Applied Vegetation Science **17** (2014) 504–515

Red Lists and conservation prioritization of plant communities – a methodological framework

Christian Berg, Anja Abdank, Maike Isermann, Florian Jansen, Tiemo Timmermann & Jürgen Dengler

Keywords
Biodiversity; Conservation value; Decision matrix; Endangerment; Habitat classification; Methodology; Need for action; Normative; Phytosociology; Prioritization; Threat assessment; Vegetation classification

Abbreviations
CBD = Convention on Biological Diversity; IUCN = International Union for Conservation of Nature

Received 18 February 2013
Accepted 3 December 2013
Co-ordinating Editor: Ladislav Mucina

Berg, C. (corresponding author, christian.berg@uni-graz.at): Botanical Garden, Institute of Plant Sciences, University of Graz, Holteigasse 6, 8010 Graz, Austria
Abdank, A. (anja.abdank@lung.mv-regierung.de): State Agency for Environment, Nature and Geology (LUNG), Goldberger Strasse 12, 18273 Güstrow, Germany
Isermann, M. (maike.isermann@uni-bremen.de): Vegetation Ecology and Conservation Biology, Bremen University, Leobener Str., 28359 Bremen, Germany
Jansen, F. (f.jansen@bgbm.org): Biodiversity Informatics (BDI), Botanical Garden and Botanical Museum Berlin-Dahlem, Freie Universität Berlin, Königin-Luise-Str. 6–8, 14195 Berlin, Germany
Timmermann, T. (tiemo@uni-greifswald.de): Landscape Ecology and Ecosystem Dynamics (LEED), Institute of Botany and Landscape Ecology, University of Greifswald, Grimmer Str. 88, 17487 Greifswald, Germany
Dengler, J. (juergen.dengler@uni-bayreuth.de): Biodiversity, Evolution and Ecology of Plants (BEE), Biocentre Klein Flottbek and Botanical Garden, University of Hamburg, Ohnhorststr. 18, 22609 Hamburg, Germany; Current address: Disturbance Ecology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Universitätsstr. 30, 95447 Bayreuth, Germany; Secondary affiliation: Synthesis Centre (sDiv), German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, Deutscher Platz 5e, 04103 Leipzig, Germany

Abstract

Aims: Red Lists of threatened species are a well-established conservation tool throughout the world. In contrast, Red Lists of ecosystems, habitats or plant community types have only recently found interest at the global level, although they have a longer tradition in Central Europe. We contribute to the debate by presenting and discussing a comprehensive conservation assessment methodology for plant communities that was developed within the framework of the project 'The plant communities of Mecklenburg-Vorpommern and their vulnerability'.

Location: Mecklenburg-Vorpommern, Northeast Germany (23,174 km²).

Approach: Our approach adopts various concepts from modern red listing and prioritization at various organizational levels of biodiversity, and combines them into a methodological framework applicable for regional to continental Red Lists of plant communities. For each distinguished plant community, three steps are carried out, i.e. (1) assessment of *endangerment* (scientific part, using the three criteria 'past trend', 'current status' and 'prognosis'), (2) assessment of *conservation value* (normative part, using the three criteria 'degree of naturalness', 'relevance for species conservation' and 'global relevance'), and (3) a combination of (1) and (2) to derive a *need for action* (conservation prioritization). These steps are all based on the successive aggregation of quantitative criteria via decision matrices, which makes the assessment process transparent, avoids definition gaps and allows easy adjustment of the decision rules.

Conclusions: Plant community types derived from well-documented classifications of extensive vegetation-plot databases in combination with a transparent conservation assessment methodology have great potential in nature conservation and environmental monitoring. We suggest that the presented methodology is an improvement on traditional expert judgments as it separates the scientific and normative parts of the evaluation and uses clear, quantitative criteria and explicit rules to connect these into aggregated measures. It worked effectively and yielded meaningful results for a German federal state. By adjusting the scaling of the criteria, the approach can be adapted, as a whole or in part, to other regions or higher levels of ecosystem typology.

Applied Vegetation Science
Doi: 10.1111/avsc.12093

Introduction

The protection of biodiversity is a primary goal of nature conservation. This goal finds broad societal and political support, as expressed, for example, in the Convention on Biological Diversity (CBD; United Nations 1992), which has thus far been ratified by 168 countries. While the CBD aims at conservation of biological diversity at all organizational levels, from within-species genetic diversity through species diversity to diversity of ecosystems, the practical implementation of this objective varies greatly among levels, and is affected by the unequal availability of knowledge and tools. Traditionally, conservation biology was strongly focused on species conservation (see Groom et al. 2006), and accordingly tools for assessing endangerment status have been developed primarily for this organizational level. Most prominent are the Red Lists of Threatened Species published by the International Union for Conservation of Nature (IUCN; recent edition available from http://www.iucnredlist.org/), which find wide application in conservation planning and policy (e.g. Butchart et al. 2005, 2010). In the late 1980s and in the 1990s, these formerly subjective expert assessments were replaced by a set of transparent and operational Red List categories based on clear, mostly quantitative criteria (see reviews of Rodrigues et al. 2006; Mace et al. 2008). Subsequently, this global approach has been adapted to the needs of smaller geographic entities (Schnittler & Ludwig 1996; Gärdenfors et al. 2001; Miller et al. 2007), resulting in the publication of a growing number of national and regional Red Lists, covering more and more taxonomic groups with increasingly coherent assessment systems (Zamin et al. 2010). Another rather recent methodological development is the acknowledgment that the *scientific assessment* of the likelihood of (global or regional) extinction – the subject of traditional Red Lists – alone is not sufficient to determine conservation priorities. Instead, *normative aspects* like cultural values, economic benefit of related ecological services and cost effectiveness of possible actions or, in the case of national and regional Red Lists, the relevance of the territory for the global survival should be additionally taken into account (e.g. Schnittler & Günther 1999; Pärtel et al. 2005; Fitzpatrick et al. 2007; Joseph et al. 2008).

It is undisputed that ecosystems are appropriate targets for conservation action and prioritization (Walker 1995; Noss 1996; Heywood & Iriondo 2003). However, only recently the IUCN started to develop a global Red List of ecosystems (Nicholson et al. 2009; Rodríguez et al. 2010, 2012; Keith et al. 2013). An operational ecosystem definition – as a sector of the Earth's surface with its abiotic environment and its assemblage of interacting species – can be applied to very different scales. For a global assessment, units as large as biomes or ecoregions might be appropriate (e.g. Myers et al. 2000; Noss 2000), while for continental to regional scales a much finer categorization is needed, often termed habitat types (e.g. European Commission 2007). Red Lists of habitat types have a long tradition and have experienced extensive methodological development in Central Europe (see overviews of BFANL 1986; Blab 2005). Closely related are Red Lists of plant communities. Based on early considerations of Westhoff (1979), one of the first Red List assessments for a region's plant communities was done for the federal state of Schleswig-Holstein in Northern Germany (Dierßen 1983). Subsequently, many more such Red Lists have been published in Germany and for at least nine other European countries (see review of Köppel 2002). These Red Lists are connected to detailed vegetation classifications based on a phytosociological approach (Braun-Blanquet 1964; Dengler et al. 2008), which is widespread in Europe and profits from an enormous amount of available vegetation-plot data (Schaminée et al. 2009; Dengler et al. 2011). Being derived from the species compositional data of the vegetation rather than from classifications of abiotic and structural habitat characteristics, Red Lists of plant community types are generally more differentiated and more closely related to species conservation than Red Lists of habitat types, at least for plants. Recent habitat classifications in Europe and connected conservation assessments are frequently linked to phytosociological community types (e.g. Riecken et al. 2006; European Commission 2007; Delarze & Gonseth 2008; Chytrý et al. 2010), despite the fact that the development of these systems has been dominated by zoologists. This indicates that such a typology is widely seen as more appropriate than simpler and coarser, abiotically or physiognomically defined 'habitats'.

The development of plant community Red Lists in Central Europe has not found a major echo in the international discussion, probably due to language barriers and the fact that phytosociological classifications are so far mostly restricted to Europe and a few extra-European regions (Westhoff & van der Maarel 1973; Ewald 2003; Dengler et al. 2008). In other regions, similar considerations were made for habitats and ecosystems (see reviews by Nicholson et al. 2009; Faber-Langendoen et al. 2009; Rodríguez et al. 2010; Master et al. 2012; Keith et al. 2013). Common to the various approaches is that with time, they have become more and more based on data, in particular using GIS (Pressey et al. 2000; Rouget et al. 2003; Bär & Löffler 2007), and more complex, but also increasingly focused on the practical goals of implementations (Cowling et al. 2003; Gelderblom et al. 2003; Linkov et al. 2006).

Here we want to stimulate the debate by presenting our methodological approach of conservation assessment developed in the framework of the plot-based classification of all vegetation types in the federal state of Mecklenburg-Vorpommern (NE Germany: Berg et al. 2004; Timmermann et al. 2006). This approach combines various concepts from modern red-listing and priority assessment of various organizational levels into a framework applicable for regional to continental Red Lists of plant communities. The following contribution is organized into sections along the three major steps of our approach: (1) assessment of *endangerment* (scientific part: Red List *sensu stricto*), (2) assessment of *conservation value* (normative part), and (3) combination of (1) and (2) to derive a *need for action* (conservation priorities). Subsequently, we summarize some application experiences and provide an outlook on how the approach could become valuable in other contexts. The article is accompanied with extensive Supplementary Material that documents the details of our methodology and presents the results of its application for the first time in the English language.

Endangerment: to be assessed on the basis of data

We believe that the two paradigm shifts of the 1990s in the IUCN Red Lists of species mentioned above towards (1) the use of quantitative data and (2) separation of conservation assessment and conservation priorities (Rodríguez et al. 2010; IUCN Standards & Petitions Subcommittee 2011) should also be applied for Red Lists of plant communities. Moreover, the selection of quantitative criteria and their thresholds to assess the level of endangerment have to be justified (Timmermann et al. 2006). In fact, it is not easy to define when a plant community has vanished because in many cases a concrete assembly will be transformed gradually from one community type to another. Therefore, we refrained from using qualitative changes as a second criterion (e.g. floristic impoverishment, change in physiognomy, reduction of number of subtypes, as in Rennwald 2002) in addition to quantitative changes. In a sufficiently fine typology of community types, qualitative changes are reflected by a succession line of plant communities (e.g. *Adonido vernalis-Brachypodietum pinnati* → *Briza media* subtype of *Arrhenatheretum elatioris* → *Artemisia vulgaris* subtype of *Arrhenatheretum elatioris* → *Tanaceto vulgaris-Artemisietum vulgaris*, i.e. a transition from dry grassland via mesophilous grassland to tall forb-dominated ruderal vegetation due to eutrophication and abandonment). Accordingly, some types increase and other decrease over time, and thus qualitative changes will be adequately reflected by a separate quantitative assessment of each of these fine-scale types.

Red Lists usually judge past changes to provide a forecast of the development of a species or another object of conservation into the future. Thus, an assessment period (in retrospect), a reference period (at present) and a forecast period (in future) are needed (Müller-Motzfeld 1992; Mace et al. 2008). Ludwig et al. (2005) consider a time span of 20 yr as adequate for assessment of the short-term trend of a species, and 100 yr for the long-term trend. For ecosystem assessment, Rodríguez et al. (2010) proposed 50 yr as a short-term period and 500 yr for the long-term period. For plant communities, such a deep view into history presently does not seem to be possible based on available data, and therefore a separate assessment of two past time periods is not sensible. In Central Europe, the region of the world studied best in this respect, comprehensive coverage of vegetation-plot data began in the 1950s–1960s (Jansen et al. 2011), when numerous regional and national vegetation surveys were published. The 1960s in this region had also been the main period of agricultural industrialization, and thus strong declines in habitat and species were documented. While longer assessment periods in the past are certainly meaningful for Red Lists of species and potentially can be employed for ecosystems or biomes, Red Lists of plant communities even in the best documented regions of the world, could hardly operate with a reference period much before 1950 because of a lack of vegetation-plot data from earlier decades or centuries (Dengler et al. 2011).

For our approach, we therefore chose the three criteria: *past trend since 1960* (past), *current status* (presence) and *prognosis* (future). The *current and past status* is derived from the spatial extent of a plant community within the territory considered. Spatial extent combines the total area covered by the stands of a plant community with their range (spatial distribution). While we had to estimate the past and present extent based on multiple sources, in the future information systems such as the Dutch SynBioSys (Schaminée et al. 2007) will be able to provide the required data with increasingly higher resolution. As *past trend*, we defined the relative change in spatial extent between 1960 and the present situation, ranging from very strong decline (−50% and more), through constant (± 10%), to increase (+ 10% and more) (see Appendix S1: Endangerment). The *prognosis* was based on a summation of all current and foreseeable, both direct and indirect threats and supports that a community type will experience in the next 10 yr. We choose this period because (1) it is reasonably manageable, and (2) we consider a 10-yr updating cycle of Red Lists appropriate in the framework of permanent environmental monitoring.

Assessments of the individual criteria are combined with the help of a matrix (Fig. 1) to derive the level of *endangerment* (*Red List category*). We distinguish eight levels of endangerment, closely following the suggestions of Schnittler & Ludwig (1996) and Rennwald (2002; Fig. 1). Most of these correspond to IUCN categories for species (IUCN Standards & Petitions Subcommittee 2011), with the addition of three categories, which we consider particularly useful for regional Red Lists: *indeterminate*, *naturally rare but* *not actually threatened* and *least concern and expanding*. A detailed description of this part of our methodology is available in Appendix S1: Endangerment.

Conservation value: not every plant community is worth protecting

There are essential differences between populations of species and biological communities as objects of conservation. Plant community types are not natural units like species; they are operational divisions of the continuum of vegetation cover (Dengler et al. 2008). Emergence and disappearance of plant communities reflects changes of environmental conditions, and particularly land-use practices, but also natural and anthropogenic biotic invasions,

Current status	Past trend	Prognosis				
		1	2	3	4	5
0	1	0	0	0	0	0
1	1	1	1	1	1	2
	2	1	1	1	2	2
	3	1	1	2	2	2
	4	1	2	2	R	R
	5	2	2	2	R	R
2	1	1	1	2	2	3
	2	1	2	2	3	3
	3	2	2	3	3	3
	4	2	3	3	*	*
	5	3	3	3	*<	*<
3	1	2	2	3	3	NT
	2	2	3	3	NT	NT
	3	3	3	NT	NT	NT
	4	3	NT	NT	*	*
	5	NT	NT	NT	*<	*<
4	1	3	3	NT	NT	*
	2	3	NT	NT	*	*
	3	NT	NT	*	*	*
	4	NT	*	*	*	*
	5	*	*	*	*<	*<
5	1	NT	NT	*	*	*
	2	NT	*	*	*	*
	3	*	*	*	*	*
	4	*	*	*	*	*
	5	*	*	*	*<	*<

Fig. 1. Matrix for the determination of the *level of endangerment* (*Red List category*) based on three criteria. All criteria are defined and quantified at a five- or six-step scale (see Appendix S1: Endangerment). The Red List categories are: 0 vanished; 1 critically endangered; 2 endangered; 3 vulnerable; R naturally rare but not actually threatened; NT near threatened; * least concern; *< least concern and expanding.

which all affect landscapes continuously. The protection of all extant plant community types is therefore not a reasonable goal for nature conservation. A direct connection between endangerment and an obligation of protection, as has long been common in Red Lists of species, is not appropriate for plant communities: we need a step of normative assessment. Accordingly, we derived the conservation value from three independent criteria that can be, at least basically, assessed from available data.

The *degree of naturalness* (Dierßen 1986; Machado 2004) was used to favour communities less affected by human impact and being representatives of the natural environment. In Mecklenburg-Vorpommern, only 41% of the plant communities were classified in the category 'natural habitat' (Abdank et al. 2004; see Appendix S2); these were not always the most vulnerable. In other regions, like New Zealand, where natural and anthropogenic habitats are separated more sharply, it might be appropriate to assess only the natural habitats (Holdaway et al. 2012). In Central Europe, however, cultural landscapes predominate. Their community types have co-evolved with humans over centuries or millennia (e.g. Poschlod et al. 2009), and some of the so-called semi-natural communities even belong to global plant diversity hotspots (Wilson et al. 2012). Therefore, we evaluated all community types, from natural to strongly human-influenced, as long as there was at least some degree of self-organization, while rating types found in natural landscapes highest.

To assess the suitability of plant community types as surrogates for species conservation, we calculated the *relevance for species conservation* following an idea of Knapp et al. (1985). This concept is easily applicable for abstract vegetation units represented by synoptic vegetation tables (constancy columns). We used the constancy of red-listed species, weighted by their Red List category (for details see Appendix S1: Relevance for species conservation). Hence, this criterion quantifies how many and how seriously threatened species occur on average in a plot of that plant community.

Our third criterion is relevant only for territorial (i.e. non-global) conservation assessments. The *global relevance* tries to reflect how much the considered territory is responsible for the maintenance of a certain community type. This 'relevance' is assessed by relating the distribution range within the considered territory to the estimated global range of the community type (based on literature reports or estimated from overlaying range maps of diagnostic species). Global relevance in this sense has become an integral part of many regionalized conservation assessments of species (Jäger & Hoffmann 1997; Gruttke 2005; Schmeller et al. 2008). However, some authors (e.g. Schnittler & Günther 1999; Welk 2002; Gruttke 2005) also include endangerment (at larger scale) into their measure

Doi: 10.1111/avsc.12093

of global relevance. We prefer the separation of endangerment and global relevance to keep the assessment transparent.

The three criteria used as the constituting elements of conservation value turned out to be largely independent of each other (pair-wise Spearman's rank correlation r_s values of 0.33–0.44). As for endangerment, we combined the three criteria with a decision matrix to derive the *conservation value* (Fig. 2; for more details see Appendix S1: Conservation value).

Need for action: the combination of endangerment and conservation value justifies conservation priorities for plant communities

A central goal of Red Lists is to provide adequate prioritization for conservation actions. The *level of endangerment* (*Red List status*) describes the likelihood of disappearance of a plant community type and the speed at which this is occurring. In contrast, the *conservation value* provides a normative assessment, i.e. how important and desirable is the prevention of such a disappearance.

Only the combination of both aspects provides meaningful conservation priorities, which we call the *need for action* (Fig. 3; for more details see Appendix S1: Need for action). A similar methodological approach was first proposed by Schnittler & Günther (1999) for endangered vascular plants in Central Europe. They derived their priority list ('plants requiring priority conservation measures') from the equally weighted combination of endangerment within Central Europe (combined Red List categories from all available Red Lists) and global relevance from the range perspective (in our approach one criterion of the 'conservation value').

As with *endangerment* and *conservation value*, the *need for action* can be determined using a decision matrix (Fig. 4). The *need for action* ranges from 'very high need for action' to 'no need for action' (for details, see Appendix S1: Need for action).

In conservation practice, this ranking is not the end point, but rather should be a starting point for selecting optimal management actions. Practical implication of conservation does not deal with abstract vegetation types, but with concrete stands of communities, and there are also often alternative management options. The prioritization of conservation actions therefore requires the combination of the community-level need for action with cost–benefit assessments for alternative stand-level actions and the likelihood of success of these actions (Gelderblom et al. 2003;

Relevance for species	Degree of naturalness	Global relevance 1	2	3	4	5
1	1	1	1	1	1	1
	2	1	2	2	2	2
	3	1	2	2	2	2
	4	1	2	2	2	2
	5	1	2	2	2	2
2	1	1	2	2	2	2
	2	2	2	2	2	2
	3	2	2	3	3	3
	4	2	2	3	3	3
	5	2	2	3	3	3
3	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	3	3
	4	2	3	3	4	4
	5	2	3	3	4	4
4	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	4	4
	4	2	3	4	4	4
	5	2	3	4	4	5
5	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	4	4
	4	2	3	4	4	5
	5	2	3	4	5	5

Fig. 2. Matrix for the determination of *conservation values* of plant communities based on three criteria. All criteria are defined and quantified in a five-step scale (see Appendix S1: Conservation value). The values are: 1 highest conservation value; 2 high conservation value; 3 medium conservation value; 4 low conservation value; 5 lowest conservation value.

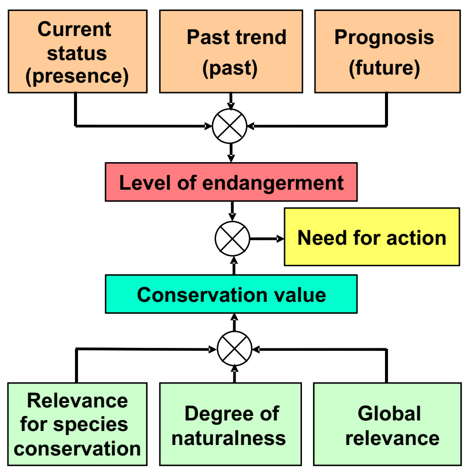

Fig. 3. System of data-driven determination of *level of endangerment* and *conservation value* using three criteria each and combination of both aspects to derive the *need for action* (see Appendix S1: Need for action). The circles containing crosses symbolize the matrix-based steps shown in Figs. 1, 2 and 4.

Applied Vegetation Science
Doi: 10.1111/avsc.12093

Combination of endangerment and conservation value = need for action										
Endang- erment / Cons. Value	0 Vanished	1 Critical endan- gered	2 Endan- gered	3 Vulner- able	# Indeter- minate	R Naturally rare	NT Near threat- ened	* Least concern	*< Expan- ding	D Data deficient
1 Highest value	[!!!]	!!!	!!!	!!	!!	(!!!)	!	–	–	?
2 High value	[!!!]	!!!	!!	!!	!!	(!!!)	!	–	–	?
3 Medium value	[!!]	!!	!!	!	!	(!!)	!	–	–	?
4 Low value	[!!]	!!	!	!	!	(!!)	–	–	–	?
5 Lowest value	[!]	!	!	!	!	(!)	–	–	–	?

Fig. 4. Decision matrix to determine the *need for action*. The categories of need for action mean: !!!: primary need for action; !!: high need for action; !: moderate need for action; [x]: restoration demand; (x): potential need for action; –: no need for action; ?: need for research.

Wilson et al. 2005, 2007; Murdoch et al. 2007; Lindenmayer et al. 2008).

Experience from application

If the methodological challenges are mastered, Red Lists of plant communities can be a major instrument for conservation planning. In Mecklenburg-Vorpommern, all 285 distinguished plant communities at the phytosociological rank of association as well as 72 sub-types were rated with the above-mentioned method (Berg et al. 2004; see Appendices S2 and S3; for overview of the classification, see Appendix S4). Figure 5 exemplifies the application of the approach with two contrasting associations; Appendix S3 summarizes Abdank et al. (2004) by presenting which community types have a particularly high or low level of endangerment, conservation value and need for action, and what the underlying threat causes are. It turns out that the endangerment and conservation value often do not coincide. Thus having a separate view on both aspects instead of seeing only a single overall category, as in traditional Red Lists, is highly informative for nature conservation. Particularly, the criterion 'global relevance within the conservation value' emphasized the responsibility of the federal state for some plant communities where Mecklenburg-Vorpommern has a major share of the overall distribution range (see Appendix S3: Conservation value). Most of the communities rated highly here had not traditionally been the focus of nature conservation because they are regionally relatively widespread and contain few rare species.

The results from the Red List assessment and prioritization (Appendices S2 and S3) have been applied for landscape and habitat assessments and conservation planning in Mecklenburg-Vorpommern since 2004. Habitat mapping (LUNG 2010a) and habitat assessments of Annex 1 habitats (e.g. LUNG 2010b) and Annex 2 species (e.g. Lange et al. 2010) of the EU Habitats Directive have been improved with the Red List of plant communities. The 'Plant Conservation Concept Mecklenburg-Vorpommern' (Litterski et al. 2006) used the Red List of plant communities to determine the 320 plant species most in need of urgent conservation and management measures.

Conclusions and outlook

The conservation assessment approach developed for the plant communities of Mecklenburg-Vorpommern proved to be a methodological framework that is intuitively applicable and delivers a reasoned list of conservation priorities. The use of decision matrices turned out to be a particularly useful approach for successively aggregating various criteria in a transparent manner. The decision matrices avoided the ambiguities and definition gaps of traditional verbal definitions of categories, while at the same time making potential inconsistencies of the approach visible as 'asymmetries' in the matrix (which then could be adjusted). Through the full documentation of each assessment step (both the scientific and normative aspects), the outcome is transparent and even allows users to re-calculate the assessment with different weighing factors of the individual criteria (reflecting different normative settings).

We believe that this approach can be adopted in other regions that have a comprehensive classification of vegetation types. An extension to a full habitat classification by adding those habitat types which are (largely) without vegetation is feasible, resulting in a reunification of habitat and community types in a universal framework for

Doi: 10.1111/avsc.12093

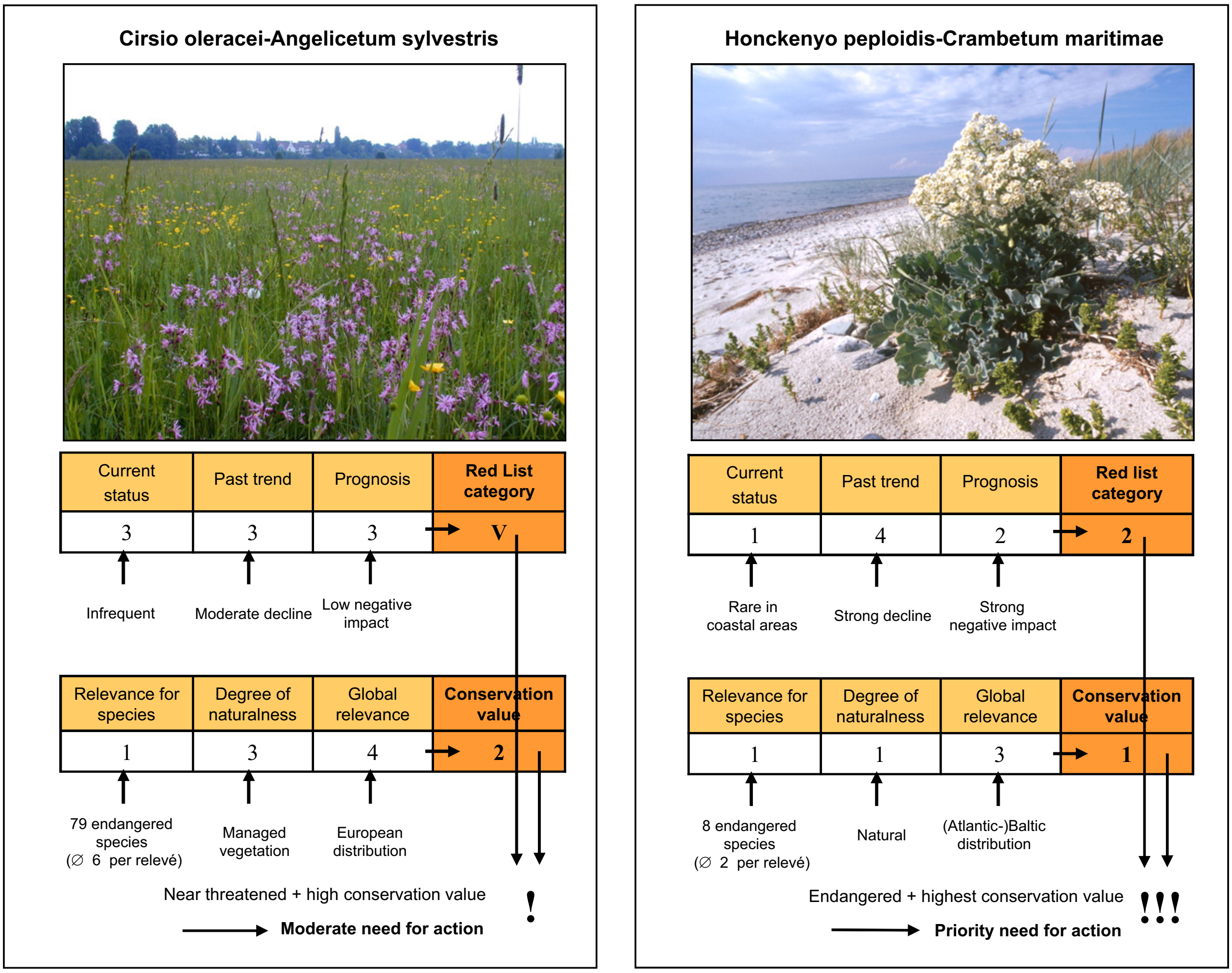

Fig. 5. Two associations from Berg et al. (2004) exemplifying the assessment approach. On the left side, a near threatened association with a medium conservation value (Photo: C. Berg). On the right side, an endangered association with the highest conservation value (Photo: J. Reich). The six criteria are rated independently, and then level of endangerment, conservation value and need for action are derived using the decision matrices (see Figs. 1, 2 and 4).

ecosystem assessment at regional to continental levels. If used in other regions, the approach would need to be adapted to the specific situation there. Not only the data basis and the level of small-scale classification, but also differences in human impact and landscape history likely will require different scaling or even different indicators for the criteria.

A substantial difference between our approach and many other conservation assessments at community, ecosystem or landscape level is the treatment of gradual, qualitative degradation. While 'degradation' is widely used as an important indicator for endangerment (e.g. Dierßen 1986; Rennwald 2002; Nicholson et al. 2009; Filibeck & Scoppola 2011; Keith et al. 2013), we consider it only when it is so severe that it causes a significant change in community composition and structure and composition, as a consequence of which the stands would be assigned to a different community type. In that way, we turn the qualitative feature 'degradation', which is hard to assess in an objective way, particularly across different community types, into a more easily assessed quantitative criterion of spatial decrease. Evidently, our approach requires a sufficiently fine level of classification and transparent classification criteria. Therefore, we recommend that Red Lists of plant communities should include all plant communities of a region, not only the threatened ones, and define them as clearly as possible, e.g. using comprehensive sets of statistically determined diagnostic species of all hierarchical levels that can be applied top-down (Berg et al. 2001, 2004) or with other explicit membership rules (De Cáceres & Wiser 2012). In contrast, when much coarser classification units are assessed, such as ecosystems or even landscapes, qualitative changes like degradation or structural and functional decline might be appropriate elements for

Doi: 10.1111/avsc.12093

the assessment (Nicholson et al. 2009; Filibeck & Scoppola 2011; Keith et al. 2013).

We believe that habitat conservation essentially based on plant community types after the prioritization process has the potential to protect the vast majority of species diversity within a region. Protecting a variety of plant community types of a territory also implies that a wide range of abiotic and disturbance regimes is maintained, as perceived by the taxa of the vegetation (vascular plants, bryophytes, lichens, macro-algae). This, in turn, will also likely save many species from groups such as bacteria, fungi or soil fauna, whose precise ecological requirements and distributions remain unknown (Noss 1996). Close connections between various animal and fungal taxa to plant community types have been documented (MacNally et al. 2002; Berg et al. 2004; Delarze & Gonseth 2008; Zachow et al. 2009).

However, there are also several caveats. (1) A shortcoming of some traditional phytosociological classification systems is that the underlying data were preferably sampled in such a way that they fit into preconceived concepts (compare criticism from Dengler 2003; Ewald 2003). Vegetation types with no or few 'diagnostic species' are largely underrepresented in databases, and often completely removed from final classifications, despite the fact that such units are often particularly widespread in the landscape. Moreover, vegetation types of limnic and marine macro-algae, as well as terricolous or saxicolous bryophyte and lichen communities, are mostly excluded from the syntaxonomic system and instead merged with the synusial system of cryptogams (for discussion, see Dengler 2003). (2) While species are natural units, any typology of vegetation or habitat types must be artificial, i.e. essentially less sharp (Noss 1996). However, if the vegetation units are delimited and defined with sound numerical methods (e.g. Chytrý et al. 2002; Dengler 2003; Tichý & Chytrý 2006; Roleček et al. 2009; Luther-Mosebach et al. 2012), and the resulting classification is presented in a comprehensive manner in tabular and textual format (e.g. Schaminée et al. 1995 et seq., Berg et al. 2001, 2004; Chytrý 2007 et seq.), this 'fuzziness' will not be a disadvantage. A particularly good solution is the publication of the vegetation typology accompanied by an electronic tool that allows the automatic assignment of new vegetation plots (e.g. Janišová 2007). (3) Presently, syntaxonomic classifications from different authors in different countries show even more idiosyncrasies than the existing diversity in taxonomic concepts (see Jansen & Dengler 2010). While the co-existence of alternative views in classification systems of community types (as in other biological entities) cannot be avoided (Ewald 2003), the emerging supra-national, plot-based classifications (e.g. Ermakov & Morozova 2011; Eliáš et al. 2013; see also Dengler et al. 2013) can contribute much to unification, while ontological tools adopted from taxonomic concept–synonymy (Berendsohn 2003) might help to maintain a clear picture even when information based on differing syntaxonomic concepts is merged.

In conclusion, plant community types derived from well-documented classifications of extensive vegetation-plot databases in combination with a transparent conservation assessment methodology seem to have great potential in nature conservation and environmental assessment. One of the neat things for both the phytosociological approach applied around the globe (Braun-Blanquet 1964; Ewald 2003; Dengler et al. 2008) and the emerging US American approach of vegetation classification (FGDC 2008) is their hierarchical structure. This allows use of the same classification but at different levels when making a conservation assessment at the regional, national or continental scale. In Europe, for example, in the context of a region or a country, the evaluation at association or sub-association level is possible and meaningful (Rennwald 2002; Berg et al. 2004), while for supranational to continental assessments, phytosociological alliances are probably the more appropriate level. An initial such overview of the alliances known from Europe has been published by Rodwell et al. (2002), and a much refined and more detailed version is in preparation (Mucina et al. in preparation).

We believe that the presented approach of conservation assessment of plant community types can become a powerful tool to define conservation priorities at the CBD level of ecosystems. In regions like Europe, with comprehensive coverage of phytosociological classification and huge vegetation-plot databases, it can be directly applied to phytosociological entities, while in other regions, a similar methodology might, as a starting point, be used for the assessment of coarser habitat types. The framework is flexible enough to allow easy adjustments for different sizes of considered territories or normative agreements. Specifically in Europe, we assume that together with the forthcoming continental phytosociological classification (L. Mucina et al., in preparation; see also Dengler et al. 2013) and the emerging joint vegetation-plot database (EVA = *European Vegetation Archive*; see http://euroveg.org/eva-database), our approach has the potential to significantly improve the presently often little substantiated priority settings of the Habitats Directive and its inconsistent application across members states of the European Union.

