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Plant communities of the Eifel National Park (Germany) – An assessment based on the first Permanent Plot Inventory

Die Pflanzengesellschaften des Nationalparks Eifel – Auswertung der ersten Permanenten Stichprobeninventur

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Abstract

The Eifel National Park, in the west of Germany, is one of the country's younger national parks, established in 2004. The first permanent plot inventory (*Permanente Stichprobeninventur*, PSI) within the National Park was carried out in 2011–2013; in addition to forest structure, it also includes records of the vegetation composition in 1,539 survey plots. These plots of 100 m² each are located on a regular grid covering the whole area of the National Park. In total, they provide a comprehensive picture of the vegetation composition of this protected area. We explored the 1,539 records and grouped them by numerical classifications (k-means analysis) into 84 vegetation units encompassing deciduous and coniferous forests as well as open habitats. The analysis hierarchically assigned vegetation of open habitats and deciduous forests to 29 phytosociological associations, 25 alliances, 18 orders and 11 classes; coniferous forests of non site-native trees were grouped into 25 vegetation units but were not assigned to the phytosociological system of syntaxa. Due to the grid-based sampling design of the PSI, the number of records per vegetation unit differs widely. The most frequent plant community of the National Park was beech forest on acid soils (*Luzulo-Fagetum*), followed by *Picea* and *Quercus* forests. Designated as a development-stage National Park owing to its formerly often intensive silviculture, the National Park features a great deal of anthropogenic forest vegetation such as planted or spontaneously germinated spruce forests. Their development towards a more natural state is facilitated by specific management. In addition to forests, large parts of the National Park are covered by mesic meadows (*Arrhenatheretum elatioris* among others). Some of these as well as some other open habitats of high conservation concern will be maintained through suitable extensive management whereas other parts will be left to natural succession. In the years to come, the vegetation of the National Park will thus change considerably. In this light, the present study forms the basis for comparisons of the recent and the future vegetation of the National Park.

Keywords: development-stage National Park, early-stage forest development, *Fagus* forest, forest inventory, grid-based sampling, mesic meadow, plant community, site heterogeneity, spruce plantation, succession

Erweiterte deutsche Zusammenfassung am Ende des Artikels

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1. Introduction

The Eifel National Park (NP), established in 2004 together with the Kellerwald-Edersee NP, is one of the youngest of the 16 NPs of Germany (BFN 2018). NPs as part of the country's natural heritage are protected by § 1, 24 of the Federal Conservation Act (German *Bundesnaturschutzgesetz*). The 16 NPs, marine areas excluded, cover about 0.6% of the German federal territory (BFN 2018) and aim at protecting natural biodiversity, its underlying ecological structures and environmental processes (IUCN 2019). Like several other NPs in Germany, the Eifel NP was established on sites of former (intensive) agri- or silvicultural use. As such, it does not encompass (near-)natural ecosystems as required by IUCN definitions, but is instead regarded as being in the development phase (German: *Entwicklungs-Nationalpark*; BFN 2018). It is expected that 30 years after establishment, the 75% of the NP area where management was ceased to protect natural processes (German: *Prozessschutz-Zone*) will be in a natural or at least near-natural state. The remaining 25% of the NP area might still be managed to maintain or restore diverse ecosystems dependant on human impact (NATIONALPARKFORSTAMT EIFEL 2008).

Monitoring is critical to identify and evaluate the developmental status of the NP. One important monitoring concept is the permanent plot inventory (*Permanente Stichprobeninventur*; PSI) performed in several NPs with a focus on the protection and restoration of forest habitats (e.g. NATIONALPARKAMT KELLERWALD-EDERSEE 2008, NATIONALPARKVERWALTUNG HAINICH 2010, and NATIONALPARKVERWALTUNG HARZ 2011). This monitoring approach evaluates forest structures as well as vegetation composition at a defined number of sampling plots to determine the status quo of the NP in terms of its vegetation composition, structure and naturalness. The plots are positioned on a regular grid spanning the NP; distances between plots vary among the NPs (e.g. 141.42 m × 141.42 m in Sächsische Schweiz NP, 150 m × 150 m in Harz NP, 200 m × 200 m in Kellerwald NP and Hainich NP, and 250 m × 250 m in Eifel NP; SÄCHSISCHE LANDESANSTALT FÜR FORSTEN 1998, NATIONALPARKAMT KELLERWALD-EDERSEE 2008, NATIONALPARKVERWALTUNG HAINICH 2010, NATIONALPARKVERWALTUNG HARZ 2011, NATIONALPARKFORSTAMT EIFEL 2017).

