	Passarge, 1979: tab. 9, rel. 61		holotype	DE (Brandenburg)		
<i>Pulsatilla (graminis)-Plicatum phloxoides</i> Passarge 1959	Passarge, 1959: tab. 16, rel. 5		lectotype selected by Passarge (2002: 52)	DE (Mecklenburg-Vorpommern)	DE (Brandenburg: DE2, DE8), LT (L72)	mostly belonging to the <i>Koeleria-Corynephorus</i> (including the type)
<i>Scleropogon (virgatae)-Helictotrichetum pratense</i> Wilken et al. 1981	Wilken et al., 1981: tab. 1, rel. 7		holotype	DK (Næstved: M8)	DE (Berlin, Brandenburg, NE Lower Saxony and Mecklenburg-Vorpommern: DE6), PL (G16)	
<i>Sipo capitatae-Pterostichum arvense</i> brachypodanetum prostratum Libbert 1933	Libbert, 1933: tab. 20, rel. 6		lectotype selected by Dengler, 1994: 263	PL ("Niemark")		the <i>Sipo capitatae-Pterostichum arvense</i> <i>typicum</i> belongs to the <i>Festucetum vulgare</i>
<i>Trifolium montanum-Britannicum (Andros)</i> Busch et al. 1992	not checked (source not available)	?	?	RU (NW)		
<i>Vernonia spicata-Achilleetum (graminis)</i> Krahulec et al. 1986	nom. nov. [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 ( $n = 1,097$ ).

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