Acknowledgements

The presented methodology was conceived by C.B., A.A. and J.D., with smaller contributions from T.T., while C.B., J.D. and F.J. planned and wrote this contribution, M.I. and C.B. compiled the Supplementary Material based on German publications of C.B., A.A., J.D., T.T. and M.I., and all co-authors critically revised the full article. We thank the State Agency for Environment, Nature and Geology (LUNG) for funding the project 'The plant communities of Mecklenburg-Vorpommern and their vulnerability', the participants of the BEE Paper-Writing Seminar in Hamburg for constructive comments on a draft of the manuscript, as well as Toby Spribille and Steven Weiss for polishing our English language usage. We are grateful for constructive comments from two anonymous reviewers, and the co-ordinating editor Laco Mucina that greatly helped to improve the manuscript.

References

Abdank, A., Berg, C. & Dengler, J. 2004. Bilanz der Roten Liste und Konsequenzen für den Naturschutz. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*, pp. 494–507. Weissdorn, Jena, DE.

Bär, A. & Löffler, J. 2007. Ecological process indicators used for nature protection scenarios in agricultural landscapes of SW Norway. *Ecological Indicators* 7: 396–411.

Berendsohn, W.G. (ed.) 2003. MoReTax – Handling factual information linked to taxonomic concepts in biology. *Schriftenreihe für Vegetationskunde* 39: 1–114.

Berg, C., Dengler, J. & Abdank, A. (eds.) 2001. *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Tabellenband*. Weissdorn, Jena, DE.

Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) 2004. *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*. Weissdorn, Jena, DE.

BFANL [Bundesforschungsanstalt für Naturschutz und Landschaftsökologie] (ed.) 1986. Rote Listen von Pflanzengesellschaften, Biotopen und Arten. Referate und Ergebnisse eines Symposiums in der Bundesforschungsanstalt für Naturschutz und Landschaftsökologie 12–15 November 1985. *Schriftenreihe für Vegetationskunde* 18: 1–166.

Blab, J. (ed.) 2005. Rote Listen – Barometer der Biodiversität: Entstehungsgeschichte und neuere Entwicklungen in Deutschland, Österreich und der Schweiz. *Naturschutz und Biologische Vielfalt* 18: 1–281.

Braun-Blanquet, J. 1964. *Pflanzensoziologie. Grundzüge der Vegetationskunde*. 3rd ed. Springer, Vienna, AT.

Butchart, S.H.M., Stattersfield, A.J., Baillie, J., Bennun, L.A., Stuart, S.N., Akçakaya, H.R., Hilton-Taylor, C. & Mace, G.M. 2005. Using Red List Indices to measure progress towards the 2010 target and beyond. *Philosophical Transactions of the Royal Society Series B* 360: 255–268.

Butchart, S.H.M., Walpole, M., Collen, B., van Strien, A., Scharlemann, J.P.W., Almond, R.E.A., Baillie, J.E.M., Bomhard, B., Brown, C., (…) & Watson, R. 2010. Global biodiversity: indicators of recent declines. *Science* 328: 1164–1168.

Chytrý, M. (ed.) 2007. *Vegetace České republiky 1. Travinná a keříčková vegetace* [Vegetation of the Czech Republic 1. Grassland and heathland vegetation]. Academia, Praha, CZ.

Chytrý, M., Tichý, L., Holt, J. & Botta-Dukát, Z. 2002. Determination of diagnostic species with statistical fidelity measures. *Journal of Vegetation Science* 13: 79–90.

Chytrý, M., Kučera, T., Kočí, M., Grulich, V. & Lustyk, P. (eds.) 2010. *Katalog biotopů České republiky* [Habitat catalogue of the Czech Republic]. Agentura ochrany přírody a krajiny ČR, Praha, CZ.

Cowling, R., Pressey, R., Sims-Castley, R., Le Roux, A., Baard, E., Burgers, C. & Palmer, G. 2003. The expert or the algorithm? – comparison of priority conservation areas in the Cape Floristic Region identified by park managers and reserve selection software. *Biological Conservation* 112: 147–167.

De Cáceres, M. & Wiser, S.K. 2012. Towards consistency in vegetation classification. *Journal of Vegetation Science* 23: 387–393.

Delarze, R. & Gonseth, Y. 2008. *Lebensräume der Schweiz. Ökologie – Gefährdung – Kennarten*. 2nd ed. Ott, Bern, CH.

Dengler, J. 2003. Entwicklung und Bewertung neuer Ansätze in der Pflanzensoziologie unter besonderer Berücksichtigung der Vegetationsklassifikation. *Archiv naturwissenschaftlicher Dissertationen* 14: 1–297.

Dengler, J., Chytrý, M. & Ewald, J. 2008. Phytosociology. In: Jørgensen, S.E. & Fath, B.D. (eds.) *Encyclopedia of ecology*, pp. 2767–2779. Elsevier, Oxford, UK.

Dengler, J., Jansen, F., Glöckler, F., Peet, R.K., De Cáceres, M., Chytrý, M., Ewald, J., Oldeland, J., Lopez-Gonzalez, G., (…) & Spencer, N. 2011. The global index of vegetation-plot databases (GIVD): a new resource for vegetation science. *Journal of Vegetation Science* 22: 582–597.

Dengler, J., Bergmeier, E., Willner, W. & Chytrý, M. 2013. Towards a consistent classification of European grasslands. *Applied Vegetation Science* 16: 518–520.

Dierßen, K. 1983. Rote Liste der Pflanzengesellschaften Schleswig-Holsteins (Stand: 1983). *Schriftenreihe des Landesamtes für Naturschutz und Landschaftspflege Schleswig-Holstein* 6: 1–123.

Dierßen, K. 1986. Zur Erarbeitung, Problematik und Anwendung der Roten Liste der Pflanzengesellschaften Schleswig-Holsteins. *Schriftenreihe für Vegetationskunde* 18: 35–39.

Eliáš, P. Jr, Sopotlieva, D., Díté, D., Hájková, P., Apostolova, I., Senko, D., Melečková, Z. & Hájek, M. 2013. Vegetation diversity of salt-rich grasslands in Southeast Europe. *Applied Vegetation Science* 16: 521–537.

Ermakov, N. & Morozova, O. 2011. Syntaxonomical survey of boreal oligotrophic pine forests in northern Europe and Western Siberia. *Applied Vegetation Science* 14: 524–536.

European Commission (ed.) 2007. *Interpretation manual of European Union habitats – EUR27*. European Commission, DG Environment, Brussels, BE.

Ewald, J. 2003. A critique for phytosociology. *Journal of Vegetation Science* 14: 291–296.

Faber-Langendoen, D., Master, L., Nichols, J., Snow, K., Tomaino, A., Bittman, R., Hammerson, G., Heidel, B., Ramsay, L. & Young, L. 2009. *NatureServe conservation status assessments:*

Applied Vegetation Science
Doi: 10.1111/avsc.12093

methodology for assigning ranks. NatureServe, Arlington, VA, US.

FGDC [Federal Geographic Data Committee] (ed.) 2008. *National vegetation classification standard, Version 2* [FGDC Document no. FGDC-STD-005-2008]. U.S. Geological Survey, Reston, VA, US. URL: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/NVCS_V2_FINAL_2008-02.pdf (accessed January 2013).

Filibeck, G. & Scoppola, A. 2011. Two Mediterranean landscape types and their interface as a case study for "landscape red-listing". *Fitosociologia* 48(Suppl 1): 119–125.

Fitzpatrick, Ú., Murray, T.E., Paxton, R.J. & Brown, M.J.E. 2007. Building on IUCN regional Red Lists to produce lists of species of conservation priority: a model with Irish bees. *Conservation Biology* 21: 1324–1332.

Gärdenfors, U., Hilton-Taylor, C., Mace, G.M. & Rodríguez, J.P. 2001. The application of the IUCN Red List criteria at regional levels. *Conservation Biology* 15: 1206–1212.

Gelderblom, C.M., Van Wilgen, B.W., Nel, J.L., Sandwith, T., Botha, M. & Hauck, M. 2003. Turning strategy into action: implementing a conservation action plan in the Cape Floristic Region. *Biological Conservation* 112: 291–297.

Groom, M.J., Meffe, G.K. & Carroll, C.R. (eds.) 2006. *Principles of conservation biology*. 3rd ed. Sinauer, Sunderland, MA, US.

Gruttke, H. (ed.) 2005. ['2004']. Ermittlung der Verantwortlichkeit für die Erhaltung mitteleuropäischer Arten. *Naturschutz und Biologische Vielfalt* 8: 1–280.

Heywood, V.H. & Iriondo, J.M. 2003. Plant conservation: old problems, new perspectives. *Biological Conservation* 113: 321–335.

Holdaway, R.J., Wiser, S.K. & Williams, P.A. 2012. Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology* 26: 619–629.

IUCN Standards and Petitions Subcommittee (ed.) 2011. *Guidelines for using the IUCN Red List categories and criteria*. Version 9.0 (September 2011). IUCN Global Species Programme Red List Unit, Cambridge, UK. URL: http://www.iucnredlist.org/documents/RedListGuidelines.pdf (accessed January 2013).

Jäger, E.J. & Hoffmann, M.H. 1997. Schutzwürdigkeit von Gefäßpflanzen aus der Sicht der Gesamtareale. *Zeitschrift für Ökologie und Naturschutz* 6: 225–232.

Janišová, M. 2007 (ed.) *Travinnoblinná vegetácia Slovenska – elektronický expertný systém na identifikáciu syntaxónov* [Grassland vegetation of the Slovak Republic – electronic expert system for identification of syntaxa]. Botanický ústav SAV, Bratislava, SK.

Jansen, F. & Dengler, J. 2010. Plant names in vegetation databases – a neglected source of bias. *Journal of Vegetation Science* 21: 1179–1186.

Jansen, F., Dengler, J., Glöckler, F., Chytrý, M., Ewald, J., Oldeland, J. & Schaminée, J.H.J. 2011. Die mitteleuropäischen Datenbanken im global index of vegetation-plot databases (GIVD). *Tuexenia* 31: 351–367.

Joseph, L.N., Maloney, R.F. & Possingham, H.P. 2008. Optimal allocation of resources among threatened species: a project prioritization protocol. *Conservation Biology* 23: 328–338.

Keith, D.A., Rodríguez, J.P., Rodríguez-Clark, K.M., Nicholson, E., Aapala, K., Alonso, A., Asmussen, M., Bachman, S., Basset, A., (…) & Zambrano-Martínez, S. (2013): Scientific foundations for an IUCN Red List of ecosystems. *PLoS ONE* 8: article e62111.

Knapp, H.D., Jeschke, L. & Succow, M. 1985. *Gefährdete Pflanzengesellschaften auf dem Territorium der DDR*. Kulturbund der DDR, Berlin, DE.

Köppel, C. 2002. ['2000']. Die Roten Listen der Pflanzengesellschaften in Europa – eine Literatur-Synopse. *Schriftenreihe für Vegetationskunde* 35: 83–87.

Lange, M., Voigtländer, U. & Russow, B. 2010. *Steckbrief für die FFH-Anhang II-Art Liparis loeselii (L.) Rich. – Sumpf-Glanzkraut*. LUNG, Güstrow, DE. URL: http://www.lung.mv-regierung.de/insite/cms/umwelt/natur/ artenschutz/ffh_arten.htm (accessed January 2013).

Lindenmayer, D., Hobbs, R.J., Montague-Drake, R., Alexandra, J., Bennett, A., Burgman, M., Cale, P., Calhoun, A., Cramer, V., (…) & Zavaleta, E. 2008. A checklist for ecological management of landscapes for conservation. *Ecology Letters* 11: 78–91.

Linkov, I., Satterstrom, F.K., Kiker, G., Batchelor, C., Bridges, T. & Ferguson, E. 2006. From comparative risk assessment to multi-criteria decision analysis and adaptive management: recent developments and applications. *Environment International* 32: 1072–1093.

Litterski, B., Berg, C. & Müller, D. 2006. *Florenschutzkonzept Mecklenburg-Vorpommern. Analyse landesweiter Artendaten (§20– Biotopkartierung) zur Erstellung von Flächenkulissen für die FFH-Management- und die Gutachtliche Landschaftsrahmenplanung*. Institut für Umwelt, Botanik und Landnutzung, Greifswald, DE. URL: http://www.lung.mv-regierung.de/insite/cms/umwelt/natur/artenschutz/florenschutz.htm (accessed January 2013).

Ludwig, G., Haupt, H., Gruttke, H. & Binot-Hafke, M. 2005. Methodische Weiterentwicklung der Roten Listen gefährdeter Tiere, Pflanzen und Pilze in Deutschland – eine Übersicht. *Natur und Landschaft* 80: 257–265.

LUNG [Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern] (ed.) 2010a. *Anleitung für die Kartierung von Biotoptypen und FFH-Lebensraumtypen in Mecklenburg-Vorpommern*. 2nd ed. [Materialien zur Umwelt des Landesamtes für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern no. 2010(2)]. LUNG, Güstrow, DE. URL: http://www.lung.mv-regierung.de/insite/cms/umwelt/natur/lebensraumschutz_portal/ lr_kartieranleitung.htm (accessed: January 2013).

LUNG [Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern] (ed.) 2010b. *Steckbriefe für die FFH-Anhang I Lebensraumtypen – 1330 Atlantische Salzwiesen (*Glauco-Puccinellietalia maritimae*)*. LUNG, Güstrow, DE. URL: http://www.lung.mv-regierung.de/insite/cms/umwelt/natur/ lebensraumschutz_portal/ffh_lrt.htm (accessed: January 2013).

Luther-Mosebach, J., Dengler, J., Schmiedel, U., Röwer, I.U., Labitzki, T. & Gröngröft, A. 2012. A first formal classification of the Hardeveld vegetation in Namaqualand, South Africa. *Applied Vegetation Science* 15: 401–431.

Mace, G.M., Collar, N.J., Gaston, K.J., Hilton-Taylor, C., Akçakaya, H.R., Leader-Williams, N., Milner-Gulland, E.J. & Stuart, S.N. 2008. Quantification of extinction risk: IUCN's system for classifying threatened species. *Conservation Biology* 22: 1424–1442.

Machado, A. 2004. An index of naturalness. *Journal of Nature Conservation* 12: 95–110.

MacNally, R., Bennett, A.F., Brown, G.W., Lumsden, L.F., Yen, A., Hinkley, S., Lillywhite, P. & Ward, D. 2002. How well do ecosystem-based planning units represent different components of biodiversity? *Ecological Applications* 12: 900–912.

Master, L.L., Faber-Langendoen, D., Bittman, R., Hammerson, G.A., Heidel, B., Ramsay, L., Snow, K., Teucher, A. & Tomaino, A. 2012. *NatureServe conservation status assessments: factors for evaluating species and ecosystem risk*. NatureServe, Arlington, VA, US.

Miller, R.M., Rodríguez, J.P., Aniskowicz-Fowler, T., Bambaradeniya, C., Boles, R., Eaton, M.A., Gärdenfors, U., Keller, V., Molur, S., Walker, S. & Pollock, C. 2007. National threatened species listing based on IUCN criteria and regional guidelines: current status and future perspectives. *Conservation Biology* 21: 684–696.

Müller-Motzfeld, G. 1992. Rote Liste der Laufkäfer von Mecklenburg-Vorpommern (Expertenumfrage contra Computerfaunistik). *Naturschutzarbeit in Mecklenburg-Vorpommern* 35: 21–30.

Murdoch, W., Polasky, S., Wilson, K.A., Possingham, H.P., Kareiva, P. & Shaw, R. 2007. Maximizing return on investment in conservation. *Biological Conservation* 139: 375–388.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.

Nicholson, E., Keith, D.A. & Wilcove, D.S. 2009. Assessing the threat status of ecological communities. *Conservation Biology* 23: 259–274.

Noss, R.F. 1996. Ecosystems as conservation targets. *Trends in Ecology & Evolution* 11: 351.

Noss, R.F. 2000. High-risk ecosystems as foci for considering biodiversity and ecological integrity in ecological risk assessments. *Environmental Science & Policy* 3: 321–332.

Pärtel, M., Kalamees, R., Reier, Ü., Tuvi, E.-L., Roosaluste, E., Vellak, A. & Zobel, M. 2005. Grouping and prioritization of vascular plant species for conservation: combining natural rarity and management need. *Biological Conservation* 123: 271–278.

Poschlod, P., Baumann, A. & Karlik, P. 2009. Origin and development of grasslands in Central Europe. In: Veen, P., Jefferson, R., de Smidt, J. & van der Straaten, J. (eds.) *Grasslands in Europe of high nature value*, pp. 15–26. KNNV Publishing, Zeist, NL.

Pressey, R.L., Hager, T.C., Ryan, K.M., Schwarz, J., Wall, S., Ferrier, S. & Creaser, P.M. 2000. Using abiotic data for conservation assessments over extensive regions: quantitative methods applied across New South Wales, Australia. *Biological Conservation* 96: 55–82.

Rennwald, E. (ed.) 2002. ['2000']. Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands – mit Datenservice auf CD-ROM. *Schriftenreihe für Vegetationskunde* 35: 1–800.

Riecken, U., Finck, P., Raths, U., Schröder, E. & Ssymank, A. 2006. Rote Liste der gefährdeten Biotoptypen Deutschlands – zweite fortgeschriebene Fassung 2006. *Naturschutz und Biologische Vielfalt* 34: 1–318.

Rodrigues, A.S.L., Pilgrim, J.D., Lamoreux, J.F., Hoffmann, M. & Brooks, T.M. 2006. The value of the IUCN Red List for conservation. *Trends in Ecology & Evolution* 21: 71–76.

Rodríguez, J.P., Rodríguez-Clark, K.M., Baillie, J.E.M., Ash, N., Benson, J., Boucher, T., Brown, C., Burgess, N.D., Collen, B., (…) & Zamin, T. 2010. Establishing IUCN Red List criteria for threatened ecosystems. *Conservation Biology* 25: 21–29.

Rodríguez, J.P., Rodríguez-Clark, K.M., Keith, D.A., Barrow, E.G., Benson, J., Nicholson, E. & Wit, P. 2012. IUCN Red List of Ecosystems. *S.A.P.I.EN.S* 5: 61–70.

Rodwell, J.S., Schaminée, J.H.J., Mucina, L., Pignatti, S., Dring, J. & Moss, D. 2002. *The diversity of European vegetation – An overview of phytosociological alliances and their relationships to EUNIS habitats* [Rapp. EC-LNV no. 2002(054)]. National Reference Centre for Agriculture, Nature and Fisheries, Wageningen, NL.

Roleček, J., Tichý, L., Zelený, D. & Chytrý, M. 2009. Modified TWINSPAN classification in which the hierarchy respects cluster heterogeneity. *Journal of Vegetation Science* 20: 596–602.

Rouget, M., Richardson, D.M., Cowling, R.M., Lloyd, J.W. & Lombard, A.T. 2003. Current patterns of habitat transformation and future threats to biodiversity in terrestrial ecosystems of the Cape Floristic Region, South Africa. *Biological Conservation* 112: 63–85.

Schaminée, J.H.J., Stortelder, A.H.F. & Westhoff, V. (eds.) 1995. *De vegetatie van Nederland – Deel 1. Inleiding tot de plantensociologie – grondslagen, methoden en toepassingen* [The vegetation of the Netherlands. Part 1: Introduction to phytosociology – fundamentals, methods and applications]. Opulus, Uppsala, SE.

Schaminée, J.H.J., Hennekens, S.M. & Ozinga, W.A. 2007. Use of the ecological information system SynBioSys for the analysis of large data sets. *Journal of Vegetation Science* 18: 463–470.

Schaminée, J.H.J., Hennekens, S.M., Chytrý, M. & Rodwell, J.S. 2009. Vegetation-plot data and databases in Europe: an overview. *Preslia* 81: 173–185.

Schmeller, D.S., Gruber, B., Budrys, E., Framsted, E., Lengyel, S. & Henle, K. 2008. National responsibilities in European species conservation: a methodological review. *Conservation Biology* 22: 593–601.

Doi: 10.1111/avsc.12093

Schnittler, M. & Günther, K.-F. 1999. Central European vascular plants requiring priority conservation measures – an analysis from national Red Lists and distribution maps. *Biodiversity and Conservation* 8: 891–925.

Schnittler, M. & Ludwig, G. 1996. Zur Methodik der Erstellung Roter Listen. *Schriftenreihe für Vegetationskunde* 28: 709–739.

Tichý, L. & Chytrý, M. 2006. Statistical determination of diagnostic species for site groups of unequal size. *Journal of Vegetation Science* 17: 809–818.

Timmermann, T., Dengler, J., Abdank, A. & Berg, C. 2006. Objektivierung von Naturschutzbewertungen – Das Beispiel Roter Listen von Pflanzengesellschaften. *Naturschutz und Landschaftsplanung* 38: 133–139.

United Nations 1992. *Convention on Biological Diversity*. – URL: http://www.cbd.int/doc/legal/cbd-en.pdf (accessed: 16 October 2011).

Walker, B. 1995. Conserving biological diversity through ecosystem resilience. *Conservation Biology* 9: 747–752.

Welk, E. 2002. Arealkundliche Analyse und Bewertung der Schutzrelevanz seltener und gefährdeter Gefäßpflanzen Deutschlands. *Schriftenreihe Vegetationskunde* 37: 1–33.

Westhoff, V. 1979. Bedrohung und Erhaltung seltener Pflanzengesellschaften in den Niederlanden. In: Willmans, O. & Tüxen, R. (eds.) *Werden und Vergehen von Pflanzengesellschaften*, pp. 285–310. Cramer, Vaduz, LI.

Westhoff, V. & van der Maarel, E. 1973. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) *Ordination and classification of communities*, pp. 617–726. Junk, The Hague, NL.

Wilson, K., Pressey, R.L., Newton, A., Burgman, M., Possingham, H.P. & Weston, C. 2005. Measuring and incorporating vulnerability into conservation planning. *Environmental Management* 35: 527–543.

Wilson, K.A., Underwood, E.C., Morrison, S.A., Klausmeyer, K.R., Murdoch, W.W., Reyers, B., Wardell-Johnson, G., Marquet, P.A., Rundel, P.W., (…) & Possingham, H.P. 2007. Conserving biodiversity efficiently: what to do, where, and when. *PLoS Biology* 5: article e223.

Wilson, J.B., Peet, R.K., Dengler, J. & Pärtel, M. 2012. Plant species richness: the world records. *Journal of Vegetation Science* 23: 796–802.

Zachow, C., Berg, C., Müller, H., Meincke, R., Komon-Zelazowska, M., Druzhinina, I.S., Kubicek, C.P. & Berg, G. 2009. Fungal diversity in the rhizosphere of endemic plant species of Tenerife (Canary Islands): relationship to vegetation zones and environmental factors. *The ISME Journal* 3: 79–92.

Zamin, T.J., Baillie, J.E.M., Miller, R.M., Rodríguez, J.P., Ardid, A. & Collen, B. 2010. National red listing beyond the 2010 target. *Conservation Biology* 24: 1012–1020.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Details of the conservation assessment methodology (endangerment, conservation value and need for action) in the Red List of plant communities of Mecklenburg-Vorpommern.

Appendix S2. Tabular overview of all plant communities (associations and subtypes) of Mecklenburg-Vorpommern with data on endangerment, conservation value and need for action.

Appendix S3. Meta-analysis of the conservation assessment of the plant communities of Mecklenburg-Vorpommern and resulting consequences for nature conservation.

Appendix S4. Overview of the phytosociological hierarchy from Berg et al. (2001, 2004) that underlies Appendices S2 and S3.

Appendix S1. Details of the conservation assessment methodology (endangerment, conservation value and need for action) in the Red List of plant communities of Mecklenburg-Vorpommern.

This appendix is a shortened English version of the methodological chapters by Abdank et al. (2004a), Berg et al. (2004b) and Abdank et al. (2004b) in the monograph *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung* (Berg et al. 2004a).

General framework

One major aim of the project *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung* (*Plant communities of Mecklenburg-Vorpommern and their vulnerability*; Berg et al. 2001, 2004a; further referred to as RLPGMV) was to provide a comprehensive conservation assessment of all listed vegetation types occuring or having occurred on the territory of this federal state in NE Germany. We name the overall product the *Red List of plant communities of Mecklenburg-Vorpommern*, while acknowledging that its scope goes significantly beyond that of traditional Red Lists (sensu stricto).

Our conservation assessment methodology consists of three major parts, which correspond to the sections of this Appendix: (i) assessment of **endangerment**, (ii) assessment of **conservation value** and (iii) the combination of (i) and (ii) to derive the **need for action**. In this context, **endangerment** means the scientific estimation of how strongly and how fast a certain community type is declining, and thus how high the risk is that it will totally vanish from the territory considered should the current environmental framework with its threats remain unchanged. By contrast, the **conservation value** represents a normative evaluation of how important it is to maintain viable stands of a certain community type in Mecklenburg-Vorpommern from various perspectives. Only the joint consideration of endangerment and conservation value according to our understanding allows the meaningful definition of priorities in nature conservation.

Endangerment

State of the art

The development of conservation assessment systems with objective and comparable criteria has been mainly discussed for Red Lists of species. Examples Germany include Blab et al. (1984), Müller-Motzfeld (1992), Nowak et al. (1994), Schnittler et al. (1994) and Schnittler & Ludwig (1996). The perception or realisation that protecting species without appropriate conservation of habitats is most often unsuccessful, increasingly led to the development of Red Lists for habitat types. Again, examples in Germany include Riecken et al. (1994), von Nordheim & Merck (1995), and von Drachenfels (1996).

First Red Lists of plant communities, as the level between species and habitats have been developed nearly 30 yr ago and their approaches and scientific concepts are discussed e.g. by Bohn (1986), Dierßen (1986), Moravec (1986) and Preising (1986). During the last 25 yr, most of the German federal states have published Red Lists of plant communities: Saxony-Anhalt (Schubert et al. 2001), Saxony (Böhnert et al. 2001), Thuringia (Westhus et al. 1993, Heinrich et al. 2001), Schleswig-Holstein (Dierßen et al. 1988), Lower Saxony (Preising et al. 1990, 1993, 1995, 1997, 2003, Drehwald & Preising 1991, Drehwald 1993), Northrhine-Wesphalia (Verbücheln et al. 1995), Hesse (only grasslands: Bergmeier & Nowak 1988), Saarland (Sauer & Weyrath 1989), Bavaria (Walentowski et al. 1990, 1991a, 1991b, 1992). A list of endangered plant communities in the entire eastern part of Germany was published by Knapp et al. (1985). The first Red List of plant communities for the whole of Germany was developed during a symposium in 2000 in Bonn (Rennwald 2002). An overview of other regional and national Red Lists of plant communities is available in Köppel (2002).

The process of the categorisation in the mentioned lists is conducted with varying intensity. Often, these Red Lists provide just a brief explanation of the categories of endangerment, which in many cases are related to the categories and definitions used in Schnittler et al. (1994) as well as Schnittler & Ludwig 1996), and based on internationally accepted criteria for plants and animals at that time (IUCN 1994). A partial disclosure of the underlying data and the steps of estimation were presented only in some Red Lists (e.g. Walentowski et al. 1990, 1991a, 1991b, 1992, Heinrich et al. 2001, Rennwald 2002).

Outline of our concept

The methodology of the conservation assessment in our opinion should satisfy the following essential requirements:

- Objective logical and comprehensible system.
- Comparability with Red Lists of plant communities for larger areas of consideration, e.g. with Red Lists in other federal states and at the country level.
- Use of Red List categories that correspond to or are at least comparable with the current national and international standards.

Therefore, the presented concept combines benefits from Red Lists for species and habitats as well as conceptual approaches of Red Lists of plant communities of individual federal states, particularly Walentowski et al. (1990, 1991a, 1991b, 1992). Concerning the Red List categories the concept mainly follows the methodological proposals of Schnittler & Ludwig (1996), which were used for many Red Lists of animals and plants in Germany and also in the Federal German Red List of plant communities (Rennwald 2002). The selected aspects used for the endangerment concept are discussed below. To get at a logical, consistent and transparent conservation assessment, in our opinion it is useful to concentrate on a few, clearly defined criteria. In contrast to other Red Lists, these criteria are not only explained verbally, but quantified numerically and connected with a decision matrix. The initial ideas behind this concept have been published by Abdank et al. (2002) and were later adopted with some minor modifications stemming from theoretical considerations and experience from practical applications.

Selection of criteria

A comparison of various Red Lists according to conservation assessment shows similarities, but also differences (Table 1). Each Red List should be based on clearly defined time periods: past, present and future. According to Müller-Motzfeld (1992), the differentiation of a past assessment period (in retrospect), a reference period (at present) and a forecast period (forward looking) is sensible. The past assessment period should be documented with accurate data so that a historical baseline can be compared with the current status. The consideration of a defined forecast period allows the estimation of further development, which is essential for a conservation assessment. While many Red Lists of plant communities consider the development in the past and in the present situation as an evaluation criterion, the question of the threat during the forecast period is usually not included. Partly there is also no clear separation between the development in the past and the current situation, for example in Rennwald (2002: p. 109), where *Flächengröße und Bestandstendenz* (total area and trend) are apparently merged into a single criterion. According to the concept for Red Lists of species (Schnittler & Ludwig 1996), we used the three criteria **current situation** (present), **past trend** (since 1960) and **prognosis**, i.e. threat from human activities within the next 10 yr (future).

Another frequently used criterion for the evaluation of plant communities is the ‘quality trend’ or ‘quality loss’ (see Böhnert et al. 2001). Such changes meight be visible through change in abundance of species or structural changes in the communities. In the literature (Bohn 1986, Dierßen 1986, Dierßen et al. 1988, Westhus et al. 1993, Heinrich et al. 2001, Rennwald 2002), sometimes even two quality criteria ("floristic changes’ and ‘decreasing number of subtypes’) are assessed separately. Regarding species, the determination of the "qualitative risk" (i.e. the consideration of intra-specific genetic loss) is still in its infancy, but will certainly play an increasing role in the future. In contrast, ‘quality loss’ is wildy used as criterion in Red Lists of plant communities and habitat types (see Table 1). However, we prefer a classification aimed to be able to reflect the changes needed for Red List assessement, and important changes in sturucture or species composition should result in leads to another plant community type. For example, in the case of abandonment and eutrophication, typical stands of the *Arrhenatheretum elatioris* turn into the *Artemisia vulgaris*-subtype and finally into the tall herb ruderal community *Tanaceto-Artemisietum vulgaris*. For such cases we used a separate conservation assessment of the different subtypes or the new comunity. However, slight qualitative changes within a plant community cannot be included in our criteria system even for our fine scaled classifcation system, but are described verbally.

Table 1. Criteria used in the Red List of plant communities in Mecklenburg-Vorpommern in comparison to other Red Lists in Germany. Qualitative changes are indirectly reflected by past trend as strong qualitative changes lead to a differen community type, thus, loss of area.

Criteria					
for		**Species** (Schnittler & Ludwig 1996)	**Habitats** (Riecken et al. 1994, von Drachenfels 1996)	**Plant communities** (Heinrich et al. 2001, Rennwald 2002)	**Plant communities M-V**
Loss of area	**present**	Current status	Rarity	Area and trend	Current status
	past	Past trend	Past trend (loss of area)	Threat by loss of area	Past trend
Quality decline		So far impossible	Quantitative development (quality loss)	Changes in species and structure decrease in the variety of subtypes	[Quantitative trend]
Future	prediction	Threat from human activities	not used	not used	Prognosis
Other influencis		Risk factors	Regenerability	Primary/ secondary habitats	–

In the literature, additionalcriteria for risk assessement in Red Lists are discussed: Schnittler & Ludwig (1996) highlighted that ‘biological risk factors’ are applicable only to species. Riecken et al. (1994) and von Drachenfels et al. (1996) use ‘regenerability’ as an additional criterion of the assessement of habitat types. In our concept this is included in the conservation value (see below). The question whether a community type is able to colonize primary and/or secondary sites is considered when assessing future threat and also in the criterion ‘degree of naturalness’ of the conservation value.

Basic principle

Comparing species, plant community and habitats there are similarities and differences in the methodological approaches of conservation assessment. Essential ideas for the development of our methodology have been provided by Schnittler & Ludwig (1996), complemented by Bohn (1986), Bergmeier & Nowak (1988), Walentowski et al.

(1990, 1991a, 1991b, 1992), Westhus et al. (1993), Riecken et al. (1994) and von Drachenfels (1996).

Plant communities are threatened by a complex of factors (see Appendix S3). To provide an adequate characterization of the effects of these factors on plant communities – and thus the assessment of their degree of endangerment, meaningful criteria have to be used (Schnittler & Ludwig 1996). To describe complex issues by one or two aspects it is needed to consider two or more criteria together, so that these must be aggregated (see Bastian & Schreiber 1994: pp. 52 et seq.). The **criteria** are assessed by simple **scales** and then combined in a **system** (Tables 2 and 3). This is done by means of a matrix, which finally provides the Red List category.

Table 2. The three steps of our approach.

Basic principle (indicator approach)		
First step	**Second step**	**Third step**
Criteria	**Scale**	**Criteria system**
Indicators to describe presence past future	**Quantification** of the criteria **Aggregation**	Classification into categories of endangerment by combination of criteria

The tree criteria of endangerment

As essential criteria for evaluating the level of endangerment of plant communities (Red List category sensu stricto), we use the following (Table 3):

- **current status**, i.e. the present number, distribution and size of the community stands in the reference area,
- **past trend** in the past, that means the trend of the occurrence in the assessment period, and
- **prognosis** in the forecast period, i.e. the properties of existing or foreseeable, direct or indirect effects on the survival of a plant community type.

Table 3. Indicators and scales used for the three criteria of endangerment in the *Red List of plant communities in Mecklenburg-Vorpommern*.

Endangerment criteria			
	Current status	**Past trend**	**Prognosis**
	Indicators		
	Total area covered Area covered by the plant community in the area of consideration during the last 10 yr	**Past trend** Comparison of the total area during a defined time range, e.g. in M-V since 1960	**Prognosis** Prediction of the threat from direct and indirect human activities within the next 10 yr
	Spatial distribution Distribution of a plant community within the area under consideration during the last 10 yr		
	general ranges of the criteria		
0	absent	–	–
1	very rare	very high decrease	very high threat
2	rare	high decrease	high threat
3	infrequent	less decrease	moderate threat
4	frequent	more or less unchanged	none
5	common	expanding	support

Current status (present)

The current status of a community was evaluated by considering both the total area covered and the spatial distribution of the stands within the area of consideration (during the last 10 yr). This concept reflects two of the three aspects of rarity introduced by Izco (1998): range size and frequeny. A reference to the number of occurrences, as in Red Lists of species is not meaningful for plant communities as different stands are clearly separated in some associations but not so in others. The two related indicators were defined as follows:

- **Total area covered** (Table 4): This means the area of the currently extant occurrence and is assessed on basis of the available data, e.g. direct records of associations and diagnostic species as well as expert knowledge. A roughly logarithmic scale should avoid estimation errors. Total area is classified according to Table 4 in four size categories, depending on the vegetation height.

Table 4. Scaling of the indicator total area in dependence on the average vegetation height of the stands *h*.

Size categories (dependent on vegetation type)						
Total area (Size of M-V: 23,170 km²)		**very small**	**small**	**moderately large**	**large**
Calculation scheme	average vegetation height *h*	up to 20,000 m × *h*	up to 200,000 m × *h*	up to 2,000,000 m × *h*	more than 2,000,000 m × *h*
Examples:					
Communities on trampled habitats and walls	0.05 m	up to 1,000 m²	up to 1 ha	up to 10 ha	> 10 ha
Heathlands, dry grasslands, peat bogs	0.3 m	up to 6,000 m²	up to 6 ha	up to 60 ha	> 60 ha
Meadows, arable fields	1 m	up to 2 ha	up to 20 ha	up to 2 km²	> 2 km²
Tall herb vegetation, reed beds	2 m	up to 4 ha	up to 40 ha	up to 4 km²	> 4 km²
Shrubland	5 m	up to 10 ha	up to 1 km²	up to 10 km²	> 10 km²
Woodland	30 m	up to 60 ha	up to 6 km²	up to 60 km²	> 60 km²

- **Spatial distribution** (Table 5): The determination of the spatial distribution in the considered area was done by counting the number of geographical defined entities with proven or suspected occurrence of the association. In Germany an alternatively used reference system are entities of topographic maps 1:25,000 or 1:50,000 (TK 25, TK 50) or so-called landscape-units.

Table 5. Scaling of the indicator for the current status in dependence on the proportion of geographicaly defined entities (Ordnance Survey Maps 1:25,000 and 1:1:50,000, landscape units).

Current status				
Proportion	**Number of occupied TK 25**	**Number of occupied TK 50**	**Number of occupied landscape units**	
			terrestrial	**marine**
up to 2%	< 6	< 2	< 2	< 2
3–10%	6–24	2–7	2–5	2
11–33%	25–80	8–23	6–15	3–4
34–66%	81–161	24–46	16–30	5–7
67–100%	> 161	> 46	> 30	> 7
total number in M-V	244*	70*	47	11**

* with ≥ 10 % area in Mecklenburg-Vorpommern
** only marine units with vegetation out of 17 in total

The current status is obtained as the **minimum** of the indicators of area covered and current distribution of a community, i.e. the respective lower value is decisive (see Table 6). Thus, with a large total area covered, the spatial distribution of the community decides whether it is classified as frequent or common.

Table 6. Derivation of the criterion current status as minimum of both indicators (area covered, spatial distribution).

Current status (present)		
Indicators	**Total area covered**	**Spatial distribution**
0 vanished	no recent occurrence	–
1 very rare	total area of stands very small	Occurrence in up to 2% of the geographically defined units
2 rare	total area of stands small	Occurrence in 3–10% of the geographically defined units
3 infrequent	total area of stands moderately large	Occurrence in 11–33% of the geographically defined units
4 frequent	total area of stands large	Occurrence in 34–67% of the geographically defined units
5 common		Occurrence in 67–100% of the geographically defined units

In assessing the current distribution, the study intensity of the individual areas has to be considered. If it is known that a species is largely restricted to a particular association, information about the distribution of taxa (e.g. Benkert et al. 1996) can be used to assess the current status of a community. In addition, maps of the actual occurrences of a vegetation type (based on the classified vegetation plots) and of the potential distribution (derived by overlaying distribution maps of diagnostic species can be used (Dengler 2003, Berg & Dengler 2004).

The period after the last evidence from which a community is categorised as vanished was defined as follows:

- In general, 10 yr are applied as appropriate time range.
- For 'shuttle' communities with generally episodical occurrence and long-lived permanent seed banks, like associations of the classes *Littorelletea* and *Isoeto-Nano-Juncetea*, 40 yr are appropriate (compare Schnittler & Ludwig 1996: p. 717).

If a community classified as vanished is recorded again, the current situation has to be checked again, there is no automatic classification into Category 1.

Past trend (retrospective)

This criterion compares the present extent (i.e. total area covered and/or spatial distribution) of a community with that of a reference period in the past for which sufficient data are available (Table 7). In the project RLPGMV, we used as historical reference time, the year 1960 because at that time large-scale land use changes with profound effects on the vegetation occurred in Eastern Germany (industrialisation of agriculture, intensive use of chemicals in agriculture and forestry, large-scale drainage, urbanisation). Further, there are a relatively large number of phytosociological surveys from the 1940s and 1950s, which can be used for a comparison with the current state.

In nature conservation, often the year 1850 (highest species and habitat diversity in Central Europe) has been used as a historical reference time. This year marks a turning point in land use (invention of the mineral fertilizer). For various reasons this period seem to be too long for the assessement of plant community types, especially because there are no phytosociological data from the 19th century.

Table 7. Scaling of the criterion past trend. The term ‘stands’ is used to summarize area covered and spatial distribution (i.e. number of occupied grid cells).

Past trend (retrospective)	
Indicator	**Change in community extent (area covered or spatial distribution) (since 1960)**
1 very strong decline	Loss of most of the stands (> 50 %), regional complete loss
2 strong decline	Loss of a substantial portion of the stands (25–50 %), local complete loss
3 moderate decline	Loss of a small but significant portion of the stand (10–25 %)
4 constant	More or less constant situation or only minor local loss (± 10 % range)
5 increase	Increase of stands (> 10%)

Prognosis (future)

This criterion describes the prediction of the current and foreseeable human impact on the plant communities during a forecast period, e.g. in Mecklenburg-Vorpommern 10 yr. We choose this period because (1) it is reasonably manageable and, (2) we recommend to update the Red List within this period in terms of a permanent environmental monitoring. Considered are direct effects like excavation, reforestation, peat mining, construction and land-use abandonment as well as any large-scale indirect factors, e.g. eutrophication, lowering of the ground water table, loss of potential habitat types. A separate assessment of indirect and direct threats (like in Schnittler & Ludwig 1996) is not implemented because of its difficulties. Natural processes like coastal dynamics are not defined as a threat in the sense used here. The indicator ‘prognosis’ is quantified in a five-step scale (proportion of stands concerned, see Table 8). Relevant is the summary effect of all positive and negative impacts.

Table 8. Scaling of the criterion prognosis.

Prognosis (future)	
Indicator	**Direct and indirect human impact**
1 very strong	very strong negative direct or indirect impacts; most (> 50%) of the stands and/or of the corresponding habitat type are affected
2 strong	strong negative direct or indirect impacts; large part (25-50%) of the stands and/or of the corresponding habitat type are affected
3 low	low negative direct or indirect impacts; a small, but remarkable part (10-25%) of the stands and/or of the corresponding habitat type are affected
4 no	no negative direct or indirect impacts; effects are not recognisable and/or not more than 10% of the stands and of the corresponding habitat type are affected
5 support	Support of particular habitat quality or quantity by human impact, e.g. creation of replacement habitats

System of criteria and Red List categories

For the systematic derivation of each Red List category, a **criteria system** (matrix) was developed (Table 9). The overall endangerment represents a combination of the three criteria described in the previous section: **current status** – **past trend** – **prognosis**. The matrix follows a few basic principles starting from the definitions of the criteria,.leading to a systematic and transparent construction. The criterion current status is attributed a greater importance for the derivation of the overall threat than the past trend or future prognosis. Therefore, the matrix represents a diagonally-symmetrical structure, based on the following four rules:

- Current status 0 results in Red List category 0.
- The Red List category equals the category of current status, if the sum of the categories of past trend and prognosis is 4 or 5. The category NT corresponds to the current status level 4, the category * (least concern) the current status level 5.
- The Red List category is increased by one compared to the category of current status for levels 2–5 when the sum of past trend and prognosis categories is 2 or 3. When the current status is 1, the Red List category remains 1.
- The Red List category is reduced by one compared to the category of current status for levels1–4 when the sum of past trend and prognosis categories exceeds 5. When the current status is 5, the Red List category is * (least concern).

If the past trend is constant or increasing (4 or 5) and there is no negative prognosis (4 or 5), the following additional rules are applied:

- If the current status is 1, the Red List category R (naturally rare, but not actually threatened) is assigned.
- If the current status is 2–5, the Red List category * (least concern) is assigned when the past trend was constant and *< (least concern and expanding) when the past trend was positive.

Table 9. Matrix for the determination of Red List categories, based on the three criteria current status, past trend and prognosis.

Current status	Past trend	Prognosis				
		1	2	3	4	5
0	1	0	0	0	0	0
1	1	1	1	1	1	2
	2	1	1	1	2	2
	3	1	1	2	2	2
	4	1	2	2	R	R
	5	2	2	2	R	R
2	1	1	1	2	2	3
	2	1	2	2	3	3
	3	2	2	3	3	3
	4	2	3	3	*	*
	5	3	3	3	*<	*<
3	1	2	2	3	3	NT
	2	2	3	3	NT	NT
	3	3	3	NT	NT	NT
	4	3	NT	NT	*	*
	5	NT	NT	NT	*<	*<
4	1	3	3	NT	NT	*
	2	3	NT	NT	*	*
	3	NT	NT	*	*	*
	4	NT	*	*	*	*
	5	*	*	*	*<	*<
5	1	NT	NT	*	*	*
	2	NT	*	*	*	*
	3	*	*	*	*	*
	4	*	*	*	*	*
	5	*	*	*	*<	*<

For the naming of the Red List categories we use, as far as possible, the terminology of the international IUCN categories (IUCN 1994, 2001) as well as adaptations of Schnittler & Ludwig (1996). These categories also correspond to the terms used in the *Red List of plant communities in Germany* (Rennwald 2002). Only in the definition of the Red List category NT (near threatened) do we differ from Schnittler & Ludwig (1996) and Rennwald (2002). While these authors (and most of the recent Red Lists) include all non-threatened, but declining species and plant communities in this category (see Schnittler & Ludwig 1996: p. 722), we define, as mentioned above, the 'near threatened' category analogous to the categories 1–3.

These following verbal descriptions illustrate the idea of each category, while decisive for the assignment of communities to categories is the matrix (Table 9) alone.

0 **Vanished**: plant communities, known from the area under consideration in former times, but not recorded since an appropriate time (for definition, see above) IUCN: *EX – extinct*).

1 **Critically endangered:** Very rare plant communities, the last of whose stands in Mecklenburg-Vorpommern will likely disappear in the foreseeable future if the threat factors continue and no conservation measures take effect. This category also includes rare communities if they are subject to a (very) high anthropogenic threat and have a strongly declining trend (IUCN: *CR* – 1994: *critical*, 2001: *critically endangered*).

2 **Endangered:** Very rare to rare plant communities that are bearing a high risk of disappearance in the future if the threat factors continue and no conservation measures take effect. This category includes infrequent communities if they are subject to a (very) high anthropogenic threat and have a strongly declining development (IUCN: *EN – endangered*).

3 **Vulnerable:** Rare to infrequent plant communities that are facing a high threat in the foreseeable future. This category includes frequent communities if they are subject to a (very) high anthropogenic threat and have a strongly declining trend (IUCN: *VU – vulnerable*).

R **Very rare but not currently threatened:** Very rare plant communities that are neither threatened nor declining. Because of rarity and small total area, they are potentially endangered by unforeseen events (IUCN 1994: SU – susceptible, 2001: no equivalent).

NT **Near threatened** (German version: V – *Vorwarnliste*): Moderately to very frequent plant communities, currently not endangered, but under a high anthropogenic threat or with a strongly negative trend, so that under persistence of the threat a reclassification to category 3 in the foreseeable future will become necessary (IUCN: *NT – near threatened*).

***** **Least concern:** Frequent to very frequent plant communities, currently not endangered, but declining and/or threatened by human activities as well as rare or infrequent plant communities, currently not threatened by human activities nor declining (IUCN 1994: *not threatened*, 2001: *LC – least concern*).

***<** **Least concern and expanding:** Currently not threatened, rare to very frequent expanding plant communities (IUCN: no equivalent).

If no clear assignment to a specific category is possible due to insufficient data of one or more criteria, the resulting Red List category is 'calculated' for all these combinations. Should the calculation result in different potential categories of overall endangerment, the **additional categories** # and D are used, introduced by Schnittler & Ludwig (1996: 716) for cases of **inadequate data** (see Table 109): # is used if the calculated Red List categories are all within the 'red-listed' categories (e.g. 2–3). D is used if the calculated Red List categories are partly within and partly outside the red-listed categories (e.g. 3–*). We further use * in cases where the calculated Red List categories outside of the Red List categories fluctuate (e.g. NT–*):

**Probably threatened** (German version: G – *Gefährdung anzunehmen*): Communities that are likely endangered, but where the available data do not allow the classification into one of the precise Red List categories (IUCN: no equivalent).

D **Data deficient:** Communities for which the knowledge of past trend and currend status is insufficient to classify into another category. In this case, research and monitoring is necessary, because an overall endangerment cannot be excluded (IUCN: *DD – data deficient*).

Table 10. Use of the additional categories of inadequate data PT = probably threatened, * = not threatened (without differentiation) and D = data deficient.

Red-listed communities			
0	Vanished	#	D
1	Critically endangered		
2	Endangered		
3	Vulnerable		
R	Naturally rare, but not actually threatened		
Non red-listed communities			
NT	Near threatened	*	
*	Least concern		
*<	Least concern and expanding		

Conservation value

General approach

The selection of criteria to evaluate the conservation value should meet various requirements:

- Easy and transparent determination.
- Concentration on a few criteria that cover all relevant aspects.
- Selection of criteria which are largely independent of each other.
- Independence from the conservation assessment and its criteria.

After a long and controversal discussion among the project members, we selected three criteria: **relevance for species conservation**, **degree of naturalness** and **global relevance**, following Paulson & Jeschke (1996), Müller-Motzfeld et al. (1997) and Schnittler & Günther (1999)

In the literature, many more possible criteria have been proposed for the assessment of conservation value, including potential for regeneration, maturity, aesthetic value, cultural-historical relevance, occurrence in conservation areas, rarity, species diversity, structural diversity, area, representivity for a landscape unit. We decided not to use these because they are:

- closely correlatated with degree of naturalness (e.g. potential for regeneration, maturity),
- already included in the subcritiera of endangerment (e.g. occurrence in conservation areas, rarity, representativity for a landscape unit),
- hard to quantify (e.g. aesthetic value, cultural-historical relevance), and/or
- questionable as a value *per se* (e.g. total species richness [particularly when without reference to an area size], structural diversity).

The three selected criteria

Relevance for species conservation

This criterion describes the role of a plant community as habitat for endangered plant species. We defined the relevance for species conservation as the mean density of endangered species within a plant community, using the recent regional Red List status of vascular plants (Fukarek 1992), bryophytes (Berg & Wiehle 1992), lichens (Litterski 1996) and stoneworts (Schmidt 1994).

To determine the numerical value of the relevance for species conservation for an association or a subtype, the percentage constancy of each red-listed species occurring in a community type was multiplied by the weighting factor from Table 11 and then summed across all species. Accordingly a numeric relevance level of 1,000, for example, means that in a typical relevé of this vegetation type, 10 red-listed species of the categories 3 or #, or five of category 2 or R occur, respectively. The applicability of such a calculation depends on the representability of the floristic information for every vegetation unit (Jansen et al. 2012).

Table 11. Weighting factors for different categories of the Red List of species for determining the relevance for species conservation.

Weighting factors of Red List categories		
Factor	**Category**	**Verbal explanation**
4	0, +	extinct or missing
	1, !!!	critically endangered
2	2, !!	endangered
	R, 4, (!!!)	rare
1	3, !	vulnerable
	#, ?	assumed threat

The resulting values of the relevance for species conservation ranged from 0 to 4,111, with a median of 245.5. These values more or less follow an exponential distribution (Fig. 1).

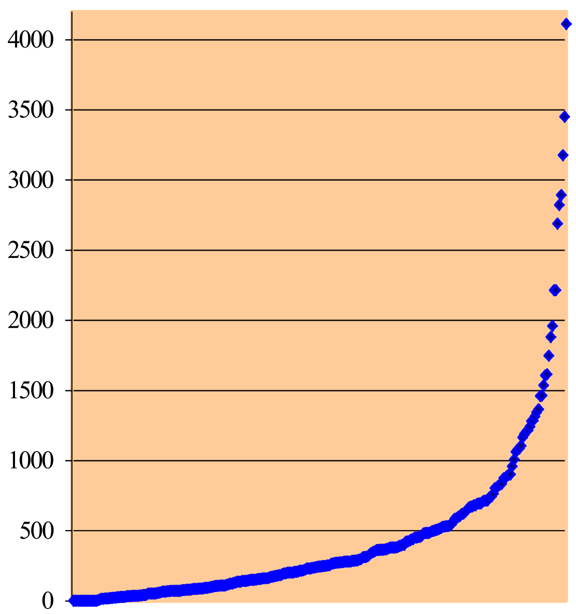

Fig. 1. Distribution of the numerical relevance for species conservation when ordering the 285 associations in ascending order.

In order to reach the desired five-point scale, the numerical relevance for species conservation values had to be classified. A variety of approaches, e.g. the normative appointment of category limits was discussed. Since these category limits are subjective, a simple mathematical approach was taken. The associations were sorted in an ascending order of the sums of the content of threat, and then divided in five (approximately) equally sized groups (quintiles). This approach resulted in an approximate "logarithmic" classification (Table 12), in which two consecutive category limits differ approximately by a factor of 2.

Table 12. Classification of the relevance for species conservation with a 5-point scale.

Relevance for species conservation	
Category	**Sum**
1	from 670
2	330 to 669
3	170 to 329
4	70 to 169
5	to 69

Table 13. The five categories of the degree of naturalness.

Degree of naturalness					
Category		**Formations**	**Definition (land use, habitat features)**	**Degree of human impact (hemeroby)**	**Examples**
1	**Natural**	Unmodified remains of natural vegetation	No management, natural habitat dynamics	Lacking human impact (oligohemerobic)	Vegetation of natural forests, unspoiled water bodies, living bogs and semi-natural coastal landscapes (dunes, brackish reedbeds, active cliffs)
2	**Semi-natural**	Modified remains of natural vegetation	Land use without direct habitat impects and without compensation of material deficiencies (e.g. fertilization)	Weak human impact (oligo- to mesohemerobic)	Managed natural forests with low timber harvest, spontaneous shrub grows, pioneer and intermediate forests, slightly eutrophic water bodies, low intensity used fen meadows and grasslands, older fallows of anthropogenic communities.
3	**Pre-industrial anthropogenic**	Managed vegetation originating in pre-industrial times	Land use with substantial habitat influence and occasional material compensation by organic fertilization	Moderate human impact (Mesohemerobic)	Managed forests of predominantly native species, spontaneous secondary forests on anthropogenic soil, dwarf shrub heaths, permanent grassland and pastures, natural fallows of strong anthropogenic communities
4	**Industrial anthropogenic**	Managed vegetation originating in industrial times	Intensive land use on the basis of habitat changes (irrigation and drainage, strong mineral fertilization, liming, biocides, grading, ploughing), anthropogenic habitat dynamics, allochthonous substance loads	Strong human impact (euhemerobic)	Intensive and disturbed secondary forests, intensive grassland, lawns, arable fields and gardens with weeds, recent mine trailings, waste places
5	**Artificial**	Largely human-controlled vegetation	Complete habitat conversion, chemical treatments, cover with non-native substrata	Excessive human impact (polyhemerobic)	Weed communities on artifical or highly degraded soils, arable fields and gardens

Naturalness (absence of human impact)

Numerous concepts for quantifying naturalness have been published (in Germany e.g. Dierschke 1984). The degree of naturalness is closely linked to the 'hemeroby' as a measure of human impact on the vegetation (e.g. Sukopp 1997). Hemeroby thus represents the reciprocal value of naturalness. Hemeroby can be quantified by the average indicator value for hemeroby of the vascular plant species occurring in the syntaxon (Kowarik 1988, Frank & Klotz 1990, Kowarik 1999, Hill et al. 2002). As the cultural influence is important for the development of vegetation types it is also possible to estimate the degree of naturalness using the type and intensity of land use. This third approach has been applied in the project RLPGMV by connecting the degree of naturalness to the hemeroby levels according to Sukopp (1997) (Table 13).

Global relevance

The responsibility for the maintenance of a particular plant community results in the project RLPGMV of the proportion of the respective distribution area of a syntaxon, attributable to the area under consideration (Table 14). If a direct assessment of the global syntaxon distribution was impossible due to limited knowledge, the number of diagnostic species with a small world distribution range was considered („stenochorous taxa') as an alternative. The term 'Central European' for the Central European floral region in Table 14 is used according to Meusel & Jäger (1992); main distribution means the center of the world range.

Table 14. The criterion global relevance divided in five categories. The highest value counts.

Global relevance			
Category		Estimated proportion of the wold range of vegetation type in the study area	Ranges of diagnostic species
1	Highest global relevance	more than 1/2	several stenochorous taxa with small ranges
2	High global relevance	1/5 – 1/2	one stenochorous taxon with a small range
3	Moderate global relevance	1/20 – 1/5	several taxa with their main distribution in Central Europe
4	Low global relevance	1/50 – 1/20	one taxon with a main distribution in Central Europe
5	Least global relevance	Less than 1/50	all taxa with a wider distribution, mainly Eurasian

Determination of the conservation value

The conservation value is derived from the combination of the three criteria presented. Although initially a greater weight of the naturalness had been discussed (Berg et al. 2001), we now suggest that all three criteria should be treated equally. This approach one hand is a compromise between different valuation preferences and on the other hand results in a more transparent evaluation. The conservation value is calculated based on two simple rules:

- The conservation value corresponds to the highest category (i.e. lowest value) if this appears at least in two of the three criteria.
- The conservation value equals the highest category (i.e. lowest value) plus 1 if this appears in only one of the three criteria.

These two rules have been implemented in a matrix (Table 15) to determine the conservation value for combination of criteria. If a plant community regularly occurs at sites with different degrees of naturalness, the calculations use the value of the lowest degree of naturalness, i.e. the highest value.

Table 15. Matrix for determination of the conservation values.

relevance for species	Degree of naturalness	Global relevance				
		1	2	3	4	5
1	1	1	1	1	1	1
	2	1	2	2	2	2
	3	1	2	2	2	2
	4	1	2	2	2	2
	5	1	2	2	2	2
2	1	1	2	2	2	2
	2	2	2	2	2	2
	3	2	2	3	3	3
	4	2	2	3	3	3
	5	2	2	3	3	3
3	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	3	3
	4	2	3	3	4	4
	5	2	3	3	4	4
4	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	4	4
	4	2	3	4	4	4
	5	2	3	4	4	5
5	1	1	2	2	2	2
	2	2	2	3	3	3
	3	2	3	3	4	4
	4	2	3	4	4	5
	5	2	3	4	5	5

The following terms are used for naming the conservation value categories (Table 16):

Table 16. Terms used for the conservation values.

Conservation value	
1	highest conservation value
2	high conservation value
3	medium conservation value
4	low conservation value
5	lowest conservation value

Need for action

A central goal of any Red List is to imorove conservation actions concerning the particular conservation objects. In the past, it was often assumed that the need for action automatically increases with the degree of endangerment. Particularly in plant communities, however, the conservation value has to be taken into account as a second aspect to define priorities. The need for action is determined using a matrix (Table 17) with the following priority levels:

- **!!! Priority need for action** for communities of the Red List categories 1–2 if the sum of Red List category and conservation value is 3 or a less.
- **!!: High need for action** for communities of the Red List categories 1–3 if the sum of Red List category and conservation value is 4 or 5.
- **!: Moderate need for action** for communities of the Red List categories 1–3 if the sum of Red List category and conservation value is more than 5 as well as for communities at least categorised as conservation value 1–3 within the category near threatened (NT).
- In case of category of endangerment #, the need for action equals the value for Red List category 3 (because this is the most positive possible category). At the same time there is need for research.
- **[!!!], [!!], [!]: Restoration demand** is given when a plant community has vanished. The demand is decreasing with increasing time after the last stand of the community type has been destroyed because the chance of re-establishing a community becomes lower and lower with time. For recently vanished communities, the restoration demand equals that of communities of Red List category 1.
- **(!!!), (!!), (!): Potential need for action** is given in rare communities of the Red List category R. Concrete action is only required if a currently not foreseeable threat occurs.
- **?: Need for research** concerning the actual endangerment exists for communities with insufficient data (D).
- **–: No need for action** for all other communities.

Table 17. Matrix to determine the need for action by combining the Red List category and the conservation value. The inner values mean: [!!!], [!!], [!] = restoration demand; !!! = priority need for action; !! = high need for action; ! = moderate need for action; • (!!!), (!!), (!): potential need for action; – = no need for action; ? = need for research.

Combination of endangerment and conservation value = need for action										
Vulnera-bility / **Cons. value**	**0** vanished	**1** critically endangered	**2** endangered	**3** vulnerable	**#** probably threatened	**R** rare	**NT** near threatened	***** Least concern	**<** expanding	**D** data deficient
1 highest value	**[!!!]**	**!!!**	**!!!**	**!!**	**!!**	**(!!!)**	**!**	**–**	**–**	**?**
2 high value	**[!!!]**	**!!!**	**!!**	**!!**	**!!**	**(!!!)**	**!**	**–**	**–**	**?**
3 medium value	**[!!]**	**!!**	**!!**	**!**	**!**	**(!!)**	**!**	**–**	**–**	**?**
4 low value	**[!!]**	**!!**	**!**	**!**	**!**	**(!!)**	**–**	**–**	**–**	**?**
5 lowest value	**[!]**	**!**	**!**	**!**	**!**	**(!)**	**–**	**–**	**–**	**?**

References

Abdank, A., Berg, C. & Dengler, J. 2002 [‘2000’]. Gefährdungseinstufung von Pflanzengesellschaften – Vorgehen bei der „Roten Liste der Pflanzengesellschaften von Mecklenburg-Vorpommern’. *Schriftenreihe für Vegetationskunde* 35: 49–63.

Abdank, A., Berg, C. & Koska, I. 2004a. Gefährdung. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) *Die Pflanzenge-*

sellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband, pp. 60–67.Weissdorn, Jena, DE.

Abdank, A., Dengler, J. & Berg, C. 2004b. Handlungsbedarf. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband,* pp. 72–73. Weissdorn, Jena, DE.

Bastian, O. & Schreiber, K.-F. 1994. *Analyse und ökologische Bewertung der Landschaft*. Fischer, Jena, DE

Benkert, D., Fukarek, F. & Korsch, H. (eds.) 1996. *Verbreitungsatlas der Farn- und Blütenpflanzen Ostdeutschlands*. Fischer, Jena, DE.

Berg, C. & Dengler, J. 2004. Von der Datenbank zur Regionalmonografie – Erfahrungen aus dem Projekt „Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung'. *Berichte der Reinhold-Tüxen-Gesellschaft* 16: 29–56.

Berg, C. & Wiehle, W. 1992. *Rote Liste der gefährdeten Moose Mecklenburg-Vorpommerns – 1. Fassung*. Umweltministerium Mecklenburg-Vorpommern, Schwerin, DE.

Berg, C., Timmermann, T. & Dengler, J. 2001. Methodische Ansätze für eine „Rote Liste der Pflanzengesellschaften Mecklenburg-Vorpommerns': Naturschutzfachliche Wertstufe. *Berichte der Reinhold-Tüxen-Gesellschaft* 13: 217–221.

Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) 2004a. *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*. Weissdorn, Jena, DE.

Berg, C., Timmermann, T. & Dengler, J. 2004b. Naturschutzfachliche Wertstufe. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*, pp. 67–72. Weissdorn, Jena, DE.

Bergmeier, E. & Nowak, B. 1988. Rote Liste der Pflanzengesellschaften der Wiesen und Weiden Hessens. *Vogel und Umwelt* 5: 23–33.

Blab, J., Nowak, E. & Trautmann, W. 1984 (eds.). Rote Liste der gefährdeten Tiere und Pflanzen in der Bundesrepublik Deutschland. 4th ed. Kilda, Greven, DE.

Bohn, U. 1986. Konzept und Richtlinien zur Erarbeitung einer Roten Liste der Pflanzengesellschaften der Bundesrepublik Deutschlands und West-Berlins. *Schriftenreihe für Vegetationskunde* 18: 41–48.

Böhnert, W., Gutte, P. & Schmidt, P. A. 2001. *Verzeichnis und Rote Liste der Pflanzengesellschaften Sachsens*. Sächsisches Landesamt für Umwelt und Geologie, Dresden, DE.

Dengler, J. 2003. Entwicklung und Bewertung neuer Ansätze in der Pflanzensoziologie unter besonderer Berücksichtigung der Vegetationsklassifikation. *Archiv naturwissenschaftlicher Dissertationen* 14: 1–297.

Dierschke, H. 1984. Natürlichkeitsgrade von Pflanzengesellschaften unter besonderer Berücksichtigung der Vegetation Mitteleuropas. *Phytocoenologia* 12: 173–184.

Dierßen, K. 1986. Zur Erarbeitung, Problematik und Anwendung der Roten Liste der Pflanzengesellschaften Schleswig-Holsteins. *Schriftenreihe für Vegetationskunde* 18: 35–40.

Dierßen, K., von Glahn, H., Härdtle, W., Höper, H., Mierwald, U., Schrautzer, J. & Wolf, A. 1988. Rote Liste der Pflanzengesellschaften Schleswig-Holsteins. 2nd ed. *Schriftenreihe des Landesamtes für Naturschutz und Landschaftspflege Schleswig-Holstein* 6: 1–157.

Drehwald, U. 1993. Die Pflanzengesellschaften Niedersachsens – Flechtengesellschaften. *Naturschutz und Landschaftspflege in Niedersachsen* 20(10): 1–124.

Drehwald, U. & Preising, E. 1991. Die Pflanzengesellschaften Niedersachsens – Moosgesellschaften. *Naturschutz und Landschaftspflege in Niedersachsen* 20(9): 1–204.

Frank, D. & Klotz, S. 1990. *Biologisch-ökologische Daten zur Flora der DDR*. 2nd ed. Martin-Luther University Halle-Wittenberg, Halle (Saale), DE.

Fukarek, F. (1992): Rote Liste der gefährdeten Höheren Pflanzen Mecklenburg-Vorpommerns – 4. Fassung, Stand: Oktober 1991. – Umweltministerium Mecklenburg-Vorpommern, Schwerin.

Heinrich, W., Klotz, S., Korsch, H., Marstaller, R., Pfützenreuter, S., Samietz, R., Scholz, P., Türk, W. & Westhus, W. 2001. Rote Liste der Pflanzengesellschaften Thüringens. *Naturschutzreport* 18: 377–409.

Hill, M. O., Roy, D. B., & Thompson, K. 2002. Hemeroby, urbanity and ruderality: bioindicators of disturbance and human impact. Journal of Applied Ecology, 39(5), 708–720.

IUCN [International Union for Conservation of Nature and Natural Resources] 1994 (eds.). *Red List categories. Prepared by the IUCN species survival commission*. IUCN, Gland, CH.

IUCN [International Union for Conservation of Nature and Natural Resources] 2001 (eds.). *Red List categories and criteria. Version 3.1*. IUCN, Gland, CH.

Izco, J. 1998. Types of rarity of plant communities. *Journal of Vegetation Science* 9: 641–646.

Jansen, F., Dengler, J. & Berg, C. 2012. VegMV – the vegetation database of Mecklenburg-Vorpommern. *Biodiversity & Ecology* 4: 149–160.

Knapp, H. D., Jeschke, L. & Succow, M. 1985. *Gefährdete Pflanzengesellschaften auf dem Territorium der DDR*. Kulturbund der DDR, Berlin, DE

Köppel, C. 2002 ['2000']. Die Rote Listen der Pflanzengesellschaften in Europa – eine Literatur-Synopse. *Schriftenreihe für Vegetationskunde* 35: 83–87.

Kowarik, I. 1988. Zum menschlichen Einfluß auf Flora und Vegetation. Theoretische Konzepte und ein Quantifizierungsansatz am Beispiel von Berlin (West). *Landschaftsentwicklung und Umweltforschung* 56: 1–280.

Kowarik, I. 1999. Natürlichkeit, Naturnähe und Hemerobie als Bewertungskriterien. In: Konold, W., Böcker, R. & Hampicke, U. (eds.) *Handbuch für Naturschutz und Landschaftspflege*. V-2.1: pp. 1–18. Ecomed, Landsberg, DE.

Litterski, B. 1996. *Rote Liste der gefährdeten Flechten Mecklenburg–Vorpommerns – 1. Fassung – Stand: Juni 1995*. MLN, Schwerin, DE.

Meusel, H. & Jäger, E.J. 1992 (eds.). *Chorologie der zentraleuropäischen Flora – Band III – Karten, Literatur, Register*. Fischer, Jena, DE

Moravec, J. 1986. Die Rote Liste der Pflanzengesellschaften der Tschechischen Sozialistischen Republik und ihre Erarbeitung. *Schriftenreihe für Vegetationskunde* 18: 9–17.

Müller-Motzfeld, G. 1992. Rote Liste der Laufkäfer von Mecklenburg-Vopommern (Expertenumfrage contra Computerfaunistik). – *Naturschutzarbeit in Mecklenburg-Vorpommern* 35: 21–30.

Müller-Motzfeld, G., Schmidt, J., Berg, C. (1997): Zur Raumbedeutsamkeit der Vorkommen gefährdeter Tier und Pflanzenarten in Mecklenburg-Vorpommern. *Natur und Naturschutz in Mecklenburg-Vorpommern* 33: 42–70, Greifswald.

Nowak, E., Blab, J. & Bless, R. 1994. Rote Liste der gefährdeten Wirbeltiere in Deutschland. *Schriftenreihe für Landschaftspflege und Naturschutz* 42: 1–190.

Paulson, C. & Jeschke, L. 1996. Bewertung von Vegetationsformen und Biotoptypen für den Naturschutz aus vegetationskundlicher Sicht. *Naturschutzarbeit in Mecklenburg-Vorpommern* 39: 5–14.

Preising, E. 1986. Rote Liste der Pflanzengesellschaften in Niedersachsen – Erarbeitung, Anwendung, Erfahrungen. *Schriftenreihe für Vegetationskunde* 18: 29–34.

Preising, E., Vahle, H.-C., Brandes, D., Hofmeister, H., Tüxen, J. & Weber, H.E. 1990. Die Pflanzengesellschaften Niedersachsens – Salzpflanzengesellschaften der Meeresküste und des Binnenlandes – Wasser- und Sumpfpflanzengesellschaften des Süßwassers. *Naturschutz und Landschaftspflege in Niedersachsen* 20(7–8): 1–163.

Preising, E., Vahle, H.-C., Brandes, D., Hofmeister, H., Tüxen, J. & Weber, H. E. 1993. Die Pflanzengesellschaften Niedersachsens – 4. Ruderale Staudenfluren und Saumgesellschaften. *Naturschutz und Landschaftspflege in Niedersachsen* 20(4): 1–88.

Preising, E., Vahle, H.-C., Brandes, D., Hofmeister, H., Tüxen, J. & Weber, H. E. 1995. Die Pflanzengesellschaften Niedersachsens – Einjährige ruderale Pionier-, Tritt- und Ackerwildkrautgesellschaften.*Naturschutz und Landschaftspflege in Niedersachsen* 20(6): 1–94.

Preising, E., Vahle, H.-C., Brandes, D., Hofmeister, H., Tüxen, J. & Weber, H.E. 1997. Die Pflanzengesellschaften Niedersachsens – Rasen-, Fels und Geröllgesellschaften. *Naturschutz und Landschaftspflege in Niedersachsen* 20(5): 1–146.

Preising, E., Weber, H.E. & Vahle, H.-C. 2003. Die Pflanzengesellschaften Niedersachsens – Bestandsentwicklung, Gefährdung und Schutzprobleme – Wälder und Gebüsche. *Naturschutz und Landschaftspflege in Niedersachsen* 20(2): 1–139.

Rennwald, E. (ed.) 2002 [‘2000’]. Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands – mit Datenservice auf CD-ROM. *Schriftenreihe für Vegetationskunde* 35: 1–800.

Riecken, U., Ries, U. & Ssymank, A. 1994. Rote Liste der gefährdeten Biotoptypen der Bundesrepublik Deutschland. *Schriftenreihe für Landschaftspflege und Naturschutz* 41: 1–184.

Sauer, E. & Weyrath, U. 1989. Rote Liste der Pflanzengesellschaften. In: Minister für Umwelt des Saarlandes (ed.) *Rote Liste – Bedrohte Tier- und Pflanzenarten im Saarland*, pp. 120–121. Ministerium für Umwelt des Saarlandes, Saarbrücken, DE.

Schmidt, D. 1994. *Rote Liste der gefährdeten Armleuchteralgen (Charophyten) Mecklenburg-Vorpommerns – 1. Fassung – Stand: November 1993*. Umweltministerium Mecklenburg-Vorpommern, Schwerin, DE.

Schnittler, M. & Günther, K.F. 1999. Central European vascular plants requiring priority conservation measures – an analysis from national Red Lists and distribution maps. *Biodiversity and Conservation* 8: 891–925.

Schnittler, M. & Ludwig, G. 1996. Zur Methodik der Erstellung Roter Listen. *Schriftenreihe für Vegetationskunde* 28: 709–739.

Schnittler, M., Ludwig, G., Pretscher, P. & Boye, P. 1994. Konzeption der Roten Listen der in Deutschland gefährdeten Tier- und Pflanzenarten – unter Berücksichtigung der neuen internationalen Kategorien. *Natur und Landschaft* 69: 451–459.

Schubert, R., Frank, D., Herdam, H., Hilbig, W., Jage, H., Karste, G., Kison, H.-U., Klotz, S., Peterson, J., Reichhoff, L., Stöcker, G., Weinitschke, H., Wegner, U. & Westhus, W. 2001. Rote Liste der Pflanzengesellschaften Sachsen-Anhalts. *Mitteilungen zur Floristischen Kartierung Sachsen-Anhalt Sonderheft* 2: 681–686.

Sukopp, H. 1997. Indikatoren für Naturnähe. In: Bundesministerin für Umwelt, Naturschutz und Reaktorsicherheit (ed.) *Ökologie. Grundlage einer nachhaltigen Entwicklung in Deutschland. Tagungsband zum Fachgespräch 29. und 30. April 1997*: pp. 71–84, Wissenschaftszentrum, Bonn, DE.

Verbücheln, G., Hinterlang, D., Pardey, A., Pott, R., Raabe, U. & van de Weyer, K 1995. Rote Liste der Pflanzengesellschaften in Nordrhein-Westfalen. *LÖBF-Schriftenreihe* 5: 1–318.

von Drachenfels, O. 1996. Rote Liste der gefährdeten Biotoptypen in Niedersachsen – Bestandsentwicklung und Gefährdungsursachen der Biotop- und Ökosystemtypen sowie ihrer Komplexe – Stand Januar 1996. *Naturschutz und Landschaftspflege in Niedersachsen* 34: 1–146.

von Nordheim, H. & Merck, T. 1995. Rote Listen der Biotoptypen, Tier- und Pflanzenarten des deutschen Wattenmeer- und Nordseebereichs. *Schriftenreihe für Landschaftspflege und Naturschutz* 44: 1–139.

Walentowski, H., Raab, B. & Zahlheimer, W.A. 1990. Vorläufige Rote Liste der in Bayern nachgewiesenen oder zu erwartenden Pflanzengesellschaften – I. Naturnahe Wälder und Gebüsche. – *Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der Heimischen Flora, Beiheft* 61: 1–62.

Walentowski, H., Raab, B. & Zahlheimer, W.A. 1991a. Vorläufige Rote Liste der in Bayern nachgewiesenen oder zu erwartenden Pflanzengesellschaften – 2. Wirtschaftswiesen und Unkrautgesellschaften. *Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der Heimischen Flora, Beiheft* 62(1): 1–85.

Walentowski, H., Raab, B. & Zahlheimer, W.A. 1991b. Vorläufige Rote Liste der in Bayern nachgewiesenen oder zu erwartenden Pflanzengesellschaften – 3. Außeralpine Felsvegetation, Trockenrasen, Borstgrasrasen und Heidekraut-Gestrüppe, wärmebedürftige Saumgesellschaften. *Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der Heimischen Flora, Beiheft* 62(2): 1–63.

Walentowski, H., Raab, B. & Zahlheimer, W.A. 1992. Vorläufige Rote Liste der in Bayern nachgewiesenen oder zu erwartenden Pflanzengesellschaften – IV. Wasser-, Verlandungs- und Moorgesellschaften, Vegetation oberhalb der alpinen Baumgrenze und alpigene Schwemmlingsfluren (Mit Gesamtübersicht Teil I bis IV) *Berichte der Bayerischen Botanischen Gesellschaft zur Erforschung der Heimischen Flora, Beiheft* 7: 1–170.

Westhus, W., Heinrich, W., Klotz, S., Korsch, H., Marstaller, R., Pfützenreuter, S. & Samietz, R. 1993. Die Pflanzengesellschaften Thüringens. *Naturschutzreport* 6: 1–349.

Appendix S2. Tabular overview of all plant communities (associations and subtypes) of Mecklenburg-Vorpommern with data on endangerment, conservation value and need for action.

The table was originally published in German language by Abdank et al. (2004). For all plant communities of the federal state (for syntaxonomic overview, see Appendix S4), Red List categories and conservation values are listed with all their subcriteria in five-step scales as well as the derived need for action (for detailed definitions, see Appendix S1). Habitat types of Annex 1 of the EU Habitats Directive are given by their habitat numbers. The '§' symbol marks plant communities that are protected legally according to § 20 of the Nature Conservation Law of Mecklenburg-Vorpommern (LNatG). 'Pro parte' means that additional conditions (e.g. geomorphological criteria) must be met to be included in this particular habitat type. A star (*) marks the priority habitat types, a star in parentheses ((*)) means that only orchid-rich stands belong to that priority habitat type.

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
01.1.1.1	Riccietum fluitantis	2	3	4	**3**	5	2	5	**3**	**!**		3150 3160	§	
01.1.1.2	Lemno-Utricularietum	2	3	3	**3**	3	2	5	**3**	**!**		3150 3160	§	§
01.1.2.1	Stratiotetum aloidis	3	2	3	**3**	3	3	4	**3**	**!**		3150	§	§
01.1.3.1	Lemno-Spirodeletum polyrhizae	5	4	4	*****	5	2-3	5	**4**	–		3150	§	§
01.1.3.2	Wolffio-Lemnetum gibbae	4	4	4	*****	5	4	5	**5**	–			§	§
01.1.3.3	Ceratophylletum submersi	4	4	4	*****	4	4	5	**4**	–		3150	§	§
02.1.1.1	Zosteretum marinae	3	3	3	**NT**	5	1	5	**2**	**!**		1110 **1150*** 1160		§
03.1.1.1	Charetum canescentis	2	2	2	**2**	2	1	2	**2**	**!!**		1110 **1150*** 1160	§	
03.1.1.2	Charetum horrido-balticae	1	1	2	**1**	1	1	1	**1**	**!!!**		1110 **1150*** 1160	§	
03.1.2.1	Chaetomorphato lini-Ruppietum cirrhosae	3	3	4	**NT**	4	2	5	**3**	**!**		1110 **1150*** 1160	§	
03.1.2.2	Ruppietum maritimae	2	3	3	**3**	4	2	5	**3**	**!**		1110 **1150*** 1160	§	
03.1.2.3	Ranunculetum baudotii	1	4	4	**R**	5	3	3	**3**	**(!!)**		1130 **1150***		§
04.1.1.1	Nitelletum capillaris	1	1	2	**1**	2	1	2	**2**	**!!!**	3130		§	
04.1.2.1	Nitello-Vaucherietum dichotomae	1	1	2	**1**	3	1	3	**2**	**!!!**		3130 3140	§	
04.2.1.1	Nitellopsietum obtusae	2	1	2	**2**	2	1	4	**2**	**!!**	3140		§	
04.2.1.2	Najadetum intermediae	3	2	3	**3**	3	1-2	4	**3**	**!**	3140		§	
04.2.1.3	Charetum contrariae	2	1	2	**2**	2	1	5	**2**	**!!**	3140		§	
04.2.1.4	Magno-Charetum hispidae	2	1	2	**2**	2	2	5	**2**	**!!**	3140		§	§
04.2.1.5	Charetum asperae	2	1	2	**2**	3	2	5	**3**	**!!**		1130 **1150*** 3140	§	§
04.2.2.1	Charetum vulgaris	3	3	4	**NT**	3	3	5	**3**	**!**		3140	§	§
05.1.1.1	Hottonietum palustris	3	4	4	*****	3	3	3	**3**	–		3150	§	§
05.1.1.2	Ranunculetum aquatilis	3	3	3	**NT**	3	3	3	**3**	**!**		3150	§	§
05.1.1.3	Ranunculo trichophylli-Callitrichetum	4	3	3	*****	2	3	2	**2**	–		3260		§
05.2.1.1	Potamogetonetum natantis	4	4	4	*****	4	3	5	**4**	–		3150	§	§
05.2.1.2	Nymphaeo albae-Nupharetum	4	3	4	*****	4	2	4	**3**	–		3150	§	§
05.2.1.3	Nupharetum pumilae	1	1	1	**1**	2	1	5	**2**	**!!!**		3160	§	
05.2.1.4	Nymphoidetum peltatae	1	2	3	**1**	2	2	5	**2**	**!!!**		3150	§	§
05.2.2.1	Potamogetono perfoliati-Ranunculetum circinati	5	4	4	*****	4	3	5	**4**	–		3150 3260 1130 **1150***	§	
05.2.2.2	Potamogetonetum lucentis	4	3	4	*****	3	2	5	**3**	–		3150 3260	§	§
05.2.2.3	Potamogetonetum praelongi	2	1	3	**2**	2	2	5	**2**	**!!**		3150	§	
05.2.2.4	Sparganio-Potamogetonetum pectinati	3	2	3	**3**	4	2	5	**3**	**!**	3260		§	
05.2.3.1	Potamogetonetum trichoidis	2	2	3	**2**	3	3	4	**3**	**!!**		3150	§	
05.2.3.2	Charo asperae-Potamogetonetum filiformis	1	1	2	**1**	1	2	5	**2**	**!!!**		3140 3150	§	
06.1.1.1	Salicornietum europaeae	2	1	4	**2**	3	1-2	4	**3**	**!!**	1310	**1340***	§	§
06.1.1.1a	– Typical subtype	1	1	4	**1**	3	1-2	4	**3**	**!!**	1310	**1340***	§	§
06.1.1.1b	– *Spergularia salina* subtype	2	1	4	**2**	3	1-2	4	**3**	**!!**	1310	**1340***	§	§

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
07.1.1.1	Juncetum bufonii	4	3	3	*	3	4	4	4	–		3132		§
07.1.1.2	Polygono-Eleocharietum ovatae	1	2	2	1	1	2	5	2	!!!	3132		§	
07.1.1.3	Eleocharito acicularis-Limoselletum aquaticae	2	2	2	2	2	2-3	5	3	!!	3132		§	
07.1.1.4	Elatino alsinastri-Juncetum tenageiae	1	2	1	1	2	3-4	3	3	!!	3132			§
07.1.2.1	Stellario uliginosi-Scirpetum setacei	2	2	2	2	2	3	5	3	!!		3132		§
07.1.2.2	Hypno lindbergii-Cicendietum filiformis	1	1	2	1	1	1-2	3	2	!!!		2192 3132	§	
07.1.2.3	Digitario ischaemi-Illecebretum verticillati	1	1	2	1	1	2	3	2	!!!		3132		§
08.1.1.1	Polygonetum hydropiperis	3	4	4	*	4	4	5	4	–		3270		§
08.1.1.2	Corrigiolo litoralis-Bidentetum radiatae	2	4	4	*	4	2	4	3	–	3270		§	
08.1.1.3	Rumici maritimi-Ranunculetum scelerati	3	4	4	*	5	4	5	5	–				§
08.1.1.4	Alopecuretum aequalis	2	3	4	3	3	3	5	3	!		3270		§
08.1.1.5	Bidentetum cernuae	3	4	4	*	5	4	5	5	–				§
08.1.2.1	Chenopodietum rubri	2	4	4	*	4	2-5	5	5	–		3270		§
08.1.2.1a	– Elbe subtype	2	4	4	*	4	2	4	3	–	3270		§	
08.1.2.1b	– lake and pond subtype	2	4	4	*	5	4-5	5	5	–				§
08.1.2.2	Xanthio albini-Chenopodietum rubri	2	4	4	*	2	2	3	2	–	3270		§	
08.1.2.3	Chenopodio polyspermi-Corrigioletum litoralis	2	3	4	3	2	2	3	2	!!	3270		§	
09.1.1.1	Isoeto lacustris-Lobelietum dortmannae	0	1	1	0	1	1	4	1	[!!!]		3110 3131	§	
09.1.2.1	Pilularietum globuliferae	1	1	2	1	2	2	3	2	!!!	3131		§	§
09.1.2.2	Samolo valerandi-Littorelletum uniflorae	1	1	1	1	1	1-2	3	2	!!!	3131			§
09.1.3.1	Myriophyllo alterniflori-Littorelletum uniflorae	2	1	2	2	1	1	3	1	!!!	3131		§	
09.1.3.2	Littorello uniflorae-Eleocharitetum acicularis	2	2	2	2	2	2	5	2	!!	3131		§	§
09.1.3.3	Ranunculo flammulae-Juncetum bulbosi	2	3	3	3	2	1-3	3	3	!		3131	§	§
10.1.1.1	Cratoneuretum commutati	1	3	3	2	3	1-2	5	3	!!	7220*		§	
10.1.2.1	Caricetum remotae	2	3	4	3	4	1-2	5	3	!			§	
11.1.1.1	Lycopodiello inundatae-Rhynchosporetum fuscae	1	1	1	1	1	1-2	3	2	!!!	4010	7150	§	§
11.1.1.2	Ericetum tetralicis	2	2	2	2	1	2	4	2	!!	4010	2193	§	
11.1.1.3	Empetro nigri-Ericetum tetralicis	2	2	2	2	1	1-2	4	2	!!	4010	2193	§	
11.2.1.1	Sphagno magellanici-Ledetum palustris	2	1	1	1	2	1	3	2	!!!	7140	7110	§	
11.2.1.2	Sphagnetum magellanici	2	2	1	1	2	1-2	4	2	!!!	7110	7140	§	
11.2.2.1	Caricetum limosae	2	1	1	1	2	1	4	2	!!!	7150	7140	§	
11.2.2.2	Sphagno tenelli-Rhynchosporetum albae	2	1	2	2	2	1-2	4	2	!!	7150	7140	§	
11.3.1.1	Sphagno recurvi-Eriophoretum vaginati	3	3	3	NT	3	1-2	4	3	!	7140	7120	§	
11.3.1.1a	– *Eriophorum vaginatum* subtype	3	3	3	NT	3	1-2	4	3	!	7140	7120	§	
11.3.1.1b	– *Eriophorum angustifolium* subtype	3	2	3	3	3	1-2	4	3	!	7140	7120	§	
12.1.1.1	Sphagno recurvi-Caricetum rostratae	3	3	3	NT	1	1	3	1	!	7140		§	
12.1.1.2	Carici canescentis-Agrostietum caninae	3	3	3	NT	2	1-2	4	2	!	7140		§	
12.1.1.2a	– Typical subtype	3	3	3	NT	2	1-2	4	2	!	7140		§	
12.1.1.2b	– *Calla palustris* subtype	2	3	3	3	2	1-2	4	2	!!	7140		§	
12.2.1.1	Caricetum lasiocarpae	1	1	1	1	1	1	5	1	!!!	7140		§	
12.2.1.2	Caricetum diandrae	3	1	2	2	1	1	4	1	!!!	7140		§	
12.2.1.3	Peucedano palustris-Caricetum lasiocarpae	3	2	2	3	1	1-2	5	2	!!		7140 **7210***	§	
12.2.2.1	Junco-Caricetum nigrae	2	2	2	2	1	1-2	4	2	!!		7140	§	
12.2.2.2	Caricetum serotinae	2	1	1	1	1	1-2	4	2	!!!	7150		§	
12.2.3.1	Scorpidio scorpioidis--Caricetum elatae	1	1	1	1	1	1	5	1	!!!	**7210***	7230	§	
12.2.3.2	Cladietum marisci	3	2	2	3	1	1-2	5	2	!!		**7210*** 7230	§	
12.2.4.1	Junco subnodulosi-Schoenetum nigricantis	1	1	1	1	1	1-2	2	2	!!!	7230		§	
12.2.4.2	Eleocharitetum pauciflorae	1	1	2	1	1	1-2	4	2	!!!	7230		§	
12.2.4.3	Juncetum alpini	1	1	2	1	1	1-2	5	2	!!!	7230		§	§
12.3.1.1	Sphagno teretis-Menyanthetum trifoliatae	1	1	1	1	1	1	3	1	!!!		7140 7230	§	
12.3.1.2	Parnassio palustris-Caricetum	1	1	2	1	1	1-2	3	2	!!!		7140 7230	§	
12.3.2.1	Paludello palustri-Caricetum	1	1	1	1	1	1	3	1	!!!	7230		§	
12.3.2.2	Schoenetum ferruginei	1	1	2	1	1	1-2	3	2	!!!	7230		§	
12.3.2.3	Juncetum subnodulosi	1	1	2	1	1	1-2	3	2	!!!	7230		§	
13.1.1.1	Cicuto virosae-Caricetum pseudocyperi	3	2	4	NT	3	1	5	2	!			§	
13.1.1.2	Scirpo lacustris-Phragmitetum australis	5	4	5	*	4	1-2	5	3	–			§	
13.1.2.1	Caricetum vesicariae	3	3	4	NT	3	1-2	5	3	!		7140	§	

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
13.1.2.2	Oenantho aquaticae-Rorippetum amphibiae	3	4	5	*	4	1-3	5	**4**	–			§	
13.1.2.3	Eleocharitetum palustris	2	4	4	*	3	1-2	4	**3**	–			§	
13.1.3.1	Sagittario sagittifoliae-Sparganietum simplicis	3	4	4	*	3	1-3	5	**3**	–			§	
13.1.3.2	Polygono hydropiperis-Veronicetum anagallidis-aquaticae	4	4	4	*	3	1-3	5	**3**	–			§	
13.2.1.1	Glycerio-Sparganietum neglecti	3	4	4	*	5	1-3	5	**4**	–			§	
13.2.1.2	Nasturtietum microphylli	3	4	4	*	5	1-3	5	**4**	–			§	
13.3.1.1	Valeriano-Caricetum paniculatae	2	2	2	**2**	2	1-2	4	**2**	**!!**			§	
13.4.1.1	Phalarido arundinaceae-Petasitetum officinalis	3	5	4	***<**	5	1-3	5	**4**	–		6431		§
13.4.1.2	Filipendulo ulmariae-Geranietum palustris	5	5	5	***<**	3	1-3	5	**3**	–		6431		§
13.4.2.1	Urtico dioicae-Calystegietum sepium	5	5	5	***<**	4	1-3	5	**4**	–		6431		§
13.4.2.2	Soncho palustris-Archangelicetum officinalis	3	4	5	*	3	1-3	5	**3**	–		6431		§
13.4.3.1	Veronico longifoliae-Scutellarietum hastifoliae	1-2	3-5	4	**D**	2	1-2	5	**2**	**?**		6431		§
13.4.3.2	Cuscuto europaeae-Calystegietum sepium	2	5	5	***<**	2	1-2	5	**2**	–		6431		§
13.4.3.3	Urtico dioicae-Leonuretum marrubiastri	2	4	4	*	2	1-3	5	**3**	–		6431		§
14.1.1.1	Centaurio vulgaris-Saginetum moniliformis	1	3	3	**2**	2	1	2	**2**	**!!**	1330	2192	§	
14.1.1.2	Sagino maritimae-Cochlearietum danicae	1	3	4	**2**	1	2	2	**2**	**!!**	1310	1330	§	
14.1.2.1	Hordeetum secalini	1	3	4	**2**	1	2	4	**2**	**!!**	1330		§	
14.1.2.2	Blysmetum rufi	1	2	2	**1**	1	2	5	**2**	**!!!**	1330		§	
14.1.2.3	Juncetum gerardii	3	1	4	**3**	2	2-3	5	**3**	**!**	1330	**1340***	§	
14.1.2.3a	– typical subtype	3	1	4	**3**	2	3	5	**3**	**!**	1330	**1340***	§	
14.1.2.3b	– *Lotus tenuis* subtypeg	3	1	4	**3**	2	2	5	**2**	**!!**	1330	**1340***	§	
14.1.2.3c	– *Eleocharis uniglumis* subtype	3	4	4	*	2	3	5	**3**	–	1330	**1340***	§	
14.1.2.4	Oenantho lachenalii-Juncetum maritimi	2	2	3	**2**	1	2	3	**2**	**!!**	1330		§	
14.1.2.5	Junco ancipis-Caricetum extensae	1	2	4	**2**	1	2	2	**2**	**!!**	1330		§	
14.1.2.6	Artemisietum maritimae	2	3	2	**2**	2	1-2	5	**2**	**!!**	1330		§	
14.1.2.6a	– typical subtype	1	3	2	**1**	1	1-2	3	**2**	**!!!**	1330		§	
14.1.2.6b	– *Potentilla anserina* subtype	2	3	2	**2**	2	1-2	5	**2**	**!!**	1330		§	
14.1.2.7	Limonietum vulgaris	1	3	2	**1**	1	2	3	**2**	**!!!**	1330		§	
14.2.1.1	Puccinellietum maritimae	2	3	4	**3**	2	1-2	5	**2**	**!!**	1330	**1340***	§	
14.2.1.1a	– typical subtype	2	3	4	**3**	2	1	4	**2**	**!!**	1330	**1340***	§	
14.2.1.1b	– *Agrostis stolonifera* subtype	2	3	4	**3**	3	2	5	**3**	**!**	1330	**1340***	§	
14.2.2.1	Puccinellietum distantis	3	3	4	**NT**	3	1-3	5	**3**	**!**	1330	**1340***	§	
14.2.2.1a	– *Polygonum aviculare* subtype	3	3	4	**NT**	4	3	5	**4**	–	1330	**1340***	§	
14.2.2.1b	– typical subtype	3	3	4	**NT**	3	3	5	**3**	**!**	1330	**1340***	§	
14.2.2.1c	– *Salicornia europaea* subtype	2	3	4	**3**	3	1	4	**2**	**!!**	1330	**1340***	§	
14.3.1.1	Scirpetum maritimi	3	3	4	**NT**	3	1-2	5	**3**	**!**		**1340***	§	§
14.3.1.1a	– *Cladophora* subtype	2	3	4	**3**	5	1	5	**2**	**!!**		**1340***	§	§
14.3.1.1b	– typical subtype	3	3	4	**NT**	4	1	5	**2**	**!**		**1340***	§	§
14.3.1.1c	– *Eleocharis uniglumis* subtype	2	4	4	*	3	2	5	**3**	–		**1340***	§	§
14.3.1.1d	– *Hippuris vulgaris* subtype	1	3	3	**2**	1	2	4	**2**	**!!**		**1340***	§	§
14.3.1.1e	– *Galium palustre* subtype	3	3	4	**NT**	3	2	4	**3**	**!**		**1340***	§	§
14.3.1.1f	– *Samolus valerandi* subtype	2	3	4	**3**	2	1	2	**2**	**!!**		**1340***	§	§
15.1.1.1	Atriplicetum littoralis	3	3	3	**NT**	3	1-2	3	**3**	**!**	1210		§	
15.1.1.1a	– *Aster tripolium* subtype	2	2	4	**3**	3	1	2	**2**	**!!**	1210		§	
15.1.1.1b	– *Chenopodium rubrum* subtype	2	3	4	**3**	4	1-2	3	**3**	**!**	1210		§	
15.1.1.1c	– typical subtype	3	4	3	**NT**	4	1-2	3	**3**	**!**	1210		§	
15.1.1.1d	– *Salsola kali* subtype	2	2	2	**2**	3	1	3	**2**	**!!**	1210		§	
15.1.2.1	Elymetum laxi	3	4	4	*	4	1-3	3	**3**	–		1220		§
15.1.3.1	Cakiletum maritimae	3	2	2	**3**	3	1	3	**2**	**!!**	1210		§	
15.1.3.1a	– *Atriplex littoralis* subtype	2	2	2	**2**	3	1	2	**2**	**!!**	1210		§	
15.1.3.1b	– typical subtype	3	3	2	**3**	3	1	3	**2**	**!!**	1210		§	
15.1.3.2	Honckenyetum peploidis	2	4	3	**3**	4	1-2	5	**3**	**!**	1220	2110		§
15.1.3.3	Honckenyo peploidis-Crambetum maritimae	1	4	2	**2**	1	1	3	**1**	**!!!**		1220		§
15.1.3.3a	– typical subtype	1	4	1	**1**	1	1	3	**1**	**!!!**	1220			§
15.1.3.3b	– *Ammophila arenaria* subtype	1	4	2	**2**	1	1	3	**1**	**!!!**	2120			§
16.1.1.1	Poetum annuae	5	4	4	*	5	4-5	5	**5**	–				

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
16.1.1.2	Polygono arenastri-Lepidietum ruderalis	3	4	4	*****	5	5	5	**5**	–				
16.1.1.3	Bryo argentei-Saginetum procumbentis	5	4	4	*****	5	5	5	**5**	–				
16.1.1.4	Rumici acetosellae-Spergularietum rubrae	2	4	4	*****	5	4-5	5	**5**	–				
16.1.1.5	Eragrostio minoris-Polygonetum arenastri	2	4	4	*****	5	5	5	**5**	–				
16.1.2.1	Hyoscyamo nigri-Malvetum neglectae	3	2	2	**3**	5	4	5	**5**	**!**				
16.1.2.2	Matricario discoideae-Anthemidetum cotulae	1	2	2	**1**	5	4	5	**5**	**!**				
16.1.2.3	Poo annuae-Coronopetum squamati	1	2	2	**1**	3	4-5	5	**4**	**!!**				
17.1.1.1	Brometum sterilis	4	4	4	*****	4	4	5	**4**	–				
17.1.1.2	Hordeetum murini	3	4	4	*****	5	4-5	5	**5**	–				
17.1.2.1	Conyzo canandensis-Lactucetum serriolae	5	4	4	*****	5	4-5	5	**5**	–				
17.1.2.2	Descurainietum sophiae	3	4	4	*****	5	4	5	**5**	–				
17.1.2.3	Chenopodietum stricti	2	4-5	4	*****	5	4	5	**5**	–				
17.1.2.4	Atriplicetum nitentis	2	4	4	*****	5	4	5	**5**	–				
17.2.1.1	Linario-Brometum tectorum	5	5	4	***<**	4	2-5	5	**5**	–				
17.2.1.2	Plantagini indicae-Senecionetum viscosi	1	4	4	**R**	5	4-5	5	**5**	**(!)**				
17.2.1.3	Bromo tectorum-Corispermetum leptopteri	2-3	5	4	***<**	4	2-5	4	**4**	–				§
17.2.1.4	Conyzo canandensis-Amaranthetum retroflexi	3	5	4	***<**	5	5	5	**5**	–				
18.1.1.1	Scleranthо annui-Arnoseridetum minimae	3	1	1	**2**	3	4	3	**3**	**!!**				
18.1.1.2	Papaveretum argemones	4	1	1	**3**	4	4	3	**4**	**!**				
18.1.1.3	Spergulo arvensis-Chrysanthemetum segetum	4	1	1	**3**	4	4	4	**4**	**!**				
18.2.1.1	Aphano arvensis-Matricarietum chamomillae	5	1	1	**NT**	4	4	4	**4**	–				
18.2.1.1a	– typical subtype	5	1	1	**NT**	4	4	4	**4**	–				
18.2.1.1b	– *Consolida regalis* subtype	4	1	1	**3**	4	4	4	**4**	**!**				
18.2.2.1	Galeopsietum speciosae	3	1	1	**2**	4	4	5	**4**	**!**				
18.3.1.1	Euphorbio exiguae-Melandrietum noctiflori	3	1	1	**2**	2	4	2	**2**	**!!**				
18.3.2.1	Veronico persicae-Lamietum hybridi	4	1	1	**3**	4	4	4	**4**	**!**				
18.3.2.1a	– typical subtype	4	1	1	**3**	4	4	4	**4**	**!**				
18.3.2.1b	– *Silene noctiflora* subtype	3	1	1	**2**	4	4	4	**4**	**!**				
19.1.1.1	Corydalidetum luteae	2	4	2	**3**	5	4	4	**4**	**!**				
19.2.1.1	Asplenietum trichomano-rutae-murariae	2	3	2	**2**	3	4	5	**4**	**!**				
19.2.2.1	Cystopteridetum fragilis	1	2	2	**1**	2	4	5	**3**	**!!**				
20.1.1.1	Polygalo vulgaris-Nardetum strictae	1	1	1	**1**	1	3	4	**2**	**!!!**	**6230***		§	
20.1.1.2	Juncetum squarrosi	1	2	1	**1**	1	3	3	**2**	**!!!**	**6230***		§	
20.2.1.1	Galio harcynici-Deschampsietum flexuosae	3	5	2	**NT**	3	3	4	**3**	**!**	4030		§	
20.2.1.2	Genisto pilosae-Callunetum vulgaris	2	2	2	**2**	2	3	5	**3**	**!!**	4030	2310	§	
20.2.1.2a	– *Cladonia* subtype	1	2	2	**1**	3	3	5	**3**	**!!**	4030	2310	§	
20.2.1.2b	– typical subtype	2	2	2	**2**	2	3	4	**3**	**!!**	4030	2310	§	
20.2.1.2c	– *Molinia caerulea* subtype	1	1	2	**1**	1	3	4	**2**	**!!!**	4030	2310	§	
20.2.2.1	Salici repentis-Empetretum nigri	2	2	2	**2**	3	2	3	**3**	**!!**	**2150***		§	
20.2.2.2	Hieracio umbellati-Empetretum nigri	2	2	2	**2**	3	1	4	**2**	**!!**	**2140***		§	
21.1.1.1	Corniculario aculeatae-Corynephoretum canescentis	4	3	2	**NT**	3	1-2	4	**3**	**!**		**2131*** 2330	§	§
21.1.1.2	Agrostietum vinealis	2	?	3	**D**	3	2	4	**3**	**?**		2330	§	§
21.1.1.3	Caricetum arenariae	3	3	3	**NT**	3	1-2	3	**3**	**!**		**2131*** 2330	§	§
21.2.1.1	Tortulo ruraliformis-Phleetum arenarii	1	1	3	**1**	2	1-2	3	**2**	**!!!**	**2131***		§	§
21.3.1.1	Carici arenariae-Airetum praecocis	2	?	4	**D**	3	2-3	4	**3**	**?**		**2137*** 2330	§	§
21.3.1.2	Airo-Festucetum	2	3	3	**3**	2	3	4	**3**	**!**		2330	§	
21.3.1.3	Vulpietum myuri	1	1-4	3	**#**	3	4-5	5	**4**	**!**				§
21.4.1.1	Galio veri-Festucetum capillatae	1-2	1-4	3	**#**	2	2-3	5	**3**	**!**		**2131***	§	§
21.4.2.1	Thymo pulegioidis-Festucetum ovinae	3	2	2	**3**	3	2-3	4	**3**	**!**		**2131*** 2330	§	§
21.4.3.1	Diantho deltoidis-Armerietum elongatae	4	3	2	**NT**	2	2-3	3	**3**	**!**		**2131*** 2330	§	§
21.4.3.2	Sileno otitae-Festucetum brevipilae	3	2	2	**3**	1	2-3	3	**2**	**!!**	6214 **(*)**	2330 1230	§	§
21.4.3.3	Allio schoenoprasi-Caricetum praecocis	1	3	3	**2**	2	2-3	2	**2**	**!!**		2330 *6120	§	
21.5.1.1	Sileno conicae-Cerastietum semidecandri	1	2	2	**1**	3	3-4	3	**3**	**!!**	**6120***		§	
21.5.2.1	Helichryso arenarii-Jasionetum litoralis	4	4	3	*****	3	1-2	3	**3**	–		**2131* 6120***	§	§
21.5.2.2	Festucetum polesicae	2	3	3	**3**	2	1-2	2	**2**	**!!**	**6120***	**2131***	§	§
21.6.1.1	Poo compressae-Saxifragetum tridactylitae	1-2	5	4	**D**	5	4-5	4	**5**	**?**				§

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
22.1.1.1	Solidagini virgaureae-Helictotrichetum pratensis	3	2	2	**3**	1	1-3	2	**2**	**!!**	6212 **(*)**		§	
22.1.2.1	Adonido vernalis-Brachypodietum pinnati	2	2	2	**2**	1	2-3	4	**2**	**!!**	**6240***		§	
22.2.1.1	Potentillo arenariae-Stipetum capillatae	1	1-2	1-2	**1**	1	2	5	**2**	**!!!**	**6240***		§	
23.1.1.1	Arrhenatheretum elatioris	5	2	3	*****	3	3	5	**3**	**–**		6510		
23.1.1.1a	– *Briza media* subtype	3	1	3	**3**	2	3	5	**3**	**!**	6510			
23.1.1.1b	– typical subtype	4	2	3	**NT**	4	3	5	**4**	**–**				
23.1.1.1c	– *Artemisia vulgaris* subtype	5	5	5	***<**	4	3	5	**4**	**–**				
23.1.2.1	Lolio perennis-Cynosuretum cristati	5	3	4	*****	4	3	5	**4**	**–**				
23.1.2.1a	– *Briza media* subtype	3	2	3	**3**	2	3	5	**3**	**!**				
23.1.2.1b	– typical subtype	5	3	4	*****	4	3	5	**4**	**–**				
23.1.2.2	Plantagini majoris-Lolietum perennis	5	5	3	*****	5	4	5	**5**	**–**				
23.1.2.2a	– typical subtype	5	5	3	*****	5	4	5	**5**	**–**				
23.1.2.2b	– *Plantago major* subtype	5	5	3	*****	4	4	5	**4**	**–**				
23.1.2.2c	– *Equisetum arvense* subtype	5	5	3	*****	5	4	4	**4**	**–**				
23.1.2.3	Festuco rubrae-Crepidetum capillaris	5	4	4	*****	4	4	5	**4**	**–**				
23.2.1.1	Ranunculo repentis-Alopecuretum geniculati	5	5	4	***<**	3	3-4	4	**4**	**–**				§
23.2.1.2	Festuco arundinaceae-Potentilletum anserinae	3	3	3	**NT**	3	3	3	**3**	**!**				§
23.2.2.1	Deschampsio cespitosae-Heracleetum sibirici	2	3	3	**3**	1	3	5	**2**	**!!**		6440		§
23.2.2.1a	– *Briza media* subtype	1	2	1	**1**	1	3	5	**2**	**!!!**		6440		§
23.2.2.1b	– typical subtype	2	3	3	**3**	1	3	5	**2**	**!!**		6440		§
23.2.2.2	Cnidio dubii-Deschampsietum cespitosae	1	2	2	**1**	1	3	3	**2**	**!!!**	6440		§	
23.3.1.1	Selino carvifoliae-Molinietum caeruleae	1	1	2	**1**	1	2	2	**2**	**!!!**	6410		§	
23.3.2.1	Cirsio oleracei-Angelicetum sylvestris	3	3	3	**NT**	1	3	5	**2**	**!**			§	
23.3.2.1a	– *Trollius europaeus* subtype	1	3	2	**1**	1	3	2	**2**	**!!!**			§	
23.3.2.1b	– typical subtype	3	3	3	**NT**	3	3	5	**3**	**!**			§	
23.3.2.2	Scirpetum sylvatici	2	2	3	**2**	1	2	4	**2**	**!!**			§	
24.1.1.1	Elymo arenarii-Agropyretum juncei	3	2	1	**2**	4	1	3	**2**	**!!**	2110		§	
24.1.1.1a	– *Salsola kali* subtype	2	2	1	**2**	4	1	3	**2**	**!!**	2110		§	
24.1.1.1b	– typical subtype	3	3	2	**3**	5	1	3	**2**	**!!**	2110		§	
24.1.2.1	Elymo arenarii-Ammophiletum arenariae	3	4	3	**NT**	4	1-3	4	**4**	**–**	2120	2110	§	§
24.1.2.1a	– *Honckenya peploides* subtype	2	3	1	**2**	4	1-2	3	**3**	**!!**	2120	2110	§	§
24.1.2.1b	– typical subtype	3	4	5	*****	5	1-3	4	**4**	**–**	2120	2110	§	§
24.1.2.1c	– *Festuca rubra* subsp. *arenaria* subtype	3	5	4	***<**	4	1-2	3	**3**	**–**	2120	2110	§	§
24.1.2.2	Festucetum arenariae	3	4	4	*****	5	1-3	2	**3**	**–**	2120		§	
25.1.1.1	Lathyro linifolii-Melampyretum pratensis	3-4	3-4	3	**D**	3	2-3	5	**3**	**?**				§
25.1.2.1	Teucrio scorodoniae-Silenetum nutantis	1	3	2	**1**	3	2	5	**3**	**!!**				§
25.1.2.2	Pteridietum aquilini	3	4	4-5	*****	2	2-3	5	**3**	**–**				
25.1.3.1	Veronico chamaedryos-Stellarietum holosteae	3-4	4	4	*****	5	2-3	5	**4**	**–**				
25.1.3.2	Potentillo sterilis-Conopodietum majoris	1	1-3	2	**1**	2	2-3	4	**3**	**!!**				
25.2.1.1	Agrimonio eupatoriae-Vicietum cassubicae	1	2	2	**1**	3	2-3	4	**3**	**!!**				§
25.2.1.2	Agrimonio eupatoriae-Trifolietum medii	3	3	3	**NT**	2	2-3	4	**3**	**!**				§
25.2.1.3	Agrostio capillaris-Agrimonietum procerae	1	3	3	**2**	2	2-3	4	**3**	**!!**				§
25.2.1.4	Trifolio medii-Melampyretum nemorosi	2	3	3	**3**	4	2-3	4	**4**	**!**				§
25.2.1.5	Galio albi-Astragaletum glycyphylli	2	4	4	*****	3	2-3	5	**3**	**–**				§
25.2.1.6	Rubo caesii-Origanetum vulgaris	3	?	3	**D**	2	2-3	5	**3**	**?**				§
25.3.1.1	Artemisio campestris-Vincetoxicetum hirundinariae	2	3	3	**3**	2	1-2	3	**2**	**!!**		1230		§
25.3.1.2	Sileno nutantis-Libanotidetum montanae	1	3	3	**2**	2	1-2	2	**2**	**!!**		1230		§
25.3.2.1	Geranio sanguinei-Trifolietum alpestris	2	3	3	**3**	1	2-3	4	**2**	**!!**				§
25.3.2.2	Arrhenathero elatioris-Peucedanetum oreoselini	3	4	3	**NT**	1	2-3	3	**2**	**!**				§
25.3.2.3	Thalictro mini-Geranietum sanguinei	1	2	2	**1**	1	2-3	4	**2**	**!!!**				§
25.3.2.4	Campanulo bononiensis-Vicietum tenuifoliae	1	3	3	**2**	1	2-3	5	**2**	**!!**				§
25.3.2.5	Trifolio medii-Astragaletum ciceris	2	3	3	**3**	1	2-3	3	**2**	**!!**				§
26.1.1.1	Senecioni-Epilobietum angustifolii	4	4	3	*****	4	3-4	5	**4**	**–**				

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
26.1.1.2	Corydalido claviculatae-Epilobietum angustifolii	1	5	5	**R**	2	3-4	5	**3**	**(!!)**				
26.1.2.1	Epilobium montanum-Scrophularia nodosa-Gesellschaft	3	4	4	*****	5	3	5	**4**	–				
26.1.2.2	Arctietum nemorosi	3	4	4	*****	5	3	5	**4**	–				
26.2.1.1	Epilobio montani-Geranietum robertiani	5	4	4	*****	4	3-4	5	**4**	–				
26.2.1.2	Alliario petiolatae-Chaerophylletum temuli	3	4	4	*****	4	3	5	**4**	–				
26.2.1.3	Torilidetum japonicae	3	4	4	*****	5	3	5	**4**	–				
26.2.1.4	Stachyo sylvaticae-Dipsacetum pilosi	2	4	4	*****	4	3	4	**4**	–				
26.2.2.1	Urtico dioicae-Aegopodietum podagrariae	5	4	4	*****	5	3	5	**4**	–				
26.2.2.2	Urtico dioicae-Cruciatetum laevipedis	2	4	3	**3**	5	3	5	**4**	**!**				
26.2.2.3	Chaerophylletum bulbosi	1	4	4	**R**	5	3	5	**4**	**(!!)**				
26.2.2.4	Urtico dioicae-Parietarietum officinalis	1	4	3	**2**	2	3-4	5	**3**	**!!**				
26.2.2.5	Polygonetum cuspidati	3	5	5	***<**	5	3-4	5	**5**	–				
26.3.1.1	Leonuro cardiacae-Ballotetum nigrae	3	4	4	*****	4	3-4	4	**4**	–				
26.3.1.2	Hyoscyamo nigri-Conietum maculati	2	4	4	*****	5	3-4	5	**5**	–				
26.3.1.3	Arctio lappae-Artemisietum vulgaris	3	4	4	*****	5	4	5	**5**	–				
26.3.1.4	Arctio tomentosi-Rumicetum obtusifolii	3	4	4	*****	5	4	5	**5**	–				
26.3.1.5	Poo trivialis-Rumicetum obtusifolii	5	5	5	***<**	5	3-5	5	**5**	–				
26.4.1.1	Rubo caesii-Calamagrostietum epigeji	5	5	5	***<**	4	1-5	5	**5**	–		1230		§
26.4.1.2	Elymo repentis-Rubetum caesii	4	4	4	*****	4	1-4	5	**4**	–		1220 1230		§
26.4.1.3	Petasitetum spurii	1	3	3	**2**	4	1-4	3	**4**	**!**		1230 2120		§
26.5.1.1	Convolvulo arvensis-Agropyretum repentis	5	5	5	***<**	5	1-5	5	**5**	–		1230		§
26.5.1.2	Falcario vulgaris-Agropyretum repentis	2	4	4	*****	4	4	4	**4**	–				
26.5.1.3	Diplotaxio tenuifoliae-Agropyretum repentis	1	4	5	**R**	5	4-5	5	**5**	**(!)**				
26.5.1.4	Asparago officinalis-Chondrilletum junceae	2	4	3	**3**	4	4	4	**4**	**!**				
26.5.1.5	Agropyro repentis-Rumicetum thyrsiflori	3	5	4	***<**	4	4-5	5	**5**	–				
26.5.1.6	Convolvulo arvensis-Caricetum hirtae	3	4	4	*****	5	4-5	5	**5**	–				
26.5.1.7	Convolvulo arvensis-Brometum inermis	3	5	5	***<**	5	3-5	5	**5**	–				
26.5.1.8	Bromus carinatus-Gesellschaft	2	5	5	***<**	5	4-5	3	**4**	–				
26.5.2.1	Poetum humili-compressae	3	4	4	*****	4	4-5	5	**5**	–				
26.5.2.2	Poo compressae-Tussilaginetum farfarae	4	4	4	*****	5	1-5	5	**5**	–		1230		§
26.5.2.3	Poo compressae-Anthemidetum tinctoriae	2	4	3	**3**	3	2-4	4	**4**	**!**				
26.6.1.1	Tanaceto vulgaris-Artemisietum vulgaris	5	5	4	***<**	4	3-4	5	**4**	–				
26.6.1.2	Cichorietum intybi	3	4	4	*****	5	4-5	5	**5**	–				
26.6.1.3	Dauco carotae-Picridetum hieracioidis	2	3	3	**3**	2	3-4	5	**3**	**!**				§
26.6.1.4	Melilotetum albo-officinalis	3	4	3	**NT**	4	4-5	5	**5**	–				
26.6.1.5	Berteroetum incanae	3	4	4	*****	4	4-5	4	**4**	–				
26.6.1.6	Potentillo argenteae-Artemisietum absinthii	3	4	4	*****	5	4	5	**5**	–				
26.6.2.1	Lappulo echinatae-Cynoglossetum officinalis	2	4	3	**3**	3	4	5	**4**	**!**				
26.6.2.2	Resedo luteolae-Carduetum nutantis	2	4	4	*****	4	4	5	**4**	–				
26.6.2.3	Onopordetum acanthii	2	4	4	*****	3	4-5	5	**4**	–				
27.1.1.1	Salicetum triandro-viminalis	1	3	2	**1**	2	1	5	**2**	**!!!**	**91EO***		§	
27.1.1.2	Salici-Populetum nigrae	1	3	3	**2**	3	1	5	**2**	**!!**	**91EO***		§	
28.1.1.1	Eriophoro-Pinetum sylvestris	2	2	1	**1**	3	1	5	**2**	**!!!**	**91D2***		§	
28.1.2.1	Vaccinio uliginosi-Pinetum sylvestris	2	2	1	**1**	2	1-2	4	**2**	**!!!**	**91D2***	***91D0**	§	
28.1.2.2	Ledo palustris-Pinetum sylvestris	3	2	1	**2**	3	1-2	5	**3**	**!!**	**91D2***		§	
29.1.1.1	Betuletum humilis	1	1	1	**1**	1	1	3	**1**	**!!!**	7230		§	
29.1.1.2	*Cladium mariscus-Salix pentandra-* community	1	1	2	**1**	1	1-2	4	**2**	**!!!**	***91D0**		§	
29.1.1.3	Junco subnodulosi-Betuletum pubescentis	2	1	1	**1**	1	1	3	**1**	**!!!**	***91D0**		§	
29.1.1.4	Salici pentandrae-Betuletum pubescentis	3	1	2	**2**	2	1-2	5	**2**	**!!**			§	
29.1.2.1	Rhamno catharticae-Betuletum pubescentis	3	2	1	**2**	1	1-2	5	**2**	**!!**			§	
29.2.1.1	Salici auritae-Betuletum pubescentis	3	2	2	**3**	2	1	5	**2**	**!!**	**91D1***		§	
29.2.2.1	Molinio caeruleae-Franguletum alni	3	3	2	**3**	2	1-2	5	**2**	**!!**	**91D1***		§	
29.2.2.2	Lysimachio vulgaris-Quercetum roboris	3	3	3	**NT**	4	1-2	5	**3**	**!**		**91D1***	§	
30.1.1.1	Cratoneuro filicini-Alnetum glutinosae	1	3	3	**2**	2	1	3	**2**	**!!**	**7220***		§	
30.1.1.2	Cardamino amarae-Alnetum glutinosae	3	2	2	**3**	4	1	5	**2**	**!!**			§	

Syntaxon ID.	Syntaxon name	Current status	Past trend	Prognosis	Red List category	Relevance for species	Degree of naturalness	Global relevance	Conservation value	Need for action	Annex 1 Habitats Directive	Annex 1 Habitats directive pro parte	LNatG	LNatG pro parte
30.1.2.1	Carici remotae-Fraxinetum excelsior	3	3	3	**NT**	4	1-2	4	**3**	**!**	**91EO***		§	
30.2.1.1	Hottonio palustris-Alnetum glutinosae	3	3	2	**3**	4	1	4	**2**	**!!**			§	
30.2.1.2	Carici elongatae-Alnetum glutinosae	3	2	2	**3**	4	1	5	**2**	**!!**	**91D0***		§	
30.2.2.1	Bidens cernua-Alnus glutinosa-Gesellschaft	3	4	3	**NT**	4	2	5	**3**	**!**	**91EO***		§	
30.2.2.2	Irido pseudoacori-Alnetum glutinosae	2	2	2	**2**	4	1	5	**2**	**!!**	**91EO***		§	
30.3.1.1	Pruno padi-Fraxinetum excelsioris	5	4	3	*****	5	1-2	5	**3**	–			§	
30.3.1.2	Querco-Ulmetum	0	1	1	**0**	4	1	3	**2**	**[!!!]**	91F0	91F0	§	§
31.1.1.1	Crataego monogynae-Prunetum spinosae	4	4	4	*****	3	2	5	**3**	–			§	§
31.1.1.1a	– *Pimpinella saxifraga* subtype	3	3	3	**NT**	2	2	5	**2**	**!**			§	
31.1.1.1b	– typical subtype	4	4	4	*****	5	2	5	**3**	–			§	§
31.1.1.1c	– *Stachys sylvatica* subtype	4	4	4	*****	5	2	5	**3**	–			§	§
31.1.1.2	Rubo plicati-Sarothamnetum scoparii	3	5	4	***<**	4	3	5	**4**	–				§
31.1.1.3	Hippophao rhamnoidis-Sambucetum nigrae	3	4	4	*****	4	2	2	**2**	–		2160		§
31.1.1.3a	– typical subtype	3	4	4	*****	5	2	2	**2**	–		2160		§
31.1.1.3b	– *Vincetoxicum hirundinaria* subtype	1	4	4	**R**	3	1	1	**1**	**(!!!)**			§	
31.1.1.3c	– *Festuca arundinacea* subtype	1	4	4	**R**	4	1	1	**1**	**(!!!)**				§
31.2.1.1	Lamio albi-Sambucetum nigrae	4	5	5	***<**	4	4	5	**4**	–				§
31.2.1.2	Balloto nigrae-Robinietum pseudoacaciae	3	4	4	*****	5	4	5	**5**	–				
32.1.1.1	Vaccinio mytilli-Pinetum sylvestris	4	2	2	**NT**	4	3	5	**4**	–		2180		§
32.1.1.1a	– typical subtype	4	2	2	**NT**	4	3-4	5	**4**	–				
32.1.1.1b	– *Empetrum nigrum* subtype	1	3	2	**1**	3	1-2	5	**3**	**!!**	2180		§	§
32.1.1.2	Vaccinio-Juniperetum communis	2	2	2	**2**	5	2	5	**3**	**!!**	5130		§	
32.1.1.3	Empetro nigri-Pinetum sylvestris	1	2	1	**1**	1	1-2	4	**2**	**!!!**	2180		§	
32.1.1.4	Cladino-Pinetum sylvestris	1	2	2	**1**	3	2	5	**3**	**!!**		2180		§
32.1.2.1	Peucedano oreoselini-Pinetum sylvestris	1	3	2	**1**	2	1-2	5	**2**	**!!!**		2180	§	
32.1.2.1a	– *Phleum phleoides* subtype	1	3	2	**1**	2	2	5	**2**	**!!!**	91U0		§	
32.1.2.1b	– *Festuca polesica* subtype	1	2	2	**1**	2	1	2	**2**	**!!!**	2180		§	
33.1.1.1	Lonicero periclymeni-Fagetum sylvaticae	1	1	2	**1**	4	1-2	2	**2**	**!!!**	9110			
33.1.1.2	Vaccinio myrtilli-Fagetum sylvaticae	3	5	2	**NT**	4	1-3	4	**4**	–		9110		
33.1.1.2a	– typical subtype	3	4	3	**NT**	4	1-2	3	**3**	**!**	9110			
33.1.1.2b	– *Leucobryum glaucum* subtype	2	2	2	**2**	4	1-2	3	**3**	**!!**	9110			
33.1.1.2c	– *Vaccinium myrtillus* subtype	2	2	2	**2**	4	3	4	**4**	**!**				
33.1.2.1	Betulo pendulae-Quercetum roboris	5	4	3	*****	4	3	3	**3**	–		9190		
34.1.1.1	Adoxo moschatellinae-Aceretum pseudoplatani	2	4	2-3	**3**	5	1	4	**2**	**!!**	**9180***			
34.1.1.2	Prunus avium-Acer platanoides-Gesellschaft	1	4	4	**R**	2	1	3	**2**	**(!!!)**	**9180***			
34.2.1.1	Fraxino excelsioris-Fagetum sylvaticae	4	5	3	*****	5	2-4	4	**4**	–	9130	9160		
34.2.1.1a	– typical subtype	3	4	3	**NT**	5	2	3	**3**	**!**	9130	9160		
34.2.1.1b	– *Cirsium oleraceum* subtype	3	4	2	**NT**	5	3	3	**3**	**!**	9130			
34.2.1.1c	– *Urtica dioica* subtype	4	5	4	***<**	5	4	4	**4**	–	9130			
34.2.1.2	Mercuriali perennis-Fagetum sylvaticae	2	4	3	**3**	3	2	3	**3**	**!**	9130			
34.2.2.1	Asperulo odoratae-Fagetum sylvaticae	5	4	3	*****	5	2-3	4	**4**	–	9130			
34.2.3.1	Carici-Fagetum sylvaticae	1	4	4	**R**	1	1	3	**1**	**(!!!)**	9150		§	
34.2.3.2	Orchido purpureae-Cornetum sanguinei	1	4	4	**R**	1	1	3	**1**	**(!!!)**			§	
34.2.3.3	Vincetoxico hirundinariae-Quercetum	1	4	4	**R**	3	1	3	**2**	**(!!!)**	**91GO***		§	

References

Abdank, A., Berg, C. & Dengler, J. 2004. Bilanz der Roten Liste und Konsequenzen für den Naturschutz. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*, pp. 494–507. Weissdorn, Jena, DE.

Appendix S3. Meta-analysis of the conservation assessment of the plant communities of Mecklenburg-Vorpommern and resulting consequences for nature conservation.

This appendix is a shortened English version of Abdank et al. (2004). For a synopsis of the results for all community types, see Appendix S2; for the underlying syntaxonomic classification, see Appendix S4.

Introduction

Why a Red List of plant communities?

Red Lists draw attention to the extent of decline in biodiversity and initiate actions to protect species and habitats. For decades, Red Lists of threatened species have been a common instrument in nature conservation and are available in Mecklenburg-Vorpommern now for many of the better known species groups. Our knowledge of the species' habitat preferences makes it possible to some degree to draw conclusions about particular ecosystems.

Plant communities contribute much to the structure and habitat function of biotopes. They allow finer classifications of habitats than approaches based solely on abiotic and structural parameters. Consequently, many modern habitat type lists are largely based on phytosociological units.

A Red List of plant communities should not replace Red Lists of species or habitat types, but represents a useful addition to these two conservation tools. As a Red List of habitat types does not exist in Mecklenburg-Vorpommern so far, our Red List provides important information for nature conservation assessment of biotopes. Using the classification presented here, the presence of certain species groups could be used for habitat identification and assessment.

Compared to the extant Red Lists of species in Mecklenburg-Vorpommern, the presented Red List of plant communities has the additional advantage of a separate evaluation of endangerment and conservation value. This allows defining priorities for nature conservation measures based on a transparent methodology.

Database and interpretability

This "Red List of plant communities of Mecklenburg-Vorpommern" is based on the classification of all plant communities of the country (with the exception of the single-layered cryptogamic vegetation; see Berg et al. 2001, 2004). Table 1 gives an overview of the number of distinguished syntaxa on each levels of the hierarchy. Compared to the tables volume (Berg et al. 2001), the number of associations has increased by one, as we include in the analysis below the vanished *Querco-Ulmetum* (30.3.1.2), of which no relevés were available. The statistical analyses refer – unless otherwise specified – thus always to the number of 285 associations known from the territory of the federal state of Mecklenburg-Vorpommern. The level of subtypes is given when the association was further subdivided.

Table 1. Number of syntaxa on different hierarchy levels underlying the Red List. K = class, UK = subclass, O = order, UO = suborder, V = alliance, Ass = association, AB = subtype of association.

Hierarchy	K	UK	O	UO	V	Ass.	AB
Number	34	12	70	6	125	285	72

In the following sections, the ratings of all community types with regard to endangerment and conservation value from the association chapters in Berg et al. (2004) are systematically compiled and analyzed. The analysis is based on the methodology presented in Appendix S1, while some author-specific nuances in the interpretation of the sub-criteria cannot be ruled out. To minimize such cases multiple comparative validity checks have been carried out.

Endangerment

Overall balance

The overall balance of endangerment (Table 2 and Fig. 1) shows that more than one half of the associations of the state are more or less endangered. Only 42% are not red-listed, of which, however, another 10% are already placed in the category 'near threatened'.

In Table 3, a comparison of the endangemerent balance of Mecklenburg-Vorpommern with the that of the surrounding federal states of Schleswig-Holstein (Dierßen et al. 1988), Sachsen-Anhalt (Schubert et al. 2001), Thuringia (Heinrich et al. 2001) and Saxony (Böhnert et al. 2001) and the regional assessment of the German lowlands in the Red List of Germany (Rennwald 2002) is presented. Although the data, due to the different classification and evaluation methodology in the various lists, are not entirely comparable, the result of Mecklenburg-Vorpommern are overall similar to the other Red Lists.

Table 2. Frequency of Red List categories within the associations and subtypes of Mecklenburg-Vorpommern. 0 = vanished, 1 = critically endangered, 2 = endangered, 3 = vulnerable, R = naturally rare but not actually threatened, # = probably threatened, NT = near threatened, * = least concern, * < = least concern and expanding, D = data deficient.

Red List-category	0	1	2	3	R	#	NT	*	*<	D	Σ
Number of associations	2	53	49	43	9	2	28	75	18	6	285
Proportion of associations [%]	1	19	17	15	3	1	10	26	6	2	100
	1	55					42			2	
Number of subtypes	-	10	12	18	2	-	15	12	3	-	72

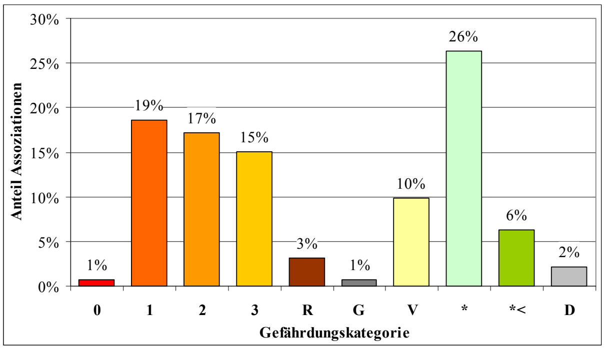

Fig. 1. Distribution of the 285 associations of Mecklenburg-Vorpommern among the Red List categories (for meaning of the categories, see Table 2).

Table 3. Proportion (in %) of vanished (Category 0), endangered (categories 1-3, R, #) and not endangered (categories *, * <, NT) plant communities of Mecklenburg-Vorpommern in comparison to surrounding states and the entire German lowlands (references see text). Ass. = associations, Ges. = informal plant communities, UE = rated subtypes, ZEH = assigned informal types.

Region	Rated syntaxa	Vanished	Endangered	Not endangered	Data deficient
Mecklenburg-Vorpommern	285 Ass.	1	55	42	2
Schleswig-Holstein	338 Ass. + Ges.	8	69	24	–
Sachsen-Anhalt	460 Ass.	1	57	42	–
Thuringia	451 Ass.	1	53	46	–
Saxonia	485 Ass., Ges. + UE	4	56	33	–
German lowlands	577 Ass., Ges. + ZEH	1	55	41	3

The following habitats and ecosystems host particularly high numbers of endangered plant communities:

0: Two previously occurring communities have **vanished** from the territory of Mecklenburg-Vorpommern. The *Isoeto lacustris-Lobelietum dortmannae* (09.1.1.1) disappeared probably in the second half of the 19th century due to the increasing eutrophication of oligotrophic glacial lakes, while it is still occurring in the neighboring Schleswig-Holstein. The hardwood floodplain forest (*Querco-Ulmetum*, 30.3.1.2), the natural vegetation type of the higher areas in the flood plains of the large central European rivers still exists in the adjacent regions, while in the small fraction of the Elbe valley belonging to Mecklenburg-Vorpommern it could not found any more.

1: The 19% of Mecklenburg-Vorpommern's associations that are **critically endangered** and the eight subtypes classified in this category belong predominantly to natural or very extensively used habitats: Baltic coast (03.1.1.2 – *Charetum horrido-balticae*, 6.1.1.1a – typical subtype of the *Salicornietum europaeae*, V14.1.2 – all associations of the *Armerion maritimae*, 15.1.3.3a – typical subtype of *Honckenyo peploidis-Crambetum maritimae*), oligo- to mesotrophic water bodies and their shores (O4.1 – *Nitelletalia flexilis*, O5.2 – *Potamogetonetalia*, O7.1 – *Nano-Cyperetalia*, V9.1.2 – *Eleocharition multicaulis*), acidic bogs and wet heathlands (K11 – *Oxycocco-Sphagnetea*), base-rich fens (UK12b – *Drepanoclado revolventis-Caricenea diandrae*), *Nardus* grasslands and dry heaths (K20 – *Calluno-Ulicetea*), dry grasslands (21.2.1.1 – *Tortulo ruraliformis-Phleetum arenarii*, 21.5.1.1 – *Sileno conicae-Cerastietum semidecandri*, 22.2.1.1 – *Potentillo arenariae-Stipetum capillatae*), (intermittendly) moist to wet grasslands (UK23b – *Molinio-Juncenea*), thermophilic forest-edge vegetation (K25 – *Trifolio-Geranietea sanguinei*), *Salix*-rich riparian forests (27.1.1.1 – *Salicetum triandro-viminalis*), forests and shrubland of oligotrophic wet habitats (O28.1 – *Vaccinio uliginosi-Pinetalia sylvestris*), shrub communities of mesotrophic base-rich fens (V29.1.1 – *Salici pentandrae-Betulion pubescentis*), dry pine forests (O32.1 – *Piceetalia excelsae*) and one acidophytic beech forest type (33.1.1.1 – *Lonicero periclymeni-Fagetum sylvaticae*). Among communities stronger bound to human activities, only two associations of the *Malvion neglectae* (V16.1.2), which rely on extensive poultry farming, and the *Cystopteridetum fragilis* (19.2.2.1), an association of old rocks, are critical endangered.

The largest proportion among the communities of Red List category 1 belongs to the base rich fens (subclass 12b – *Drepanoclado revolventis-Caricenea diandrae*, 11 of the 53 critical endangered associations.). Among the most endangered vegetation types (Table 4), even one half belongs to this subclass. In some associations only particular subtypes are critical endangered: 06.1.1.1a, 14.1.2.6a, and 15.1.3.3a in coastal vegetation, 20.2.1.2a and 20.2.1.2c in heathlands and 23.2.2.1a and 23.3.2.1a in grasslands.

Table 4: The most critically endangered associations in Mecklenburg-Vorpommern, i.e. those rated in category 1 for all three subcriteria (very rare, with very strong decline and with very strong decline in the future prognosis).

The most critically endangered associations	
05.2.1.3	Nupharetum pumilae
09.1.2.2	Samolo valerandi-Littorelletum uniflorae
11.1.1.1	Lycopodiello inundatae-Rhynchosporetum fuscae
12.2.1.1	Caricetum lasiocarpae
12.2.3.1	Scorpidio scorpioidis--Caricetum elatae
12.2.4.1	Junco subnodulosi-Schoenetum nigricantis
12.3.1.1	Sphagno teretis-Menyanthetum trifoliatae
12.3.2.1	Paludello palustri-Caricetum
20.1.1.1	Polygalo vulgaris-Nardetum strictae
22.2.1.1	Potentillo arenariae-Stipetum capillatae
29.1.1.1	Betuletum humilis

2: Endangered associations have a proportion of 17% and also predominantly inhabit natural and semi-natural sites. Particularly well represented in this category are the following habitats and groups of syntaxa: oligotrophic water bodies and their banks (V4.2.1 – *Charion fragilis*, O5.2 – *Potamogetonetalia*, O7.1 – *Nano-Cyperetalia*, V09.1.3 – *Eleocharition acicularis*), Baltic Sea coast (03.1.1.1, 06.1.1.1, O14.1, 15.1.3.3, 24.1.1.1), acidic bogs and wet heathlands (V11.1.1, V11.2.2), spring swamps and mesotrophic to eutrophic swamps and mires (10.1.1.1, V12.2.1, V12.2.2, 13.3.1.1, 27.1.1.2, 28.1.2.2, O29.1, 30.1.1.1, 30.2.2.2), dwarf shrub heaths (O20.2), dry grasslands (21.4.3.3, 22.1.2.1), moist to wet grasslands (23.3.2.2) and the juniper heaths (32.1.1.2). Among communities with stronger anthropogenic influence, the *Asplenietum trichomano-rutae-murariae* (19.2.1.1) and some the tall herb forest-edge vegetation (UK25b – *Trifolio-Geranienea sanguinei*) as well as perennial ruderal communities (26.2.2.4, 26.4.1.3) belong to category 2.

Particularly in coastal habitats, there are some of endangered subtypes (14.1.2.6b, 14.3.1.1d, 15.1.1.1d, 15.1.3.1a, 15.1.3.3b, 24.1.1.1a, 24.1.2.1a) of associations, which as a whole mainly belong to the category 'near threatened' (V). Even three associations and one further subtype of arable weed communities have so strongly decreased mainly due to fertilizer and herbicide use in Mecklenburg-Vorpommern that they are classified as endangered. These are vegetation types that formerly inhabited acidic or calcareous soils of low productivity (18.1.1.1 – *Sclerantho annui-Arnoseridetum minimae*, 18.2.2.1 – Galeopsietum speciosae, 18.3.1.1 – *Euphorbio exiguae-Melandrietum noctiflori*). Among the communities of cultivated grasslands (K23), the more nutrient-poor subtypes of the *Arrhenatheretum elatioris* (23.1.1.1a) and *Lolio perennis-Cynosuretum cristati* (23.1.2.1a) belong to the category 'endangered'.

3: Vulnerable are 15% of the associations of Mecklenburg-Vorpommern. They belong to many different classes and represent similar proportions of natural and anthropogenic communities. Mainly communities of fresh water bodies (K01, 04, 05) and their banks (K03, 08, 09, 12), syntaxa of Baltic Sea coast (K14, K15), arable fields (K18), dry grasslands (K21), moist to wet grassland (K23), perennial herbaceous communities of nutrient-poor (K25) and nutrient-rich sites (K26) as well as swamp forests (K30) and beech forests (K34) are assessed as 'vulnerable'.

#: The category **probably threatened** has been assigned only twice for xeric grasslands communities (21.3.1.3 – *Vulpietum myuri* and 21.4.1.1 – *Galio veri-Festucetum capillatae*). In both cases the past trend was not sufficiently known for an accurate classification of the Red List category.

R: As **naturally rare** but not actually threatened we considered only 3% of all associations and two subtypes: an association of inner Baltic Sea coast (03.1.2.3 – *Ranunculetum baudotii*), coast-bound shrub communities (31.1.1.3b+c – *Hippophao rhamnoidis-Sambucetum nigrae:*, two subtypes, 34.1.1.2 – *Prunus avium-Acer platanoides* community), and all three associations of alliance V34.2.3 – *Sorbo-Fagion sylvaticae*, which is restricted in Mecklenburg-Vorpommern to small spots along the Baltic Sea coast. Besides this natural coastal communities further four ruderal associations fall into category R (17.2.1.2 – *Plantagini indicae-Senecionetum viscosi*, 26.1.1.2 – *Corydalido claviculatae-Epilobietum angustifolii*, 26.2.2.3 – *Chaerophylletum bulbosi*, 26.5.1.3 *Diplotaxio tenuifoliae-Agropyretum repentis*). Their classification is explained by the fact that they reach their range edge in Mecklenburg-Vorpommern or their occurrence followed a recent introduction. All communities of the category R have very small stands in the country, while no threat in the future is foreseeable either because of the inaccessible locations (Baltic Sea cliffs) or ruderal behaviour.

NT: In the category **near threatened** we classified 10% of all associations, scattered over all vegetation classes. Most of these communities are moderately frequent with a weak negative trend in the past and/or a recognizable decline in the future. This category also includes few associations that are still common, but experienced a significant negative quantitative development in the past or are subject to negative prognosis. Finally, the *Aphano arvensis-Matricarietum chamomillae* (18.2.1.1) is the only community in the category "V", which is still very common but has already strongly decreased, and under the present form of agricultural practice continues to be highly threatened in the future.

***:** Currently not threatened (**least concern**) are about one third of all plant communities of the federal state. This mainly includes syntaxa of water bodies (K01, K05), *Bidens* communities (K08), reeds and wetland tall herb communities (K13), short-lived communities of trampled habitats (K16), short-lived weed communities (K17), mesophilous grassland (K23) and ruderal tall herb communities (K26). Within the woody vegetation, *Prunus spinosa* and *Sambucus nigra* shrublands (K31) and three widespread natural deciduous forest communities (33.1.2.1, 34.2.1.1 and 34.2.2.1) are classified as 'least concern'. Among the communities of category *, 14% is facing a weak anthropogenic threat.

*<: The 6% associations classified as **least concern and expanding** are mainly ruderal herb and shrub communities (O13.4, V17.2.1, K26, 31.1.1.2 – *Rubo plicati-Sarothamnetum scoparii*, 31.2.1.1 – *Lamio albi-Sambucetum nigrae*) and the *Urtica dioica* subtype of the *Fraxino excelsioris-Fagetum* (34.2.1.1c). Many of these types are rich in neophytes. As a result of management

changes in grassland, also the *Artemisia vulgaris* subtype of the *Arrhenatheretum elatioris* (23.1.1.1c) and the *Ranunculo repentis-Alopecuretum geniculati* (23.2.1.1) are expanding.

D: In the category **data deficient,** we classified 2% of the associations. A decision whether they are endangered or not is not yet possible. This concerns three dry grassland communities (21.1.1.2 – *Agrostietum vinealis*, 21.3.1.1 – *Carici arenariae-Airetum praecocis*, 21.6.1.1 – *Poo compressae-Saxifragetum tridactylitae*), two forest-edge communities (25.1.1.1 – *Lathyro linifolii-Melampyretum pratensis*; 25.2.1.6 – *Rubo caesii-Origanetum vulgaris*) and a tall herb association of intermittently wet sites (13.4.3.1 – *Veronico longifoliae-Scutellarietum hastifoliae*).

Subcriteria

As Figure 2 shows, approximately one quarter of the plant communities each were classified as very rare, rare and infrequent, respectively. The categories frequent and common share only 8% each. They are distinguished in the spatial distribution and not in the extent of the covered area (see Appendix S1).

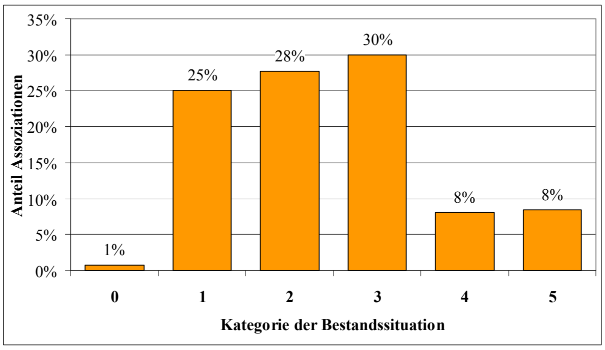

Fig. 2. Distribution of the 285 associations of Mecklenburg-Vorpommern among the categories of current status. Associations that have been assigned to two categories due to imprecise knowledge were counted proportionally in both categories; 0 = missing, 1 = very rare, 2 = rare, 3 = infrequent, 4 = frequent, 5 = common.

It should be noted, that the **current distribution** considers both the area coverage and the spatial distribution of the occurrences. As 'very rare' particularly associations of base-rich fens (K12: 10 associations), salt marshes (K14: 6 associations) and thermophilous forest-edge communities (K25: 7 associations) have been classified. Among this category are those who have always been very rare, mainly because of their restriction to certain geophysical regions such as river Elbe, Baltic Sea coast or Uckermark (SE Mecklenburg-Vorpommern), as well as those whos area have dramatically declined in recent decades.

As very common (5) according to the definition we classified communities, whose stands have a relatively large total area (but the threshold is less than 1% of the country) and are represented in (almost) all regions of the country. Such associations are found mainly in the classes of managed grasslands (K23: 5 associations) and tall-herb ruderal communities (K26: 6 associations). Among the arable weeds communities only one, the *Aphano arvensis-Matricarietum chamomillae* (18.2.1.1) is classified here. The latter, however, unlike the other very common communities but similar to the *Arrhenatheretum elatioris* (23.1.1.1) and *Lolio perennis-Cynosuretum cristati* (23.1.2.1) has already faced a remarkable decline in the past.

The **past trends** of the associations (1960 until 2004, Fig. 3) show an alarming picture: almost 60% have declined. The strongest decline (category 1) is found in associations of nutrient-poor water bodies and their shores (K04, some associations of K05, K09), nutrient-poor to mesotrophic mires and swamps (K11, K12, K29), and species-rich arable weed communities (K18). The decrease of the former diversity of arable weeds is visible by a strong downward trend and continued threat of arable weed communities – an indication of the large-scale homogenization of the habitat conditions and the suppression of all arable weeds by herbicides.

Just one third of all communities – mainly those of nutrient-rich and anthropogenic sites – had a stable distribution in the past, while less than 10% were in expansion. They colonize, with a few exceptions, nutrient-rich sites and belong to one of the following syntaxa: ruderal tall herb communities (K26), reeds and tall herb wetland vegetation (O13.4) and short lived ruderal communities (K17). Two associations of intensively managed grasslands (23.1.2.2, 23.2.1.1) are also included.

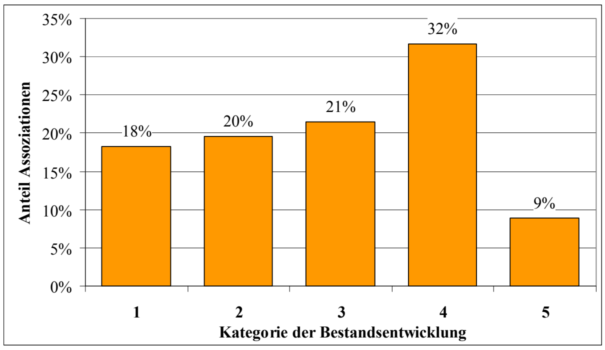

Fig. 3. Distribution of the 285 associations of Mecklenburg-Vorpommern among the categories of past trend. Associations that have been assigned to two categories due to imprecise knowledge were counted proportionally in both categories; 1 = very strong decline, 2 = strong decline, 3 = moderate decline, 4 = constant, 5 = increase.

The analysis of the predicted **prognosis** (Fig. 4) indicates that the current trend will continue in the future: 61% of the plant communities of the state are more or less threatened, while only a few (5%) likely will benefit from human activities. The development towards an increasingly uniform landscape will continue if no effective countermeasures are taken.

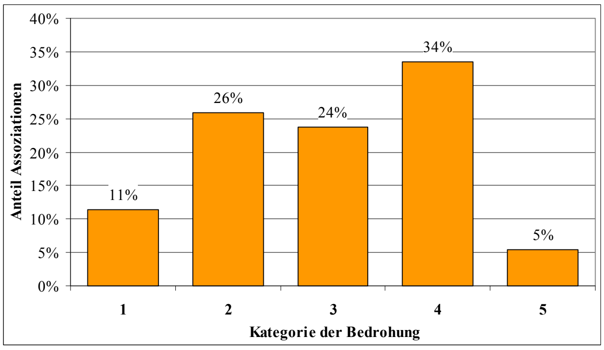

Fig. 4. Distribution of the 285 associations of Mecklenburg-Vorpommern amnong the categories of threat in the future. Associations that have been assigned to two categories due to imprecise knowledge were counted proportionally in both categories; 1 = very strong decline, 2 = strong decline, 3 = low decline, 4 = no decline, 5 = promotion.

Conservation value

Overall balance

The frequency of different conservation values among associations and subtypes in Mecklenburg-Vorpommern is shown in Table 5 and Figure 5.

Table 5: Distribution of conservation value categories among the associations and subtypes of Mecklenburg-Vorpommern, 1 = highest conservation value, 2 = high conservation value, 3 = medium conservation value, 4 = low conservation value, 5 = lowest conservation value.

Conservation value	1	2	3	4	5	∑
Number of associations	14	98	79	56	38	285
Proportion of associations [%]	5	34	28	20	13	100
	67			33		
Number of subtypes	4	25	27	14	2	72

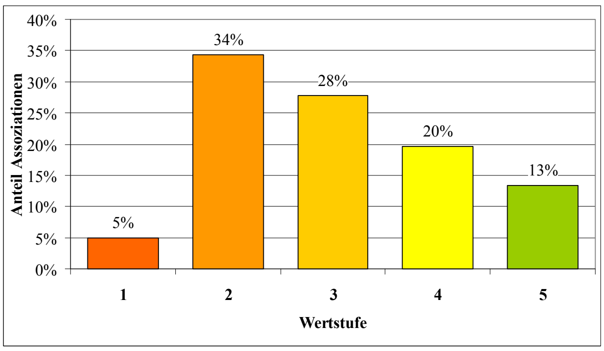

Fig. 5. Distribution of the 285 associations of Mecklenburg-Vorpommern among the five levels of conservation value. For numerical values see Table 5.

Two thirds of the associations have a medium to high conservation value. High protection value (conservation value 2) is the most frequent category, comprising more than one third of the associations. As highest worthy of protection (conservation value 1), we consider only 5% of the associations (Table 6). These are those syntaxa where at least two of the three subcriteria achieve the highest category.

Higher proportions of conservation values 1 or 2 can be found in nutrient-poor fens (both the open K12 and the woodland class K29), in oligotrophic-acidic bogs and wet heaths (K11), in *Litorella* communities (K09) and in salt marshes (K14).

Table 6. The associations and some subtypes with the 'highest protection value' (category 1).

Plant communities primarily worthy of protection	
03.1.1.2	Charetum horrido-balticae
09.1.1.1	Isoeto lacustris-Lobelietum dortmannae
09.1.3.1	Myriophyllo alterniflori-Littorelletum uniflorae
12.1.1.1	Sphagno recurvi-Caricetum rostratae
12.2.1.1	Caricetum lasiocarpae
12.2.1.2	Caricetum diandrae
12.2.3.1	Scorpidio scorpioidis--Caricetum elatae
12.3.1.1	Sphagno teretis-Menyanthetum trifoliatae
12.3.2.1	Paludello palustri-Caricetum
15.1.3.3	Honckenyo peploidis-Crambetum maritimae
29.1.1.1	Betuletum humilis
29.1.1.3	Junco subnodulosi-Betuletum pubescentis
34.2.3.1	Carici-Fagetum sylvaticae
34.2.3.2	Orchido purpureae-Cornetum sanguinei
31.1.1.3b	Hippophao rhamnoidis-Sambucetum nigrae: *Vincetoxicum hirundinaria* subtype
31.1.1.3c	Hippophao rhamnoidis-Sambucetum nigrae: *Festuca arundinacea* subtype

Subcriteria

The **relevance for species conservation** has been scaled in such a way that one fifth of the associations falls in each of the five categories (see Appendix S1). A numeric value of 1,000 means that in an average vegetation plot of that community type 10 species of Red List category 3, five of category 2, or 2.5 of the category 1 occur, respectively. When comparing the relevance for species conservation of different communities, it has to be taken into account that these are referring to different plot sizes areas (see table header data in the table volume, Berg et al. 2001) and constancy values increase with plot size (Dengler et al. 2009).

Table 7 demonstrates that the highest weighted number of endangered plant species occur in the nutrient-poor open (K12) and wooded fens (K29). By contrast, the ruderal vegetation types of short lived (K16, K17) and the tall herb ruderal communities (K26) are generally inhabited by only few red-listed species.

Table 7: The associations with the highest relevance for species conservation, sorted by the decreasing numeric value. The category 1 starts at a numeric value of 671. A value of 1,000 means that there is on average 10 species of Red List category 3 per relevé.

Values over 4000	
12.3.2.2	Schoenetum ferruginei
Values over 3000	
29.1.1.1	Betuletum humilis
12.3.2.1	Paludello palustri-Caricetum
Values over 2000	
12.3.2.3	Juncetum subnodulosi
12.3.1.1	Sphagno teretis-Menyanthetum trifoliatae
12.2.4.1	Junco subnodulosi-Schoenetum nigricantis
12.2.4.2	Eleocharitetum pauciflorae
29.1.1.3	Junco subnodulosi-Betuletum pubescentis
Values over 1000	
12.3.1.2	Parnassio palustris-Caricetum
23.3.1.1	Selino carvifoliae-Molinietum caeruleae
07.1.1.2	Polygono-Eleocharietum ovatae
12.2.3.1	Scorpidio scorpioidis-Caricetum elatae
29.1.1.2	Cladium mariscus-Salix pentandra-Gesellschaft
22.2.1.1	Potentillo arenariae-Stipetum capillatae
11.1.1.1	Lycopodiello inundatae-Rhynchosporetum fuscae
12.2.1.2	Caricetum diandrae
20.1.1.2	Juncetum squarrosi
09.1.2.2	Samolo valerandi-Littorelletum uniflorae
20.1.1.1	Polygalo vulgaris-Nardetum strictae
22.1.2.1	Adonido vernalis-Brachypodietum pinnati
09.1.1.1	Isoeto lacustris-Lobelietum dortmannae
12.2.1.1	Caricetum lasiocarpae
07.1.2.2	Hypno lindbergii-Cicendietum filiformis
25.3.2.3	Thalictro mini-Geranietum sanguinei
34.2.3.1	Carici-Fagetum sylvaticae
14.1.1.2	Sagino maritimae-Cochlearietum danicae
14.1.2.2	Blysmetum rufi
11.1.1.2	Ericetum tetralicis
12.2.2.1	Junco-Caricetum nigrae
12.2.2.2	Caricetum serotinae
14.1.2.5	Junco ancipis-Caricetum extensae

The degrees of **naturalness** of the various associations are shown in Figure 6. Just one half of all associations have been assigned to a single category only, most of them to category 1 (natural). By contrast, many associations can live at sites of different naturalness; the most common case being '1–2'. This means communities that are found equally in natural as in semi-natural habitats. Remarkable are the three associations that cover the whole range of values, i.e. '1–5'. They all belong to the subclass 26c of semi-ruderal grasslands. Their natural habitat is located in highly dynamic sites of the Baltic Sea coast and the banks of the Elbe River. They have the ability to colonize natural as well as strongly anthropogenicly altered pioneer sites.

By summarizing the communities with only a single value in the degree of naturalness and those with a value range (e.g. 1–2), it is evident that the greatest variety of associations can be found under semi-natural conditions (Fig. 6). Under such condition one half of all communities in the state occur. The number of associations decreases both to more natural and to more anthropogenic sites.

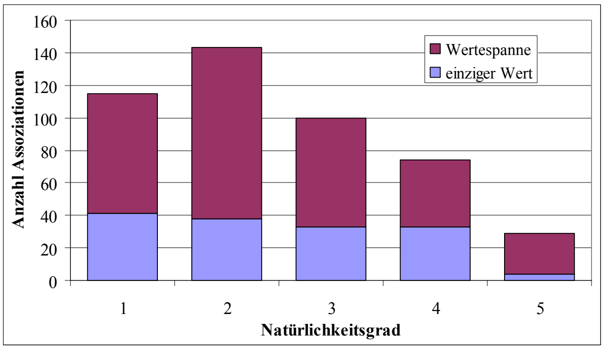

Fig. 6: Occurrence of the 285 associations of Mecklenburg-Vorpommern in sites of different degrees of naturalness. The lower part of the columns (blue) refers to communities that are limited to a single category, the upper part (red) to those that occur at sites of varying naturalness; 1 = natural, 2 = semi-natural, 3 = pre-industrial anthropogenic, 4 = industrial anthropogenic, 5 = artificial.

The world distribution ranges of the plant communities show a similar picture as in plant taxa. Not a single association is endemic to Mecklenburg-Vorpommern. Figure 7 shows that the federal state has no special responsibility for the majority of its plant communities because they have wide overall ranges. In global relevance, our highest category 1, in which a community is classified when 50% or more of its total range is inside the study area, was hard to reach for such a small reference area as Mecklenburg-Vorpommern. The low values also indicate that Mecklenburg-Vorpommern is a 'young' (in terms of post-glacial recolonization) and geographically not isolated territory.

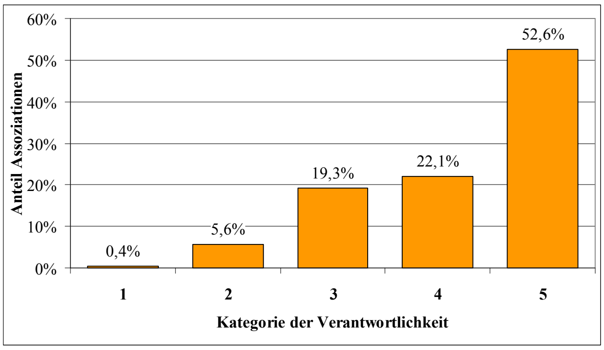

Fig. 7. Distribution of the 285 associations of Mecklenburg-Vorpommern among the categories of global relevance. 1 = highest global relevance, 2 = high global relevance, 3 = moderate global relevance, 4 = low global relevance, 5 = least global relevance.

All the more, attention should be paid to protect the few associations that have a large proportion of their worldwide range in the territory of Mecklenburg-Vorpommern (Table 8). This is particularly true for the only association classified with the highest global relevance category, the *Charetum horrido-balticae* (03.1.1.2). Further, these are those plant communities in which Mecklenburg-Vorpommern accounts for 1/5 and more of their world range (category 2; Table 8). Among them are mostly communities of the Baltic Sea coast (a brackish water community, three salt marsh communities, two dune communities, two shrub and herbaceous communities of the cliffs), but also three types of dry grasslands.

Table 8. Associations for whose conservation the state of Mecklenburg-Vorpommern carries a particular global relevance in the global framework (categories 1 and 2 of global relevance).

1 – Highest global relevance	
03.1.1.2	Charetum horrido-balticae
2 – High global relevance	
03.1.1.1	Charetum canescentis
04.1.1.1	Nitelletum capillaris
05.1.1.3	Ranunculo trichophylli-Callitrichetum
12.2.4.1	Junco subnodulosi-Schoenetum nigricantis
14.1.1.1	Centaurio vulgaris-Saginetum moniliformis
14.1.1.2	Sagino maritimae-Cochlearietum danicae
14.1.2.5	Junco ancipis-Caricetum extensae
18.3.1.1	Euphorbio exiguae-Melandrietum noctiflori
21.4.3.3	Allio schoenoprasi-Caricetum praecocis
21.5.2.2	Festucetum polesicae
22.1.1.1	Solidagini virgaureae-Helictotrichetum pratensis
23.3.1.1	Selino carvifoliae-Molinietum caeruleae
24.1.2.2	Festucetum arenariae
25.3.1.2	Sileno nutantis-Libanotidetum montanae
31.1.1.3	Hippophao rhamnoidis-Sambucetum nigrae
33.1.1.1	Lonicero periclymeni-Fagetum sylvaticae

Combination of endangerment and conservation value: the need for action

We treat endangerment and conservation value as two independent, complementary criteria (see Appendix S1). Nevertheless, there are some correlations between the two criteria (Fig. 8): communities tend to be more valuable, the more endangered they are and vice versa. So most of the associations of the two highest conservation value levels are endangered (category 2), the majority of the remaining value levels not.

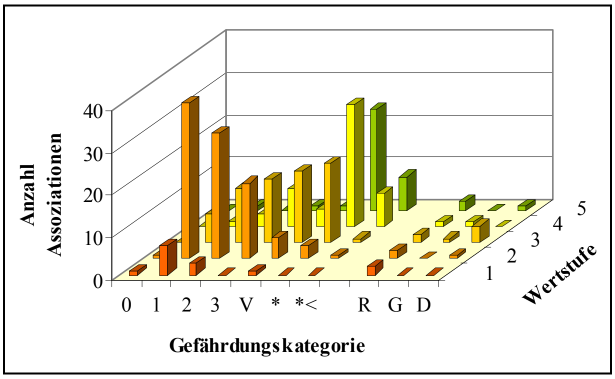

Fig. 8. Frequency of occurrence of different combinations of Red List category and conservation value among the 285 associations of Mecklenburg-Vorpommern. The Red List categories R, # and D, which do not be fit into the ordinal sequence, are displayed separately at the right-hand end.

Of particular interest are the exceptions of this dominant scheme. Their significant proportion confirms our approach to determine conservation value and Red List category independently.

On the one hand, there are associations with high endangerment but low conservation value. Foremost among these are two communities of the *Malvion neglectae* (V16.1.2). Although they are critically endangered in Mecklenburg-Vorpommern their (relatively) low content of endangered species and their wide world ranges lead to only low to moderate conservation value.

The opposite case is represented by vegetation types that have a high conservation value but are not endangered in the country so far. Highly worthy are five associations that are in Mecklenburg-Vorpommern not endangered or even spreading, including a water plant community (05.1.1.3), two associations of the Baltic Sea coast (24.1.2.2, 31.1.1.3) and two of the Elbe valley (08.1.2.2, 13.4.3.2). 'Classical' Red Lists that are based solely on the endangerment would not draw the attention to these units for which the state of Mecklenburg-Vorpommern has a high global relevance in the international context.

In the **need for action** we finally combined endangerment and conservation value in an overall priorization tool for nature conservation. The need for action is targeted at all actors involved in nature conservation, to give them a meaningful prioritization when implementing conservation, development and restoration measures. The conservation measures listed in Berg et al. (2004) for each plant community provide appropriate information. However, in addition to defining priorities one has to judge their cost-effect ratio and their chances of success.

Table 9. Frequency of categories of need for action among the associations and subtypes of Mecklenburg-Vorpommern. !!! = primary need for action, !! = high need for action, ! = moderate need for action, [x] = [!!!], [!!] or [!] means restoration demand, (x) = (!!!), (!!) or (!), or stands for potential need for action, – = no need for action. ? = require research.

Need for action	**!!!**	**!!**	**!**	**[x]**	**(x)**	**–**	**?**	**∑**
Number of associations	47	69	54	2	9	98	6	285
Proportion of associations [%]	16	24	19	1	3	34	2	100
	60			4				
Number of subtypes	21	22	8	-	2	19	-	72

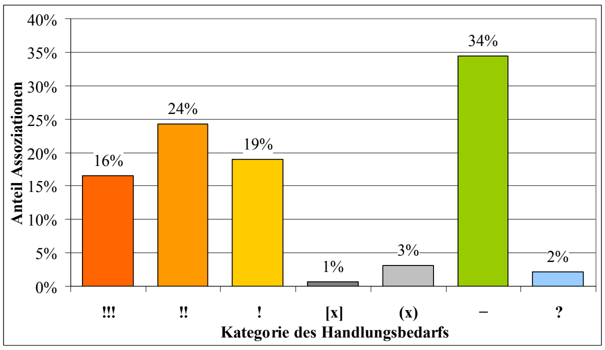

Fig. 9. Distributin of the 285 associations of Mecklenburg-Vorpommern among the categories of need for action. For the meaning of the catetories, see Table 9.

Table 9 and Fig. 9 show the proportion of the need for action. In 60% of the vegetation types in the country no current action is needed to protect it. There are another 11 associations with potential need for action or with the need of restoration.

!!! – **Primary need for action** for immediate and effective protection is documented for 47 associations. They are characterized by a combination of high endangerment and high conservation value and belong to the following habitats and syntaxa:

- Bogs and fens (K11 – *Oxycocco-Sphagnetea*, UK12b – *Drepanoclado revolventis-Caricenea diandrae* with 12 associations)
- Lakes and shores (O04.1 – *Nitelletalia flexilis*, O05.2 – *Potamogetonetalia*, K07 – *Isoeto-Nano-Juncetea*, K09 – *Littorelletea*)
- Baltic Sea coast (V03.1.1 – *Charion canescentis*, V14.1.2 – *Armerion maritimae*, 15.1.3.3 – *Honckenyo peploidis-Crambetum maritimae*, 21.2.1.1 – *Tortulo ruraliformis-Phleetum arenarii*)
- Grasslands and thermophilous forest-edge vegetation (V20.1.1 – *Violion caninae*, 22.2.1.1 – *Potentillo arenariae-Stipetum capillatae*, UK23b – *Molinio-Juncenea*, 25.3.2.3 – *Thalictro mini-Geranietum sanguinei*)
- Woody vegetation (27.1.1.1 – *Salicetum triandro-viminalis*, K28 – *Vaccinio uliginosi-Pinetea*, V29.1.1 – *Salici pentandrae-Betulion pubescentis*, K32 – *Vaccinio-Piceetea*, 33.1.1.1 – *Lonicero periclymeni-Fagetum sylvaticae*).

[!!!] – **Restoration demand** of highest level is assigned to highly valued associations that have not been observed in Mecklenburg-Vorpommern for at least 10 yr (vanished, Red List category 0). This category was asigned only twice, but could increase in the future with continuous monitoring of vegetation change. For the affected associations, potential habitats should be restored with high priority. In case of the *Querco-Ulmetum* (30.3.1.2) recovery measures have already successfully been performed in neighboring federal states, while in the case of the vanished *Isoeto lacustris-Lobelietum dortmannae* (09.1.1.1) a restoration seem to be currently not very realistic. If communities of the category [!!!] are rediscovered, they will turn into the category !!!.

(!!!) – **Potential need for action** of highest level has been assigned to four forest communities of the Baltic Sea coast, the *Prunus avium-Acer platanoides* community (34.1.1.2) and three rare beach forest communities on limestone and marl cliffs (34.2.3.1, 34.2.3.2, 34.2.3.3). Most of their stands are currently secured in protected areas. However, their total areas covered are so small that immediate measures are needed if in the future any threat should arise.

Endangerment, conservation value and need for action according to vegetation classes

The synoptic overview (Table 10) presents the proportion of the associations in each of the 34 vegetation classes that fall into certain categories of endangerment, conservation valuable and need for action.

Regarding **endangerment**, the following four classes include the largest number of threatened associations (in descending order): K12 – *Parvo-Caricetea*, K25 – *Trifolio-Geranietea sanguinei*, K14 – *Juncetea maritimi* and K26 – *Artemisietea vulgaris*. In the last class, the large number results mainly from the fact that this is the class with the highest number of associations, while the percentage with 24% is far below average. Looking at the proportion of **vulnerable** associations, there is a different picture: All communities (100%) of K06 – *Thero-Salicornietea strictae*, only one association in the state!), K09 – *Littorelletea*, K10 – *Montio-Cardaminetea*, K19 – *Asplenietea trichomanis*, K22 – *Festuco-Brometea*, K27 – *Salicetea purpureae* and K28 – *Vaccinio uliginosi-Pinetea*, are threatened to some degree. With more than 50% critically endangered associations the situation is extreme in the classes K07 – *Isoeto-Nano-Juncetea*, K12 – *Parvo-Caricetea* and K32 – *Vaccinio-Piceetea*alarming. By contrast, so far little or not endangered (≤ 10% vulnerable associations) are the classes K02 – *Zosteretea*, K13 – *Phragmito-Magno-Caricetea*, K17 – *Sisymbrietea* and K31 – *Rhamno-Prunetea*.

The proportion of the associations with high **conservation value** generally shows a similar picture as that of the endangerment. Contrasting patterns, i.e. a high proportion of valuable communities with a lower proportion of threatened ones, occur in the following classes: K05 – *Potamogetonetea*, K13 – *Phragmito-Magno-Caricetea* and K33 – *Quercetea robori-petraeae*. Low conservation values but high proportions of endangerment show the associations of K18 – *Stellarietea mediae* and K19 – *Asplenietea trichomanis*.

In almost half of all classes all associations have a **need for action**. Only in seven of the 34 classes less than a half of the communities need conservation measures. However, considering the different urgency to act in the form of the median (not shown), the highest need for action appears forn K09 – *Littorelletea*, K12 – *Parvo-Caricetea* as well as K28 – *Vaccinio uliginosi-Pinetea*, followed by the tree-free, nutrient-poor acidic bogs and wet heaths K11 – *Oxycocco-Sphagnetea* and the willow alluvial woodlands of K27 – *Salicetea purpureae*.

Table 10. Proportion of threatened and valuable associations, and those with high need for action within the 34 vegetation classes (in % except for *n* = number of associations), End. = proportion of threatened associations (category 0-3, R and G); Value = proportion of valuable associations (category 1-3), H = proportion of associations with need for action (including potential need and restoration requirement); shares from 75% fat, high values of the individual categories shaded (without R, G, D), numbers in italics = classes with *n* <4.

			Endangerment											Conservation value						H
	Class	***n***	**End.**	**0**	**1**	**2**	**3**	**V**	*****	***<**	**R**	**G**	**D**	**Value**	**1**	**2**	**3**	**4**	**5**	**!-!!!, (x), [x]**
01	**Lemnetea**	6	50				50		50					50			50	33	17	50
02	**Zosteretea**	1	*0*					*100*						***100***		*100*				***100***
03	**Ruppietea maritimae**	5	**80**		20	20	20	20				20		**100**	20	20	60			**100**
04	**Charetea**	8	**88**		25	50	13	13						**100**		100				**100**
05	**Potamogetonetea**	13	46		23	15	8	8	46					**85**		38	46	15		54
06	**Thero-Salicornietea strictae**	1	***100***			*100*								***100***			*100*			***100***
07	**Isoeto-Nano-Juncetea**	7	**86**		57	29			14					**86**		43	43	14		**86**
08	**Bidentetea**	8	25				25		75					50		25	25	13	38	25
09	**Littorelletea**	6	**100**	17	33	33	17							**100**	33	50	17			**100**
10	**Montio-Cardaminetea**	2	***100***			*50*	*50*							***100***			*100*			***100***
11	**Oxycocco-Sphagnetea**	8	**88**		50	38		13						**100**		88	13			**100**
12	**Parvo-Caricetea**	17	**88**		65	12	12	12						**100**	35	65				**100**
13	**Phragmito-Magno-Caricetea**	17	6			6		12	53	24			6	71		24	47	29		18
14	**Juncetea maritimi**	12	**83**		17	50	17	17						**100**		75	25			**100**
15	**Cakiletea maritimae**	5	60			20	40	20	20					**100**	20	20	60			80
16	**Polygono-Poetea annuae**	8	38		25		13		63					0				13	88	38
17	**Sisymbrietea**	10	10						60	30		10		0				20	80	10
18	**Stellarietea mediae**	7	**86**			43	43	14						29		14	14	71		**86**
19	**Asplenietea trichomanis**	3	***100***		*33*	*33*	*33*							*33*			*33*	*67*		***100***
20	**Calluno-Ulicetea**	6	**83**		33	50		17						**100**		50	50			**100**
21	**Koelerio-Corynephoretea**	16	56		13	6	25	19	6		13		19	**88**		25	63	6	6	75
22	**Festuco-Brometea**	3	***100***		*33*	*33*	*33*							***100***		*100*				***100***
23	**Molinio-Arrhenatheretea**	11	36		18	9	9	18	36	9				64		45	18	27	9	55
24	**Ammophiletea**	3	*33*			*33*		*33*	*33*					*67*		*33*	*33*	*33*		*33*
25	**Trifolio-Geranietea sanguinei**	18	61		22	17	22	11	17				11	**89**		39	50	11		72
26	**Artemisietea vulgaris**	41	24			5	12	2	54	20		7		7			7	54	39	24
27	**Salicetea purpureae**	2	***100***		*50*	*50*								***100***		*100*				***100***
28	**Vaccinio uliginosi-Pinetea**	3	***100***		*67*	*33*								***100***		*67*	*33*			***100***
29	**Molinio-Betuletea pubescentis**	8	**88**		38	25	25	13						**100**	25	63	13			**100**
30	**Alnetea glutinosae**	9	67	11		22	33	22	11					**100**		67	33			**89**
31	**Rhamno-Prunetea**	5	0						60	40				40		20	20	40	20	0
32	**Vaccinio-Piceetea**	5	**80**		60	20		20						80		40	40	20		**80**
33	**Quercetea robori-petraeae**	3	*33*		*33*			*33*	*33*					*67*		*33*	*33*	*33*		*33*
34	**Carpino-Fagetea**	8	**75**				25		25			50		**75**	25	38	13	25		**75**

Threat causes

Within the project, threat causes for plant communities as a separate category, but they were integrated into the sections *Gefährdung* (Endangerment) and *Erhaltungsmöglichkeiten* (Conservation measures) of the association treatments in Berg et al. (2004). A systematization of the threat causes is difficult due to the manifold interconnections (such as drainage and eutrophication of wetlands), and existing approaches are unsatisfactory. We nevertheless compiled by survey questionnaire among the authors of the class treatments in Berg et al. (2004) to elucidate the relative importance of a wide array of factors

The threat causes distinguished have been grouped on the basis of an internal list of the German Federal Agency for Nature Conservation into 12 complexes, which mainly reflect the origin of threat (Table 11). Figure 10 shows the same data in aggregate form. It is important to note that the causal complexes listed here, just mean the summation of all individual causes assigned to the respective complex. For example, the causal complex 'agriculture' does not mean that agriculture *per se* is a threat for plant communities, but certain forms of management or some measures according to the details of Table 11.

Table 11. Threat causes and number of endangered associations that are affected (n = 173) based on author assessment; multiple answers were possible, only threat causes with at least 4 entries are listed; bold type indicates causes affecting at least 40 associations.

Threat causes	**# of assoc.**
Agriculture:	
Eutrophication and pollution	**83**
Loss of landscape structures	**45**
Drainage of wetlands etc.	**43**
Fallow / abandonment	31
Lost of old forms of land use	22
Intensive agriculture (mineral fertilizers, herbicides, impoverished, short rotation, etc.)	14
Industrial grassland management	12
Changes in land use (eg turns grassland to arable fields)	9
Mechanical loads (sealing, deposition)	8
Damage by machining techniques (soil compaction, deep plowing, etc.)	5
Contamination:	
Diffuse nutrient inputs from the atmosphere and air pollution	**62**
Water pollution (surface and ground waters)	**40**
Direct contamination, such as waste dumping	12
Forestry:	
Drainage	**47**
Structural losses	18
Mechanical and material loads	18
Intensive forestry	15
Reforestation	11
Hydraulic engineering:	
Regulation / suppression of natural river dynamics	**42**
Structural losses, such as river straightening	10
Changes through structural measures	8
Industrial water body management	4
Habitat management:	
Inappropriate or lacking management	26
Lack of public awareness	4
Fishery:	
Water pollution, such as biocides, fertilizing, liming, feeding	23
Intensive fishing	9
Landscape changes:	
Fragmentation and isolation of habitats	17
Changes of urban settlement structures	8
Loss of village structures, urbanization	6
Coastal protection:	
Dike construction, shore protection, formation of dunes	21
Transport and energy:	
Release of contaminants	14
Intensive road and rail maintenance	6
Sealing by roads etc.	5
Leisure and tourism:	
Destruction / trampling / pollution	15
Space consumption	5
Construction and mining	
Closing small area excavation	8
Material loads	5
Military:	
Abandonment	8
Mechanical and material loads	4

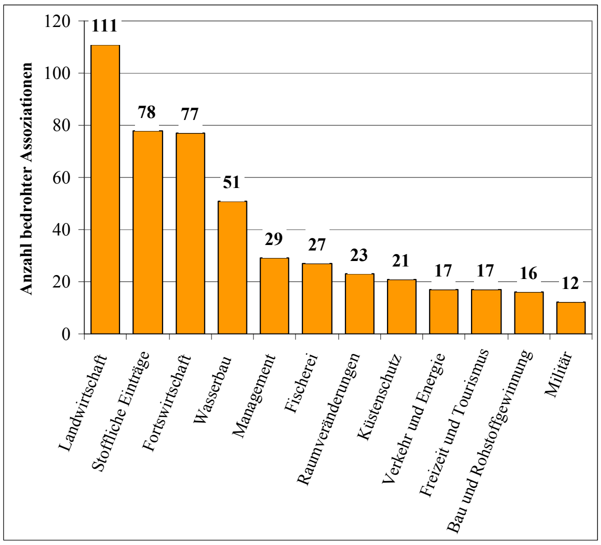

Fig. 10. Number of threatened associations (n = 173) affected by different causal complexes in Mecklenburg-Vorpommern, multiple assignments were allowed. The sequence of causal complexes is the same as in Table 11.

Table 11 shows that most plant communities – 64% of all threatened associations – are threatened by factors attributable to the (intensive) agriculture. The main damaging factors within the agricultural practice are eutrophication and herbicide application, changes in landscape structure and drainage of wetlands, followed by contaminations (mainly diffuse nutrient inputs from the atmosphere and water pollution), forestry (especially drainage) and hydraulic engineering (especially water body regulation).

Overall of medium importance as threats factors are the complexes habitat management, fisheries, landscape changes and coastal protection. Least important as a threat to for the majority of plant communities are those factors related to transport and energy supply, leisure and tourism, urban development, mining and military. It should be noted, however, that this assessment refers to plant communities as abstract types and all these factors may cause a substantial threat for individual concrete vegetation stands.

This spectrum of dominant threat causes is closely connected to the geological and economic structure of Mecklenburg-Vorpommern as agricultural land with low degree of industrialization, but a high percentage of arable land and semi-aquatic habitats. The main threat factors eutrophication and drainage could decrease in the next decades when a more sustainable agriculture would be established. The opportunities existing in the agricultural sector (e.g. subsidies for conservation-oriented grassland management) and in hydraulic engineering (e.g. restoration of water bodies and swamps) should be exploited.

Legal protection

Protection of habitats according to § 20 of the Nature Conservation Law of Mecklenburg-Vorpommern (LNatG)

Targets of § 20 of the Law for the Protection of Nature and Landscape in Mecklenburg-Vorpommern (Land Conservation Act – LNatG MV) of 22 October 2002, last amended on 17 December 2003, are the endangered habitats. As 'identifiable habitats of plant and animal communities' they usually characterized among others by typical vegetation. The assignment of all associations to a habitat type as defined as **legally protected biotopes** (Annex 1 to § 20 LNatG MV) provides a good measure of check their status of protection. In particular, the 125 associations and the subtypes of nine other associations with high or very high need for action require special attention. Fortunately, almost 80% of these associations are generally protected by law. Among them, with one exception, all associations with currently very high need for action.

However, there are also 11 (9%) of these highly action requiring associations and one subtype that are presently not protected by law (Table 12). These are ruderal and arable weed communities, wall vegetation, forest-edge tall herb communities and some mesophilous forest types.

Table 12. Plant communities with high or very high need for action, but not protected by § 20 LNatG MV. H = need for action; § 20 = protected by § 20 LNatG MV, § 30 = protected by § 30 BNatSchG =, FFH = protected by the EU Habitats Directive, * = priority habitat types.

Association or subtype		H	§ 20	§ 30	FFH
16.1.2.3	Poo annuae-Coronopetum squamati	!!	–	–	–
18.1.1.1	Scleranthо annui-Arnoseridetum minimae	!!	–	–	–
18.3.1.1	Euphorbio exiguae-Melandrietum noctiflori	!!	–	–	–
19.2.2.1	Cystopteridetum fragilis	!!	–	–	–
25.1.3.2	Potentillo sterilis-Conopodietum majoris	!!	–	–	–
26.1.1.2	Corydalido claviculatae-Epilobietum angustifolii	(!!)	–	–	–
26.2.2.3	Chaerophylletum bulbosi	(!!)	–	–	–
26.2.2.4	Urtico dioicae-Parietarietum officinalis	!!	–	–	–
33.1.1.1	Lonicero periclymeni-Fagetum sylvaticae	!!!	–	–	yes
33.1.1.2b	Vaccinio myrtilli-Fagetum sylvaticae, *Leucobryum glaucum* subtype	!!	–	–	yes
34.1.1.1	Adoxo moschatellinae-Aceretum pseudoplatani	!!	–	yes	yes*
34.1.1.2	*Prunus avium-Acer platanoides* community	(!!!)	–	yes	yes*

Another 17 (14%) associations and two subtypes with a high to very high need for action fall under legal habitat protection only under certain conditions (for example, certain structural features of the biotopes). They belong to the following habitats:

- Water bodies, shores and swamps (07.1.1.4, 07.1.2.1, 07.1.2.3, 09.1.2.2)
- Lagoons and sea shore drift line (03.1.2.3, 15.1.3.3) and coastal shrubs (31.1.1.3c)
- Wet grassland (23.2.2.1, 23.2.2.1a)
- Thermophilous forest-edge and tall herb vegetation (25.1.2.1, 25.2.1.1, 25.2.1.3, 25.3.1.1 and 25.3.1.2, 25.3.2.1, 25.3.2.3, 25.3.2.4, 25.3.2.5)
- Lichen-rich pine forest (32.1.1.4)

Some communities are part of protected habitats according to Annex I of the EU Habitats Directive (Directive 92/43/EEC, see Table 13 and Appendix S2). Since all states of the European Union are obliged to establish and maintain a network of protected areas (Natura 2000), the lack of legal protection of biotopes on the state-level could be compensated.

In connection with the last amendment (25.11.2003) of the Federal Nature Conservation Act – BNatSchG), parts of the remaining protection deficit were eliminated. Previously, in Mecklenburg-Vorpommern only natural swamp forests and forests of dry and warm locations were protected by law. Due to the amendment of § 30 BNatSchG now also ravine and slope forests are included in the habitat protection of the German federal states. Specifically the legal protection of marine and coastal habitats and inland water bodies and their plant communities have been extended in this act (see Riecken 2002). Now the whole area of all water bodies (lakes, ponds, backwaters, abandoned mining waters, etc.) with their complete vegetation fall under legal habitat protection.

Assignment of the associations with FFH habitats

The assignment to habitat types of Annex I of the EU Habitats Directive, based on the treatment for the whole of Germany by Ssymank et al. (1998), is given in Table 13. This result enables to differentiate, describe and assess the Annex I habitats in phytosociological terms.

Table 13. Overview of the assignment of the associations of Mecklenburg-Vorpommern to Annex I habitats of the EU Habitats Directive. Habitats type = habitat type in Annex I of the EU Habitats Directive; * = priority habitat; (*) = only orchid rich stands belong to that priority habitat type.

Habitat typ	No. of assoc.	Associations	
		Habitats	Habitats p.p.
Marine and coastal habitats (incl. inland dunes)			
Open sea and tidal areas			
1110	p.p 1		02.1.1.1
1130	p.p 7		03.1.1.1, 03.1.1.2 03.1.2.1, 03.1.2.2 03.1.2.3, 04.2.1.5 05.2.2.1
***1150**	p.p 8		all 1110 and 1130
1160	p.p 5		02.1.1.1, 03.1.1.1 03.1.1.2, 03.1.2.1, 03.1.2.2

Habitat typ	No. of assoc.	Associations – Habitats	Associations – Habitats p.p.
Sea cliffs and shingle or stony beaches			
1210	2	15.1.1.1, 15.1.3.1	
1220	1, p.p 3	15.1.3.2	15.1.2.1, 15.1.3.3 26.4.1.2
1230	p.p 10		17.2.1.1, 17.2.1.3 21.4.3.2, 25.3.1.1 25.3.1.2, 26.4.1.1 26.4.1.2, 26.4.1.3 26.5.1.1, 26.5.2.2
Atlantic and continental salt marshes and salt meadows			
1310	2	06.1.1.1, 14.1.1.2	
1330	10, p.p 1	14.1.1.1, 14.1.2.1 14.1.2.2, 14.1.2.3 14.1.2.4, 14.1.2.5 14.1.2.6, 14.1.2.7 14.2.1.1, 14.2.2.1	14.1.1.2
***1340**	p.p 5		06.1.1.1, 14.1.2.3, 14.2.1.1, 14.2.2.1, 14.3.1.1
Sea dunes of the Atlantic, North Sea and Baltic coast			
2110	1, p.p 3	24.1.1.1	15.1.3.2, 15.1.3.3 24.1.2.1
2120	2, p.p 3	24.1.2.2, 24.1.2.1	15.1.3.3, 17.2.1.3 26.4.1.3
***2131**	1, p.p 7	21.2.1.1	21.1.1.1, 21.1.1.3 21.4.1.1, 21.4.2.1 21.4.3.1, 21.5.2.1, 21.5.2.2
***2137**	1		21.3.1.1
***2140**	1	20.2.2.2	
2150	1	20.2.2.1	
2160	p.p 1		31.1.1.3
2180	1	32.1.1.3	32.1.1.1, 32.1.1.4 32.1.2.1
2192	p.p 2		07.1.2.2, 14.1.1.1
2193	p.p 2		11.1.1.2, 11.1.1.3
Inland dunes			
2310	p.p 1		20.2.1.2
2330	p.p 9		21.1.1.1, 21.1.1.2 21.1.1.3, 21.3.1.1, 21.3.1.2, 21.4.2.1, 21.4.3.1, 21.4.3.2, 21.4.3.3
Freshwater habitats			
Standing water			
3110	1	09.1.1.1	
3130	1, p.p 1	04.1.1.1	04.1.2.1
3131	4, p.p 2	09.1.2.1, 09.1.2.2 09.1.3.1, 09.1.3.2	09.1.1.1 09.1.3.3
3132	3, p.p 4	07.1.1.2, 07.1.1.3 07.1.1.4	07.1.1.1, 07.1.2.1 07.1.2.2, 07.1.2.3
3140	4, p.p 4	04.2.1.1, 04.2.1.2 04.2.1.3, 04.2.1.4	04.1.2.1, 04.2.1.5 04.2.2.1, 05.2.3.2
3150	p.p 13		01.1.1.1, 01.1.1.2 01.1.2.1, 01.1.3.1 01.1.3.3, 05.2.1.1, 05.2.1.2, 05.2.1.4, 05.2.2.1, 05.2.2.2, 05.2.2.3, 05.2.3.1, 05.2.3.2
3160	p.p 4		01.1.1.1, 01.1.1.2 05.1.1.3, 05.2.1.3
Running water			
3260	1, p.p 2	05.2.2.4	05.2.2.1 05.2.2.2
3270	3, p.p 2	08.1.1.2, 08.1.2.2, 08.1.2.3	08.1.1.1, 08.1.2.1

Habitat typ	No. of assoc.	Associations – Habitats	Associations – Habitats p.p.
Temperate heath and scrub			
European wet and dry heaths			
4010	p.p 3		11.1.1.1, 11.1.1.2 11.1.1.3
4030	2	20.2.1.1, 20.2.1.2	
Sub-Mediterranean and temperate scrub			
5130	1	32.1.1.2	
Natural and semi-natural grassland formations			
Natural grassland			
6120	2, p.p 1	21.5.1.1, 21.5.2.2	21.5.2.1
Semi-natural dry grasslands and scrubland facies			
(*)6212	1	22.1.1.1	
(*)6214	1	21.4.3.2	
***6230**	2	20.1.1.1, 20.1.1.2	
***6240**	2	22.1.2.1, 22.2.1.1	
Semi-natural tall-herb humid meadows			
6410	2	23.3.1.1, 23.2.2.2	
6431	p.p 7		13.4.1.1, 13.4.1.2 13.4.2.1, 13.4.2.2 13.4.3.1, 13.4.3.2 13.4.3.3
6440	p.p 1		23.2.2.1
Mesophile Grassland			
6510	p.p 1		23.1.1.1
Raised bogs and mires and fens			
Sphagnum acid bogs			
***7110**	1, p.p 1	11.2.1.2	11.2.1.1
7120	p.p 1		11.3.1.1
7140	6, p.p 8	11.2.1.1, 11.3.1.1 12.1.1.1, 12.1.1.2 12.2.1.1, 12.2.1.2	11.2.1.2, 11.2.2.1 11.2.2.2, 12.2.1.3 12.2.2.1, 12.3.1.1 12.3.1.2, 13.1.2.1
7150	2, p.p 2	11.2.2.1, 11.2.2.2	11.1.1.1, 12.2.2.2
Calcareous fens			
***7210**	2, p.p 2	12.2.3.1, 29.1.1.2	12.2.1.3, 12.2.3.2
***7220**	2	10.1.1.1, 30.1.1.1	
7230	7, p.p 4	12.2.4.1, 12.2.4.2 12.2.4.3, 12.3.2.1 12.3.2.2, 12.3.2.3 29.1.1.1	12.2.3.1, 12.2.3.2 12.3.1.1, 12.3.1.2
Forests			
9110	1, p.p 1	33.1.1.1	33.1.1.2
9130	3	34.2.1.1, 34.2.1.2 34.2.2.1	
9150	1	34.2.3.1	
9160	p.p 1		34.2.1.1
***9180**	2	34.1.1.1, 34.1.1.2	
9190	p.p 1		33.1.2.1
***91D0**	1	30.2.1.2	
***91D1**	2	29.2.1.1, 29.2.2.1	
***91D2**	3	28.1.1.1, 28.1.2.1, 28.1.2.2	
91E0	5	27.1.1.1, 27.1.1.2 30.1.2.1, 30.2.2.1 30.2.2.2	
91F0	1	30.3.1.2	
91T0	1	32.1.1.4	
91U0	1	32.1.2.1	

References

Abdank, A., Berg, C. & Dengler, J. 2004. Bilanz der Roten Liste und Konsequenzen für den Naturschutz. In: Berg, C., Dengler, J., Abdank, A. & Isermann, M. (ed.) *Die Pflanzengesellschaften Meck-*

lenburg-Vorpommerns und ihre Gefährdung – Textband, pp. 494–507. Weissdorn, Jena, DE..

Berg, C., Dengler, J. & Abdank, A. (eds.) 2001. *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Tabellenband*. Weissdorn, Jena, DE.

Berg, C., Dengler, J., Abdank, A. & Isermann, M. (eds.) 2004. *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband*. Weissdorn, Jena, DE.

Böhnert, W., Gutte, P. & Schmidt, P.A. 2001. *Verzeichnis und Rote Liste der Pflanzengesellschaften Sachsens*. Sächsisches Landesamt für Umwelt und Geologie, Dresden, DE.

Dengler, J., Löbel, S. & Dolnik, C. 2009. Species constancy depends on plot size – a problem for vegetation classification and how it can be solved. *Journal of Vegetation Science* 20: 754–766.

Dierßen, K., von Glahn, H., Härdtle, W., Höper, H., Mierwald, U., Schrautzer, J. & Wolf, A. 1988. Rote Liste der Pflanzengesellschaften Schleswig-Holsteins. 2nd ed. *Schriftenreihe des Landesamtes Naturschutz Landschaftspflege Schleswig-Holstein* 6: 1–157.

Heinrich, W., Klotz, S., Korsch, H., Marstaller, R., Pfützenreuter, S., Samietz, R., Scholz, P., Türk, W. & Westhus, W. 2001. Rote Liste der Pflanzengesellschaften Thüringens. *Naturschutzreport* 18: 377–409.

Rennwald, E. (eds.) 2002 [‘2000’]. Verzeichnis und Rote Liste der Pflanzengesellschaften Deutschlands – mit Datenservice auf CD-ROM. *Schriftenreihe Vegetationskunde* 35: 1–800 + CD-ROM.

Riecken, U. 2002. Novellierung des Bundesnaturschutzgesetzes: Gesetzlich geschützte Biotope nach § 30. *Natur und Landschaft* 77: 397–406.

Schubert, R., Frank, D., Herdam, H., Hilbig, W., Jage, H., Karste, G., Kison, H.-U., Klotz, S., Peterson, J., Reichhoff, L., Stöcker, G., Weinitschke, H., Wegner, U. & Westhus, W. 2001. Rote Liste der Pflanzengesellschaften Sachsen-Anhalts. *Mitteilungen zur Floristischen Kartierung in Sachsen-Anhalt Sonderheft* 2: 681–686.

Ssymank, A., Hauke, U., Rückriem, C. & Schröder, E. 1998. Das europäische Schutzgebietssystem NATURA 2000. BfN-Handbuch zur Umsetzung der Fauna-Flora-Habitat-Richtlinie (92/43/EWG) und der Vogelschutzrichtlinie (79/409/EWG). *Schriftenreihe für Landschaftspflege und Naturschutz* 53: 1–560.

Appendix S4. Overview of the phytosociological hierarchy from Berg et al. (2001, 2004) that underlies Appendices S2 and S3.

Detailed justification for the chosen classification and nomenclature is provided in the monograph *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung* (Berg et al. 2004) as well as in the nomenclatural contributions by Dengler et al. (2003, 2004).

1. Class: Lemnetea O. de Bolòs & Masclans 1955
- 1.1 Order: Lemnetalia O. de Bolòs & Masclans 1955
  - 1.1.1 Alliance: Lemnion trisulcae den Hartog & Segal 1964
    - 01.1.1.1 Riccietum fluitantis Slavnić 1956
    - 01.1.1.2 Lemno-Utricularietum Soó 1947
  - 1.1.2 Alliance: Hydrocharition morsus-ranae (Passarge 1964) Westhoff & den Held 1969
    - 01.1.2.1 Stratiotetum aloidis Miljian 1933
  - 1.1.3 Alliance: Lemnion minoris O. de Bolòs & Masclans 1955
    - 01.1.3.1 Lemno-Spirodeletum polyrhizae W. Koch 1954
    - 01.1.3.2 Wolffio-Lemnetum gibbae Slavnić 1956
    - 01.1.3.3 Ceratophylletum submersi den Hartog & Segal ex Redeker 1969

2. Class: Zosteretea Pignatti 1953
- 2.1 Order: Zosteretalia Béguinot ex Pignatti 1953 nom. cons. propos.
  - 2.1.1 Alliance: Zosterion Br.-Bl. & Tx. ex Pignatti 1953
    - 2.1.1.1 Zosteretum marinae van Goor ex Pignatti 1953

3. Class: Ruppietea maritimae J. Tx. ex den Hartog & Segal 1964
- 3.1 Order: Ruppietalia J. Tx. ex den Hartog & Segal 1964 nom. cons. propos.
  - 3.1.1 Alliance: Charion canescentis Krausch 1964
    - 03.1.1.1 Charetum canescentis Chorillion 1957
    - 03.1.1.2 Charetum horrido-balticae Fukarek 1961
  - 3.1.2 Alliance: Ruppion maritimae Br.-Bl. ex Soó 1947
    - 03.1.2.1 Chaetomorpho lini-Ruppietum cirrhosae Br.-Bl. in Br.-Bl. & al. corr. Berg in Dengler & al. 2004
    - 03.1.2.2 Ruppietum maritimae Gillner 1960
    - 03.1.2.3 Ranunculetum baudotii Br.-Bl. in Br.-Bl. & al. 1952

4. Class: Charetea F. Fukarek ex Krausch 1964
- 4.1 Order: Nitelletalia flexilis Krause 1969
  - 4.1.1 Alliance: Nitellion flexilis Krause 1969
    - 4.1.1.1 Nitelletum capillaris Corillion 1957
  - 4.1.2 Alliance: Nitellion syncarpo-tenuissimae Krause 1969
    - 4.1.2.1 Nitello-Vaucherietum dichotomae Krausch 1964
- 4.2 Order: Charetalia Sauer ex Krausch 1964
  - 4.2.1 Alliance: Charion fragilis Krausch 1964
    - 04.2.1.1 Nitellopsietum obtusae Dąmbska 1961
    - 04.2.1.2 Najadetum intermediae Lang 1973
    - 04.2.1.3 Charetum contrariae Corillion 1957
    - 04.2.1.4 Magno-Charetum hispidae Corillion 1957
    - 04.2.1.5 Charetum asperae Corillion 1957
  - 4.2.2 Alliance: Charion vulgaris (Krause & Lang 1977) Krause 1981
    - 4.2.2.1 Charetum vulgaris Corillion 1957

5. Class: Potamogetonetea Klika in Klika & V. Novák 1941
- 5.1 Order: Callitricho-Batrachietalia Passarge 1978

5.1.1 Alliance: Ranunculion aquatilis Passarge 1964
05.1.1.1 Hottonietum palustris Tx. ex Roll 1940
05.1.1.2 Ranunculetum aquatilis Géhu 1961
05.1.1.3 Ranunculo trichophylli-Callitrichetum Soó 1949
5.2 Order: Potamogetonetalia W. Koch 1926
5.2.1 Alliance: Nymphaeion albae Oberd. 1957
05.2.1.1 Potamogetonetum natantis Hild 1959
05.2.1.2 Nymphaeo albae-Nupharetum luteae Nowiński 1928 nom. mut. propos.
05.2.1.3 Nupharetum pumilae Oberdorfer ex T. Müller & Görs 1960
05.2.1.4 Nymphoidetum peltatae Bellot 1951 nom. mutat. propos.
5.2.2 Alliance: Magno-Potamogetonion (Vollmar 1947) den Hartog & Segal 1964
05.2.2.1 Potamogetono perfoliati-Ranunculetum circinati Sauer 1937
05.2.2.2 Potamogetonetum lucentis Hueck 1931
05.2.2.3 Potamogetonetum praelongi Hild 1959
05.2.2.4 Sparganio-Potamogetonetum pectinati Reichhoff & Hilbig 1975
5.2.3 Alliance: Parvo-Potamogetonion (Vollmar 1947) den Hartog & Segal 1964
05.2.3.1 Potamogetonetum trichoidis Tx. 1974
05.2.3.2 Charo asperae-Potamogetonetum filiformis Spence 1964 nom. invers. propos.

6. Class: Thero-Salicornietea strictae Tx. in Tx. & Oberd. 1958

6.1 Order: Thero-Salicornietalia Pignatti 1953
6.1.1 Alliance: Salicornion ramosissimae Tx. ex W. Matuszkiewicz 1981
6.1.1.1 Salicornietum europaeae Christiansen 1955 nom. mut. propos.

7. Class: Isoeto-Nano-Juncetea Br.-Bl. & Tx. ex Br.-Bl. & al. 1952

7.1 Order: Nano-Cyperetalia Klika 1935
7.1.1 Alliance: Nano-Cyperion flavescentis W. Koch ex Libbert 1932
07.1.1.1 Juncetum bufonii Felföldi 1942
07.1.1.2 Polygono-Eleocharietum ovatae Eggler 1933
07.1.1.3 Eleocharito acicularis-Limoselletum aquaticae Wendelberger-Zelinka 1952
07.1.1.4 Elatino alsinastri-Juncetum tenageiae Libbert ex W. Fischer 1973
7.1.2 Alliance: Cicendion (Rivas-Goday in Rivas Goday & Borja Carbonell 1961) Br.-Bl. 1967
07.1.2.1 Stellario uliginosi-Scirpetum setacei Libbert 1932
07.1.2.2 Hypno lindbergii-Cicendietum filiformis Allorge 1922 nom. invers. et mut. propos.
07.1.2.3 Digitario ischaemi-Illecebretum verticillati Diemont & al. 1940 nom. mut. propos.

8. Class: Bidentetea Tx. & al. ex von Rochow 1951

8.1 Order: Bidentetalia Br.-Bl. & Tx. ex Klika & Hadač 1944
8.1.1 Alliance: Bidention tripartitae (W. Koch 1926) Nordhagen 1940
08.1.1.1 Polygonetum hydropiperis Passarge 1965
08.1.1.2 Corrigiolo litoralis-Bidentetum radiatae Lericq 1971
08.1.1.3 Rumici maritimi-Ranunculetum scelerati Oberd. 1957
08.1.1.4 Alopecuretum aequalis T. Müller 1975
08.1.1.5 Bidentetum cernuae Kobendza 1948
8.1.2 Alliance: Chenopodion rubri (Tx. in Poli & J. Tx. 1960) Hilbig & Jage 1972
08.1.2.1 Chenopodietum rubri Tímár 1950
08.1.2.2 Xanthio albini-Chenopodietum rubri Lohmeyer & Walther in Lohmeyer 1950 corr. Hilbig & Jage 1972
08.1.2.3 Chenopodio polyspermi-Corrigioletum litoralis Hülbusch & Tx. ex Wißkirchen 1995

9. Class: Littorelletea Br.-Bl. & Tx. ex Westhoff & al. 1946

9.1 Order: Littorelletalia uniflorae W. Koch ex Tx. 1937
9.1.1 Alliance: Littorellion uniflorae W. Koch ex Tx. 1937

9.1.1.1 Isoeto lacustris-Lobelietum dortmannae Tx. 1937
9.1.2 Alliance: Eleocharition multicaulis Vanden Berghen 1969
09.1.2.1 Pilularietum globuliferae Tx. ex T. Müller & Görs 1960
09.1.2.2 Samolo valerandi-Littorelletum uniflorae Westhoff ex Vanden Berghen 1964
9.1.3 Alliance: Eleocharition acicularis Pietsch ex Dierßen 1975
09.1.3.1 Myriophyllo alterniflori-Littorelletum uniflorae Jeschke ex Passarge in Scamoni 1963
09.1.3.2 Littorello uniflorae-Eleocharitetum acicularis Chouard 1924
09.1.3.3 Ranunculo flammulae-Juncetum bulbosi Oberd. 1957

10. Class: Montio-Cardaminetea Br.-Bl. & Tx. ex Klika 1948

10.1 Order: Montio fontanae-Cardaminetalia amarae Pawłowski in Pawłowski & al. 1928
10.1.1 Alliance: Adiantion capilli-veneris Br.-Bl. ex Horvatić 1934
10.1.1.1 Cratoneuretum commutati Aichinger 1933
10.1.2 Alliance: Caricion remotae Kästner 1941
10.1.2.1 Caricetum remotae Kästner 1941

11. Class: Oxycocco-Sphagnetea Br.-Bl. & Tx. ex Westhoff & al. 1946

11.1 Order: Sphagno-Ericetalia tetralicis Schwickerath 1941 nom. invers. propos.
11.1.1 Alliance: Ericion tetralicis Schwickerath 1933
11.1.1.1 Lycopodiello inundatae-Rhynchosporetum fuscae Schaminée & al. ex Timmermann in Dengler & al. 2004
11.1.1.2 Ericetum tetralicis Allorge 1922
11.1.1.3 Empetro nigri-Ericetum tetralicis Westhoff ex de Smidt 1977
11.2 Order: Sphagnetalia magellanici Kästner & Flößner 1933 nom. mut. propos.
11.2.1 Alliance: Sphagnion magellanici Kästner & Flößner 1933 nom. mut. propos.
11.2.1.1 Sphagno magellanici-Ledetum palustris Sukopp ex Neuhäusl 1969 nom. invers. et mut. propos.
11.2.1.2 Sphagnetum magellanici Kästner & Flößner 1933 nom. mut. propos.
11.2.2 Alliance: Scheuchzerion palustris Nordhagen ex Tx. 1937
11.2.2.1 Caricetum limosae Osvald 1923
11.2.2.2 Sphagno tenelli-Rhynchosporetum albae Osvald 1923 nom. cons. et invers. propos.
11.3 Order: Sphagno fallacis-Eriophoretalia vaginati Timmermann in Dengler & al. 2004
11.3.1 Alliance: Sphagno fallacis-Eriophorion vaginati Timmermann in Dengler & al. 2004
11.3.1.1 Sphagno recurvi-Eriophoretum vaginati Hueck 1929 nom. invers. propos.

12. Class: Parvo-Caricetea den Held & Westhoff in Westhoff & den Held 1969 nom. cons. propos.

12a Subclass: Sphagno fallacis-Caricenea canescentis Timmermann in Dengler & al. 2004
12.1 Order: Sphagno-Caricetalia Succow 1974
12.1.1 Alliance: Caricion canescenti-nigrae Nordhagen ex Tx. 1937 corr. Timmermann in Dengler & al. 2004
12.1.1.1 Sphagno recurvi-Caricetum rostratae Steffen 1931
12.1.1.2 Carici canescentis-Agrostietum caninae Tx. 1937
12b Subclass: Drepanoclado revolventis-Caricenea diandrae Koska in Dengler & al. 2004
12.2 Order: Drepanoclado revolventis-Caricetalia Succow 1974
12.2a Suborder: Caricenalia diandrae Succow 1974
12.2.1 Alliance: Caricion lasiocarpae Vanden Berghen in Lebrun & al. 1949 nom. cons. propos.
12.2.1.1 Caricetum lasiocarpae Osvald 1923 nom. cons. propos.
12.2.1.2 Caricetum diandrae Jonas 1933
12.2.1.3 Peucedano palustris-Caricetum lasiocarpae Tx. ex Paul & Lutz 1941 nom. invers. propos.
12.2.2 Alliance: Comaro palustris-Juncion effusi Passarge 1999

12.2.2.1 Junco-Caricetum nigrae Grosser & al. 1967 corr. Koska in Dengler & al. 2004 nom. cons. propos.
12.2.2.2 Caricetum serotinae Pietsch 1968
12.2b Suborder: Schoenenalia nigricantis Pignatti 1953
12.2.3 Alliance: Scorpidio scorpioidis-Cladion marisci (W. Braun 1968) Succow 1974
12.2.3.1 Scorpidio scorpioidis-Caricetum elatae W. Braun 1968 nom. mut. propos.
12.2.3.2 Cladietum marisci Allorge 1921
12.2.4 Alliance: Eleocharition quinqueflorae Passarge 1978
12.2.4.1 Schoeno nigricantis-Juncetum subnodulosi Allorge 1921 nom. mut. propos.
12.2.4.2 Eleocharitetum pauciflorae Lüdi 1921
12.2.4.3 Juncetum alpini Philippi 1960 corr. Görs 1977
12.3 Order: Caricetalia davallianae Br.-Bl. 1950 nom. cons. propos.
12.3.1 Alliance: Caricion nigrae W. Koch 1926 corr. Koska in Dengler & al. 2004
12.3.1.1 Sphagno teretis-Menyanthetum trifoliatae Warén 1926 nom. invers. propos.
12.3.1.2 Parnassio palustris-Caricetum Oberd. 1957 nom. cons. propos.
12.3.2 Alliance: Caricion davallianae Klika 1934
12.3.2.1 Paludello palustri-Caricetum Succow in Knapp & al. 1985
12.3.2.2 Schoenetum ferruginei Du Rietz 1925 nom. cons. propos.
12.3.2.3 Juncetum subnodulosi W. Koch 1926

13. Class: Phragmito-Magno-Caricetea Klika in Klika & V. Novák 1941

13.1 Order: Phragmitetalia australis W. Koch 1926
13.1a Suborder: Phragmitenalia australis (W. Koch 1926) Koska in Dengler & al. 2004
13.1.1 Alliance: Phragmition communis W. Koch 1926
13.1.1.1 Cicuto virosae-Caricetum pseudocyperi Boer & Sissingh in Boer 1942
13.1.1.2 Scirpo lacustris-Phragmitetum australis W. Koch 1926 nom. cons. propos.
13.1b Suborder: Oenanthenalia aquaticae Hejný ex Koska in Dengler & al. 2004
13.1.2 Alliance: Phalarido arundinaceae-Glycerion Passarge 1964
13.1.2.1 Caricetum vesicariae Chouard 1924
13.1.2.2 Oenantho aquaticae-Rorippetum amphibiae Lohmeyer 1950 nom. cons. propos.
13.1.2.3 Eleocharitetum palustris Ubrizsy 1948
13.1.3 Alliance: Eleocharito palustris-Sagittarion sagittifoliae Passarge 1964
13.1.3.1 Sagittario sagittifoliae-Sparganietum simplicis Tx. 1953 nom. cons. propos.
13.1.3.2 Polygono hydropiperis-Veronicetum anagallidis-aquaticae Zonnefeld ex Schaminée & Weeda in Weeda & al. 1995
13.2 Order: Nasturtio officinalis-Glycerietalia fluitantis Pignatti 1953
13.2.1 Alliance: Glycerio-Sparganion Br.-Bl. & Sissingh in Boer 1942
13.2.1.1 Glycerio-Sparganietum neglecti W. Koch 1926
13.2.1.2 Nasturtietum microphylli Philippi 1973
13.3 Order: Scrophulario umbrosae-Caricetalia paniculatae Koska in Dengler & al. 2004
13.3.1 Alliance: Scrophulario umbrosae-Caricion paniculatae Koska in Dengler & al. 2004
13.3.1.1 Valeriano-Caricetum paniculatae (Wangerin ex Jeschke 1964b) Succow in H. D.Knapp & al. 1985
13.4 Order: Calystegietalia sepium Tx. ex Moor 1958 nom. cons. et mut. propos.
13.4a Suborder: Filipendulenalia ulmariae de Foucault & Géhu ex Koska in Dengler & al. 2004
13.4.1 Alliance: Filipendulo ulmariae-Petasition hybridi Br.-Bl. ex Duvigneaud 1949
13.4.1.1 Phalarido arundinaceae-Petasitetum officinalis Schwickerath 1933 nom. invers. propos.
13.4.1.2 Filipendulo ulmariae-Geranietum palustris W. Koch 1926
13.4b Suborder: Calystegienalia sepium (Tx. ex Moor 1958) Koska in Dengler & al. 2004

13.4.2 Alliance: Archangelicion litoralis Scamoni & Passarge 1963
13.4.2.1 Urtico dioicae-Calystegietum sepium Görs & T. Müller 1969 nom. mut. propos.
13.4.2.2 Soncho palustris-Archangelicetum officinalis Tx. 1937
13.4.3 Alliance: Senecionion fluviatilis Tx. ex Moor 1958
13.4.3.1 Veronico longifoliae-Scutellarietum hastifoliae Walther 1955
13.4.3.2 Cuscuto europaeae-Calystegietum sepium Tx. ex Lohmeyer 1953 nom. invers. et mut. propos.
13.4.3.3 Urtico dioicae-Leonuretum marrubiastri Passarge 1993

14. Class: Juncetea maritimi Tx. & Oberd. 1958
14.1 Order: Juncetalia maritimi Br.-Bl. ex Tx. & Oberd. 1958
14.1.1 Alliance: Saginion maritimae Westhoff & al. 1962
14.1.1.1 Centaurio vulgaris-Saginetum moniliformis Diemont & al. 1940
14.1.1.2 Sagino maritimae-Cochlearietum danicae Tx. 1957
14.1.2 Alliance: Armerion maritimae Br.-Bl. & De Leeuw 1936
14.1.2.1 Hordeetum secalini Krisch 1974 nom. mut. propos.
14.1.2.2 Blysmetum rufi Du Rietz & G. Du Rietz 1925 nom. cons. et mut. propos.
14.1.2.3 Juncetum gerardii Christiansen 1927 nom. mut. propos.
14.1.2.4 Oenantho lachenalii-Juncetum maritimi Tx. 1937 nom. invers. propos.
14.1.2.5 Junco anciptis-Caricetum extensae Br.-Bl. & de Leeuw 1936
14.1.2.6 Artemisietum maritimae Br.-Bl. & de Leeuw 1936
14.1.2.7 Limonietum vulgaris Christiansen 1927 nom. mut. propos.
14.2 Order: Puccinellio maritimae-Salicornietalia Br.-Bl. & De Leeuw 1936
14.2.1 Alliance: Puccinellion maritimae Christiansen 1927 nom. mut. propos.
14.2.1.1 Puccinellietum maritimae Christiansen 1927 nom. mut. propos.
14.2.2 Alliance: Puccinellion distantis Pignatti 1953
14.2.2.1 Puccinellietum distantis Feekes 1943
14.3 Order: Bolboschoenetalia maritimi Hejný in Holub & al. 1967
14.3.1 Alliance: Scirpion maritimi Dahl & Hadač 1941
14.3.1.1 Scirpetum maritimi van Langendonck 1931

15. Class: Cakiletea maritimae Tx. & Preising ex Br.-Bl. & Tx. 1952
15.1 Order: Atriplicetalia littoralis Sissingh in Westhoff & al. 1946
15.1.1 Alliance: Atriplicion littoralis Nordhagen 1940
15.1.1.1 Atriplicetum littoralis Christiansen ex Tx. 1937
15.1.2 Alliance: Elymo littorei-Rumicion crispi (Nordhagen 1940) Isermann & Dengler 2004
15.1.2.1 Elymetum laxi Christiansen 1927 nom. mut. propos.
15.1.3 Alliance: Salsolo kali-Honckenyion peploidis Tx. ex Tx. & Böckelmann 1957 nom. mut. propos.
15.1.3.1 Cakiletum maritimae Nordhagen 1940 nom. cons. propos.
15.1.3.2 Honckenyetum peploidis Christiansen 1927
15.1.3.3 Honckenyo peploidis-Crambetum maritimae Eigner 1973

16. Class: Polygono-Poetea annuae Rivas-Martínez 1975
16.1 Order: Polygono arenastri-Poetalia annuae Tx. in Géhu & al. 1972 corr. Rivas-Martínez & al. 1991
16.1.1 Alliance: Polygono-Coronopodion Sissingh 1969
16.1.1.1 Poetum annuae Felföldy 1942
16.1.1.2 Polygono arenastri-Lepidietum ruderalis Mucina 1993
16.1.1.3 Bryo argentei-Saginetum procumbentis Diemont & al. 1940 nom. invers. propos.
16.1.1.4 Rumici acetosellae-Spergularietum rubrae Hülbusch 1973
16.1.1.5 Eragrostio minoris-Polygonetum arenastri Oberd. 1954 corr. Mucina 1993

16.1.2 Alliance: Malvion neglectae Gutte ex Hejný 1978
16.1.2.1 Hyoscyamo nigri-Malvetum neglectae Aichinger 1933
16.1.2.2 Matricario discoideae-Anthemidetum cotulae Dihoru ex Mucina 1986
16.1.2.3 Poo annuae-Coronopodetum squamati (Oberd. 1957) Gutte 1966

17. Class: Sisymbrietea Korneck 1974 nom. cons. propos.

17.1 Order: Sisymbrietalia J. Tx. ex Görs 1966 nom. cons. propos.
17.1.1 Alliance: Sisymbrion officinalis Tx. & al. ex von Rochow 1951
17.1.1.1 Brometum sterilis Görs 1966
17.1.1.2 Hordeetum murini Libbert 1932
17.1.2 Alliance: Atriplici-Sisymbrion Hejný 1978
17.1.2.1 Conyzo canandensis-Lactucetum serriolae Lohmeyer ex Oberd. 1957 nom. mut. propos.
17.1.2.2 Descurainietum sophiae Passarge 1959 nom. mut. propos.
17.1.2.3 Chenopodietum stricti (Oberd. 1957) Passarge 1964
17.1.2.4 Atriplicetum nitentis Slavnić 1951
17.2 Order: Conyzo canadensis-Brometalia tectorum (Passarge 1988) Wollert & Dengler in Dengler & al. 2003
17.2.1 Alliance: Salsolion ruthenicae Philippi 1971
17.2.1.1 Linario-Brometum tectorum R. Knapp 1961
17.2.1.2 Plantagini indicae-Senecionetum viscosi Eliáš 1986
17.2.1.3 Bromo tectorum-Corispermetum leptopteri Sissingh & Westhoff ex Sissingh 1950 corr. Dengler in Dengler & al. 2003
17.2.1.4 Conyzo canandensis-Amaranthetum retroflexi Passarge 1988

18. Class: Stellarietea mediae Tx. & al. ex von Rochow 1951

18.1 Order: Aperetalia spicae-venti J. Tx. & Tx. in Malato-Beliz & al. 1960
18.1.1 Alliance: Scleranthion annui (Kruseman & Vlieger 1939) Sissingh in Westhoff & al. 1946
18.1.1.1 Sclerantho annui-Arnoseridetum minimae Tx. 1937
18.1.1.2 Papaveretum argemones (Libbert 1932) Kruseman & Vlieger 1939 nom. cons. propos.
18.1.1.3 Spergulo arvensis-Chrysanthemetum segetum Br.-Bl. & de Leeuw ex Tx. 1937
18.2 Order: Dicranello staphylinae-Stellarietalia mediae Manthey in Dengler & al. 2003
18.2.1 Alliance: Aphanion arvensis J. Tx. & Tx. in Malato-Beliz & al. 1960
18.2.1.1 Aphano arvensis-Matricarietum chamomillae Tx. 1937 nom. mutat. propos.
18.2.2 Alliance: Oxalidion europaeae Passarge 1978
18.2.2.1 Galeopsietum speciosae Kruseman & Vlieger 1939
18.3 Order: Papaveretalia rhoeadis Hüppe & Hofmeister ex Manthey in Dengler & al. 2003
18.3.1 Alliance: Caucalidion Tx. ex Oberd. 1957
18.3.1.1 Euphorbio exiguae-Melandrietum noctiflori G. Müller 1964
18.3.2 Alliance: Veronico-Euphorbion Sissingh ex Passarge 1964
18.3.2.1 Veronico persicae-Lamietum hybridi Kruseman & Vlieger 1939

19. Class: Asplenietea trichomanis (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977

19.1 Order: Tortulo-Cymbalarietalia muralis Segal 1969
19.1.1 Alliance: Cymbalario muralis-Asplenion Segal 1969
19.1.1.1 Corydalidetum lutae Kaiser 1926
19.2 Order: Potentilletalia caulescentis Br.-Bl. in Br.-Bl. & Jenny 1926
19.2.1 Alliance: Potentillion caulescentis Br.-Bl. in Br.-Bl. & Jenny 1926
19.2.1.1 Asplenietum trichomano-rutae-murariae Kuhn 1937
19.2.2 Alliance: Cystopteridion J. L. Richard 1972
19.2.2.1 Cystopteridetum fragilis Oberd. 1938

20. Class: Calluno-Ulicetea Br.-Bl. & Tx. ex Klika & Hadač 1944
20.1 Order: Nardetalia strictae Preising 1950
20.1.1 Alliance: Violion caninae Schwickerath 1944
20.1.1.1 Polygalo vulgaris-Nardetum strictae (Preising 1953) Oberd. 1957 nom. cons. propos.
20.1.1.2 Juncetum squarrosi Nordhagen 1922 nom. cons. propos.
20.2 Order: Vaccinio-Genistetalia Schubert ex Passarge 1964
20.2.1 Alliance: Genistion pilosae Böcher 1943
20.2.1.1 Galio harcynici-Deschampsietum flexuosae Passarge 1979
20.2.1.2 Genisto pilosae-Callunetum vulgaris Br.[-Bl.] 1915 nom. invers. propos
20.2.2 Alliance: Empetrion nigri Schubert ex Westhoff & den Held 1969
20.2.2.1 Salici repentis-Empetretum nigri Fukarek 1961
20.2.2.2 Hieracio umbellati-Empetretum nigri Libbert ex Passarge 1964
21. Class: Koelerio-Corynephoretea Klika in Klika & V. Novák 1941
21a Subclass: Koelerio-Corynephorenea (Klika in Klika & V. Novák 1941) Dengler in Dengler & al. 2003
21.1 Order: Corynephoretalia canescentis Klika 1934
21.1.1 Alliance: Corynephorion canescentis Klika 1931
21.1.1.1 Corniculario aculeatae-Corynephoretum canescentis Steffen 1931 nom. invers. propos.
21.1.1.2 Agrostietum vinealis Kobendza 1930 corr. Kratzert & Dengler 1999
21.1.1.3 Caricetum arenariae Christiansen 1927
21.2 Order: Artemisio-Koelerietalia albescentis Sissingh 1974
21.2.1 Alliance: Koelerion albescentis Tx. 1937
21.2.1.1 Tortulo ruraliformis-Phleetum arenarii Br.-Bl. & de Leeuw 1936
21.3 Order: Thero-Airetalia Rivas Goday 1964
21.3.1 Alliance: Thero-Airion Tx. ex Oberd. 1957
21.3.1.1 Carici arenariae-Airetum praecocis Westhoff & al. 1962 nom. invers. propos.
21.3.1.2 Airo-Festucetum Sommer 1971
21.3.1.3 Vulpietum myuri Philippi 1973
21.4 Order: Trifolio arvensis-Festucetalia ovinae Moravec 1967
21.4.1 Alliance: Sedo-Cerastion arvensis Sissingh & Tideman 1960
21.4.1.1 Galio veri-Festucetum capillatae Br.-Bl. & de Leeuw 1936 nom. invers. et mut. propos.
21.4.2 Alliance: Hyperico perforati-Scleranthion perennis Moravec 1967
21.4.2.1 Thymo pulegioidis-Festucetum ovinae Oberd. 1957
21.4.3 Alliance: Armerion elongatae Pötsch 1962
21.4.3.1 Diantho deltoidis-Armerietum elongatae Krausch ex Pötsch 1962 nom. cons. propos.
21.4.3.2 Sileno otitae-Festucetum brevipilae Libbert 1933 corr. Kratzert & Dengler 1999 nom. invers. propos.
21.4.3.3 Allio schoenoprasi-Caricetum praecocis Tx. ex Walther 1977
21.5 Order: Sedo acris-Festucetalia Tx. 1951 nom. invers. propos.
21.5.1 Alliance: Sileno conicae-Cerastion semidecandri Korneck 1974
21.5.1.1 Sileno conicae-Cerastietum semidecandri Korneck 1974
21.5.2 Alliance: Koelerion glaucae Volk 1931
21.5.2.1 Helichryso arenarii-Jasionetum litoralis Libbert 1940
21.5.2.2 Festucetum polesicae Regel 1928
21b Subclass: Sedo-Scleranthenea (Br.-Bl. 1955) Dengler in Dengler & al. 2003
21.6 Order: Alysso alyssoidis-Sedetalia Moravec 1967
21.6.1 Alliance: Alysso alyssoidis-Sedion Oberd. & T. Müller in T. Müller 1961
21.6.1.1 Poo compressae-Saxifragetum tridactylitae Géhu 1961

22. Class: Festuco-Brometea Br.-Bl. & Tx. ex Klika & Hadač 1944

22.1 Order: Brachypodietalia pinnati Korneck 1974

22.1.1 Alliance: Filipendulo vulgaris-Helictotrichion pratensis Dengler & Löbel in Dengler & al. 2003

22.1.1.1 Solidagini virgaureae-Helictotrichetum pratensis Willems & al. 1981

22.1.2 Alliance: Cirsio-Brachypodion pinnati Hadač & Klika in Klika & Hadač 1944

22.1.2.1 Adonido vernalis-Brachypodietum pinnati (Libbert 1933) Krausch 1961

22.2 Order: Festucetalia valesiacae Br.-Bl. & Tx. ex Br.-Bl. 1950

22.2.1 Alliance: Festucion valesiacae Klika 1931

22.2.1.1 Potentillo arenariae-Stipetum capillatae (Hueck 1931) Libbert 1933 nom. invers. propos.

23. Class: Molinio-Arrhenatheretea Tx. 1937

23a Subclass: Arrhenatherenea (Br.-Bl. 1950) F. Jansen & Päzolt in Dengler & al. 2003

23.1 Order: Arrhenatheretalia elatioris Tx. 1931

23.1.1 Alliance: Arrhenatherion elatioris W. Koch 1926

23.1.1.1 Arrhenatheretum elatioris Br.[-Bl.] 1915

23.1.2 Alliance: Cynosurion cristati Tx. 1947 nom. cons. propos.

23.1.2.1 Lolio perennis-Cynosuretum cristati Tx. 1937

23.1.2.2 Plantagini majoris-Lolietum perennis Beger 1932 nom. invers. propos.

23.1.2.3 Festuco rubrae-Crepidetum capillaris Hülbusch & Kienast in Kienast 1978

23b Subclass: Molinio-Juncenea (Br.-Bl. 1950) Päzolt & F. Jansen in Dengler & al. 2003

23.2 Order: Deschampsietalia cespitosae Horvatić 1958

23.2.1 Alliance: Potentillion anserinae Tx. 1947

23.2.1.1 Ranunculo repentis-Alopecuretum geniculati Tx. 1937 nom. cons. propos.

23.2.1.2 Potentillo anserinae-Festucetum arundinaceae Nordhagen 1940 nom. invers. propos.

23.2.2 Alliance: Deschampsion cespitosae Horvatić 1930

23.2.2.1 Deschampsio cespitosae-Heracleetum sibirici Libbert 1932

23.2.2.2 Cnidio dubii-Deschampsietum cespitosae Hundt ex Passarge 1960

23.3 Order: Molinietalia caeruleae W. Koch 1926

23.3.1 Alliance: Molinion caeruleae W. Koch 1926

23.3.1.1 Selino carvifoliae-Molinietum caeruleae Kuhn 1937

23.3.2 Alliance: Calthion palustris Tx. 1937

23.3.2.1 Cirsio oleracei-Angelicetum sylvestris Tx. 1937

23.3.2.2 Scirpetum sylvatici Ralski 1931

24. Class: Ammophiletea Br.-Bl. & Tx. ex Westhoff & al. 1946

24.1 Order: Elymetalia arenarii Br.-Bl. & Tx. ex Fröde 1958

24.1.1 Alliance: Agropyro juncei-Honckenyion peploidis Tx. ex Br.-Bl. & Tx. 1952 nom. mut. propos.

24.1.1.1 Elymo arenarii-Agropyretum juncei Tx. 1952

24.1.2 Alliance: Elymion arenarii Christiansen 1927

24.1.2.1 Elymo arenarii-Ammophiletum arenariae Br.-Bl. & de Leeuw 1936 nom. cons. propos.

24.1.2.2 Festucetum arenariae Regel 1928

25. Class: Trifolio-Geranietea sanguinei T. Müller 1962

25a Subclass: Melampyro pratensis-Holcenea mollis Passarge ex Dengler in Dengler & al. 2003

25.1 Order: Melampyro pratensis-Holcetalia mollis Passarge 1979

25.1.1 Alliance: Melampyrion pratensis Passarge 1979

25.1.1.1 Lathyro linifolii-Melampyretum pratensis Passarge 1967

25.1.2 Alliance: Teucrion scorodoniae de Foucault & al. 1983

25.1.2.1 Teucrio scorodoniae-Silenetum nutantis de Foucault & Frileux 1983
25.1.2.2 Pteridietum aquilini Jouanne & Chouard 1929
25.1.3 Alliance: Violo rivinianae-Stellarion holosteae Passarge 1994
25.1.3.1 Veronico chamaedryos-Stellarietum holosteae Passarge 1994
25.1.3.2 Potentillo sterilis-Conopodietum majoris de Foucault & Frileux 1983
25b Subclass: Trifolio-Geranienea sanguinei (T. Müller 1962) Dengler in Dengler & al. 2003
25.2 Order: Origanetalia vulgaris T. Müller 1962
25.2.1 Alliance: Trifolion medii T. Müller 1962
25.2.1.1 Agrimonio eupatoriae-Vicietum cassubicae Passarge 1967 nom. invers. propos.
25.2.1.2 Agrimonio eupatoriae-Trifolietum medii T. Müller 1962 nom. invers. propos.
25.2.1.3 Agrostio capillaris-Agrimonietum procerae Dengler & Krebs 2003
25.2.1.4 Trifolio medii-Melampyretum nemorosi Dierschke 1973
25.2.1.5 Galio albi-Astragaletum glycyphylli Schwarz 2001
25.2.1.6 Rubo caesii-Origanetum vulgaris van Gils & Huits 1978
25.3 Order: Antherico ramosi-Geranietalia sanguinei Julve ex Dengler in Dengler & al. 2003
25.3.1 Alliance: Galio littoralis-Geranion sanguinei Géhu & Géhu-Franck in de Foucault & al. 1983
25.3.1.1 Artemisio campestris-Vincetoxicetum hirundinariae Dengler & Krebs 2003
25.3.1.2 Sileno nutantis-Libanotidetum montanae Jeschke ex Passarge 1979
25.3.2 Alliance: Geranion sanguinei Tx. in T. Müller 1962
25.3.2.1 Geranio sanguinei-Trifolietum alpestris T. Müller 1962
25.3.2.2 Arrhenathero elatioris-Peucedanetum oreoselini (Dengler 1994) Schwarz 2001
25.3.2.3 Thalictro mini-Geranietum sanguinei Korneck 1974
25.3.2.4 Campanulo bononiensis-Vicietum tenuifoliae Krausch in T. Müller 1962
25.3.2.5 Trifolio medii-Astragaletum ciceris Reichhoff in Hilbig & al. 1982

26. Class: Artemisietea vulgaris Lohmeyer & al. ex von Rochow 1951

26a Subclass: Epilobienea angustifolii Tx. & Preising ex Rivas Goday & Borja Carbonell 1961
26.1 Order: Atropetalia bellae-donnae Tx. 1947
26.1.1 Alliance: Epilobion angustifolii Tx. ex Oberd. 1957
26.1.1.1 Senecioni-Epilobietum angustifolii Hueck 1931
26.1.1.2 Corydalido claviculatae-Epilobietum angustifolii Hülbusch & Tx. 1968
26.1.2 Alliance: Atropion bellae-donnae Aichinger 1933
26.1.2.1 *Epilobium montanum-Scrophularia nodosa*-Community
26.1.2.2 Arctietum nemorosi Tx. ex Oberd. 1957
26b Subclass: Lamio albi-Urticenea dioicae Dengler & Wollert in Dengler & al. 2003
26.2 Order: Galio-Alliarietalia petiolatae Oberd. in Görs & T. Müller 1969
26.2.1 Alliance: Geo urbani-Alliarion petiolatae Lohmeyer & Oberd. in Görs & T. Müller 1969
26.2.1.1 Epilobio montani-Geranietum robertiani Lohmeyer ex Görs & T. Müller 1969
26.2.1.2 Alliario petiolatae-Chaerophylletum temuli Lohmeyer ex Oberd. 1957
26.2.1.3 Torilidetum japonicae Lohmeyer ex Görs & T. Müller 1969
26.2.1.4 Stachyo sylvaticae-Dipsacetum pilosi (Tx. ex Oberd. 1957) Passarge ex Wollert & Dengler in Dengler & al. 2003
26.2.2 Alliance: Aegopodion podagrariae Tx. 1967
26.2.2.1 Urtico dioicae-Aegopodietum podagrariae Tx. ex Görs 1968 nom. cons. propos.
26.2.2.2 Urtico dioicae-Cruciatetum laevipedis Dierschke 1973
26.2.2.3 Chaerophylletum bulbosi Tx. 1937
26.2.2.4 Urtico dioicae-Parietarietum officinalis Klotz 1985
26.2.2.5 Polygonetum cuspidati Görs & T. Müller ex Görs 1975
26.3 Order: Arctio lappae-Artemisietalia vulgaris Dengler 2002

26.3.1 Alliance: Arction lappae Tx. 1937

26.3.1.1 Leonuro cardiacae-Ballotetum nigrae Slavnić 1951

26.3.1.2 Hyoscyamo nigri-Conietum maculati Slavnić 1951 nom. invers. propos.

26.3.1.3 Arctio lappae-Artemisietum vulgaris Oberd. & al. ex Seybold & T. Müller 1972

26.3.1.4 Arctio tomentosi-Rumicetum obtusifolii Passarge 1959

26.3.1.5 Poo trivialis-Rumicetum obtusifolii Hülbusch 1969

26c Subclass: Agropyrenea intermedio-repentis (Oberd. & al. ex T. Müller & Görs 1969) Dengler & Wollert in Dengler & al. 2003

26.4 Order: Rubo caesii-Calamagrostietalia epigeji Dengler & Wollert in Dengler & al. 2003

26.4.1 Alliance: Rubo caesii-Calamagrostion epigeji (Dengler 1997) Dengler & Wollert in Dengler & al. 2003

26.4.1.1 Rubo caesii-Calamagrostietum epigeji Coste 1985

26.4.1.2 Elymo repentis-Rubetum caesii Dengler 1997

26.4.1.3 Petasitetum spurii Steffen 1931 nom. mut. propos.

26.5 Order: Agropyretalia intermedio-repentis Oberd. & al. ex T. Müller & Görs 1969

26.5.1 Alliance: Convolvulo arvensis-Agropyrion repentis Görs 1966

26.5.1.1 Convolvulo arvensis-Agropyretum repentis Felföldy 1943 nom. cons. et invers. propos.

26.5.1.2 Falcario vulgaris-Agropyretum repentis T. Müller & Görs 1969

26.5.1.3 Diplotaxio tenuifoliae-Agropyretum repentis Philippi in T. Müller & Görs 1969

26.5.1.4 Asparago officinalis-Chondrilletum junceae Passarge 1978

26.5.1.5 Agropyro repentis-Rumicetum thyrsiflori Passarge 1989

26.5.1.6 Convolvulo arvensis-Caricetum hirtae Jehlík 1994

26.5.1.7 Convolvulo arvensis-Brometum inermis Eliáš 1979

26.5.1.8 *Bromus carinatus*-Community

26.5.2 Alliance: Poion compressae T. Müller & Görs ex Dengler & Wollert in Dengler & al. 2003

26.5.2.1 Poetum humili-compressae Bornkamm 1961 nom. mut. propos.

26.5.2.2 Poo compressae-Tussilaginetum farfarae Tx. 1931

26.5.2.3 Poo compressae-Anthemidetum tinctoriae T. Müller & Görs ex Brandes 1986

26d Subclass: Artemisienea vulgaris (Lohmeyer & al. ex von Rochow 1951) Rivas Goday & Borja Carbonell 1961

26.6 Order: Onopordetalia acanthii Br.-Bl. & Tx. ex Klika & Hadač 1944

26.6.1 Alliance: Dauco carotae-Melilotion Görs ex Rostański & Gutte 1971

26.6.1.1 Tanaceto vulgaris-Artemisietum vulgaris Sissingh 1950

26.6.1.2 Cichorietum intybi Tx. ex Sissingh 1969

26.6.1.3 Dauco carotae-Picridetum hieracioidis Görs 1966

26.6.1.4 Melilotetum albo-officinalis Sissingh 1950

26.6.1.5 Berteroetum incanae Sissingh & Tideman ex Sissingh 1950

26.6.1.6 Potentillo argenteae-Artemisietum absinthii Faliński 1965

26.6.2 Alliance: Onopordion acanthii Br.-Bl. in Br.-Bl. & al. 1936

26.6.2.1 Lappulo echinatae-Cynoglossetum officinalis Klika 1935

26.6.2.2 Resedo luteolae-Carduetum nutantis Sissingh 1950 nom. invers. propos.

26.6.2.3 Onopordetum acanthii Libbert 1932

27. Class: Salicetea purpureae Moor 1958

27.1 Order: Salicetalia purpureae Moor 1958

27.1.1 Alliance: Salicion albae Tx. ex Moor 1958

27.1.1.1 Salicetum triandro-viminalis Lohmeyer ex Moor 1958

27.1.1.2 Salici-Populetum nigrae Meijer Drees 1936 nom. cons. propos.

28. Class: Vaccinio uliginosi-Pinetea Passarge & G. Hofmann 1968
28.1 Order: Vaccinio uliginosi-Pinetalia sylvestris Passarge & G. Hofmann 1968
28.1.1 Alliance: Eriophoro-Pinion sylvestris Passarge & G. Hofmann 1968
28.1.1.1 Eriophoro-Pinetum sylvestris Hueck 1931
28.1.2 Alliance: Vaccinio uliginosi-Pinion sylvestris Passarge & G. Hofmann 1968
28.1.2.1 Vaccinio uliginosi-Pinetum sylvestris de Kleist 1929 nom. invers. propos.
28.1.2.2 Ledo palustris-Pinetum sylvestris de Kleist 1929 nom. invers. propos.
29. Class: Molinio-Betuletea pubescentis Passarge & G. Hofmann 1968
29.1 Order: Salici pentandrae-Betuletalia pubescentis Clausnitzer in Dengler & al. 2004
29.1.1 Alliance: Salici pentandrae-Betulion pubescentis Clausnitzer in Dengler & al. 2004
29.1.1.1 Betuletum humilis Steffen 1931
29.1.1.2 *Cladium mariscus-Salix pentandra*-Community
29.1.1.3 Junco subnodulosi-Betuletum pubescentis Kloss 1962
29.1.1.4 Salici pentandro-Betuletum pubescentis Soó 1955
29.1.2 Alliance: Rhamno catharticae-Betulion pubescentis Clausnitzer in Dengler & al. 2004
29.1.2.1 Rhamno catharticae-Betuletum pubescentis Kloss 1962
29.2 Order: Molinio caeruleae-Betuletalia pubescentis Passarge & G. Hofmann 1968
29.2.1 Alliance: Betulion pubescentis Lohmeyer & Tx. ex Oberd. 1957
29.2.1.1 Salici auritae-Betuletum pubescentis Meijer Drees 1936
29.2.2 Alliance: Lysimachio vulgaris-Quercion roboris Passarge & G. Hofmann 1968
29.2.2.1 Molinio-Franguletum alni Passarge & Hofmann 1968
29.2.2.2 Lysimachio vulgaris-Quercetum roboris Passarge & Hofmann 1968
30. Class: Alnetea glutinosae Br.-Bl. & Tx. ex Westhoff & al. 1946
30.1 Order: Cardamino amarae-Alnetalia glutinosae Clausnitzer in Dengler & al. 2004
30.1.1 Alliance: Cardamino amarae-Fraxinion excelsioris Passarge & G. Hofmann 1968
30.1.1.1 Cratoneuro filicini-Alnetum glutinosae (Scamoni 1957) Clausnitzer in Dengler & al. 2004
30.1.1.2 Cardamino amarae-Alnetum glutinosae (Meijer Drees 1936) Passarge & Hofmann 1968
30.1.2 Alliance: Carici remotae-Fraxinion excelsioris Passarge & G. Hofmann 1968
30.1.2.1 Carici remotae-Fraxinetum excelsior W. Koch ex Faber 1937
30.2 Order: Alnetalia glutinosae Tx. 1937 nom. cons. propos.
30.2.1 Alliance: Alnion glutinosae Malcuit 1929
30.2.1.1 Hottonio palustris-Alnetum glutinosae Hueck ex F. Fukarek 1961
30.2.1.2 Carici elongatae-Alnetum glutinosae Tx. 1931
30.2.2 Alliance: Irido pseudacori-Alnion glutinosae Passarge & G. Hofmann 1968
30.2.2.1 *Bidens cernua-Alnus glutinosa*-Community
30.2.2.2 Irido pseudoacori-Alnetum glutinosae Doing ex Passarge & Hofmann 1968 nom. cons. propos.
30.3 Order: Alno-Fraxinetalia excelsioris Passarge & G. Hofmann 1968
30.3.1 Alliance: Alno-Ulmion minoris Br.-Bl. & Tx. ex Tchou Yen-Tcheng 1948 nom. cons. propos.
30.3.1.1 Pruno padi-Fraxinetum excelsioris Oberd. 1953
31. Class: Rhamno-Prunetea Rivas Goday & Borja Carbonell ex Tx. 1962
31.1 Order: Prunetalia spinosae Tx. 1952
31.1.1 Alliance: Urtico dioicae-Crataegion Passarge & G. Hofmann 1968
31.1.1.1 Crataego monogynae-Prunetum spinosae Hueck 1931 nom. invers. propos.
31.1.1.2 Rubo plicati-Sarothamnetum scoparii H. E. Weber 1987
31.1.1.3 Hippophao rhamnoidis-Sambucetum nigrae Boerboom 1960

31.2 Order: Chelidonio majoris-Robinietalia pseudoacaciae Jurko ex Hadač & Sofron 1980
31.2.1 Alliance: Balloto nigrae-Robinion pseudoacaciae Hadač & Sofron 1980
31.2.1.1 Lamio albi-Sambucetum nigrae Linke 2003
31.2.1.2 Balloto nigrae-Robinietum pseudoacaciae Jurko 1963

32. Class: Vaccinio-Piceetea Br.-Bl. in Br.-Bl. & al. 1939

32.1 Order: Piceetalia excelsae Pawłowski & al. 1928
32.1.1 Alliance: Dicrano polyseti-Pinion sylvestris (Libbert 1933) W. Matuszkiewicz 1962 nom. cons. propos.
32.1.1.1 Vaccinio mytilli-Pinetum sylvestris Juraszek 1927
32.1.1.2 Vaccinio-Juniperetum communis Passarge & Hofmann 1968
32.1.1.3 Empetro nigri-Pinetum sylvestris Libbert & Sissingh in Libbert 1940 nom. invers. propos.
32.1.1.4 Cladino-Pinetum sylvestris Juraszek 1927 nom. invers. propos.
32.1.2 Alliance: Festuco-Pinion sylvestris Passarge & G. Hofmann 1968
32.1.2.1 Peucedano oreoselini-Pinetum sylvestris Matuszkiewicz 1962

33. Class: Quercetea robori-petraeae Br.-Bl. & Tx. ex Br.-Bl. 1950 nom. mut. propos.

33.1 Order: Quercetalia roboris Tx. 1931
33.1.1 Alliance: Luzulo luzuloidis-Fagion sylvaticae Lohmeyer & Tx. in Tx. 1954
33.1.1.1 Lonicero periclymeni-Fagetum sylvaticae Passarge 1957 nom. mut. propos.
33.1.1.2 Vaccinio myrtilli-Fagetum sylvaticae Scamoni 1935 nom. invers. propos.
33.1.2 Alliance: Quercion roboris Malcuit 1929
33.1.2.1 Betulo pendulae-Quercetum roboris Tx. 1930 nom. invers. propos.

34. Class: Carpino-Fagetea Passarge & G. Hofmann 1968

34.1 Order: Aceretalia pseudoplatani Moor 1975
34.1.1 Alliance: Tilio platyphylli-Acerion Klika 1955
34.1.1.1 Adoxo moschatellinae-Aceretum pseudoplatani Passarge 1960
34.1.1.2 *Prunus avium-Acer platanoides*-Community
34.2 Order: Fagetalia sylvaticae Pawłowski & al. ex Tx. 1937
34.2.1 Alliance: Fraxino excelsioris-Fagion sylvaticae Jeschke 1964 nom cons. propos.
34.2.1.1 Fraxino excelsioris-Fagetum sylvaticae Scamoni in Scamoni & Passarge 1959
34.2.1.2 Mercuriali perennis-Fagetum sylvaticae Scamoni 1935 nom. invers. propos.
34.2.2 Alliance: Fagion sylvaticae Luquet 1926
34.2.2.1 Asperulo odorati-Fagetum sylvaticae Sougnez & Thill 1959 nom. cons. propos.
34.2.3 Alliance: Sorbo-Fagion sylvaticae Passarge & G. Hofmann 1968
34.2.3.1 Carici-Fagetum sylvaticae Moor 1952
34.2.3.2 Orchido purpureae-Cornetum sanguinei Doing ex Haveman & al. 1999
34.2.3.3 Vincetoxico hirundinariae-Quercetum Passarge 1957

References

Berg, C., Dengler & Abdank, A. 2001 (eds.). *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Tabellenband.* Weissdorn, Jena, DE.

Berg, C., Dengler, J., Abdank, A. & Isermann, M. 2004 (eds.). *Die Pflanzengesellschaften Mecklenburg-Vorpommerns und ihre Gefährdung – Textband.* Weissdorn, Jena, DE.

Dengler, J., Berg, C., Eisenberg, M., Isermann, M., Jansen, F., Koska, I., Löbel, S., Manthey, M., Päzolt, J., Spangenberg, A., Timmermann, T. & Wollert, H. 2003. New descriptions and typifications of syntaxa within the project 'Plant communities of Mecklenburg-Vorpommern and their vulnerability' – Part I. *Feddes Repertorium* 114: 587–631.

Dengler, J., Koska, I., Timmermann, T., Berg, C., Clausnitzer, U., Isermann, M., Linke, C., Päzolt, J., Polte, T. & Spangenberg, A. 2004. New descriptions and typifications of syntaxa within the project 'Plant communities of Mecklenburg-Vorpommern and their vulnerability' – Part II. *Feddes Repertorium* 115: 343–392.