The first PSI has been completed and vegetation records have been evaluated in several NPs (e.g. SÄCHSISCHE LANDESANSTALT FÜR FORSTEN 1998, NATIONALPARKVERWALTUNG HAINICH 2008, MEYER 2010, SCHMIDT 2010, EWALD et al. 2011). The surveys are intended to be repeated at intervals of 10 years after completion of the first PSI to monitor changes and supervise the transition to a more natural status. Until now, results of a second inventory are not yet available except for relatively few NPs (e.g. Hainich NP, NATIONALPARKVERWALTUNG HAINICH 2012).

For the first PSI in the Eifel NP, fieldwork was performed in 2011–2013 (NATIONALPARKFORSTAMT EIFEL 2017). In this PSI, forest structure was evaluated at 1,642 and vegetation composition at 1,539 sampling plots located on a regular grid of 250 m × 250 m. The lower number of plots for vegetation analysis resulted from the exclusion of extremely inhomogeneous sampling plots (NATIONALPARKFORSTAMT EIFEL 2017). The 250 m distances between plots are applied to align the plots with those of the forest inventory of North Rhine-Westphalia (*Landeswaldinventur NRW*) as well as the National Forest Inventory (*Bundeswaldinventur*) that apply sampling grids of 2 km × 2 km and 4 km × 4 km, respectively, which overlap with that of the PSI (NATIONALPARKFORSTAMT EIFEL 2017).

The data set of the PSI forms the basis for analyses of the status quo of the NP regarding its diversity and naturalness, and to predict its potential development in the coming years. The PSI complements the knowledge on flora and vegetation of the NP available from earlier investigations (for an overview of the NP's biotopes, Natura 2000 habitat types and protected species see NATIONALPARKFORSTAMT EIFEL 2014).

A detailed evaluation of the forest structure, vegetation composition, diversity and naturalness of the Eifel NP derived from PSI data was published as a comprehensive report by NATIONALPARKFORSTAMT EIFEL (2017). A summary of the forest structure analyses is available in SPORS et al. (2018). The present article summarises the results of the vegetation analysis (SCHMIEDEL et al. 2016) and gives an insight into the floristic composition and diversity of the plant communities of the Eifel NP. We aim at answering the following research questions: (1) Which plant communities can be distinguished in the Eifel NP when analysing the 1,539 PSI vegetation records? (2) Which plant communities were frequently recorded? Which communities are poorly represented by PSI plots? (3) How can the plant communities be ecologically described based on PSI and measured environmental data?

2. Methods

2.1 Study area

The Eifel NP is situated in the south-west of the state of North Rhine-Westphalia, Germany (Fig. 1). It was established in 2004 after the Belgian army had retreated from the area formerly used as military training area. The NP encompasses an area of 10,770 ha separated into three zones for the protection of natural processes and another zone in which management will be continued to maintain open habitats of particular value for nature conservation (NATIONALPARKFORSTAMT EIFEL 2014). About 40% of the NP is protected under the EU Habitats Directive. Like several other NPs in Germany, the Eifel NP is in its "development phase" (BFN 2018). The main aim of the NP is the protection of natural processes and the conservation of valuable habitats with particular focus on natural and near-natural ones. Habitats of primary concern comprise mixed beech and other deciduous forests on acidic soils, springs, waterheads and stream valleys, as well as various open habitats (NATIONALPARKFORSTAMT EIFEL 2014).

Elevations in the NP range from 185 to 630 m. The NP comprises the districts of Hetzingen, Wahlerscheid and Dedenborn as well as the Kermeter. In 2006, the former military training area of the Dreiborner Hochfläche was added to the area of the park (NATIONALPARKFORSTAMT EIFEL 2014).

The Eifel region has an oceanic climate with relatively high annual precipitation (750 mm in the northeast, 1,250 mm in the southwest); mean annual temperatures range between 6.5 °C at higher to 9.3 °C at lower elevations. The geology of the NP is dominated by Palaeozoic (Devonian) deposits with the overlying Mesozoic layers being largely eroded. Base-poor Cambisols, specifically *Braunerde*, prevail in the area; especially in the north-eastern part of the NP occur also Podzols whereas Gleys prevail in the valley bottoms (NATIONALPARKFORSTAMT EIFEL 2014).

About ¾ of the NP are covered by forests. Deciduous forests dominated by European beech (*Fagus sylvatica*) and coniferous plantations formed mainly by Norway spruce (*Picea abies*) are the most common forest types (NATIONALPARKFORSTAMT EIFEL 2014).

2.2 Data analysis

Data sources – The present analysis is based on a sample of 1,539 vegetation records resulting from the first permanent plot inventory (PSI) of the NP. Vegetation sampling had been conducted between mid of May to the end of September 2011 (for details see NATIONALPARKFORSTAMT EIFEL 2017). The PSI plots were positioned across a regular grid of 250 m × 250 m covering the entire

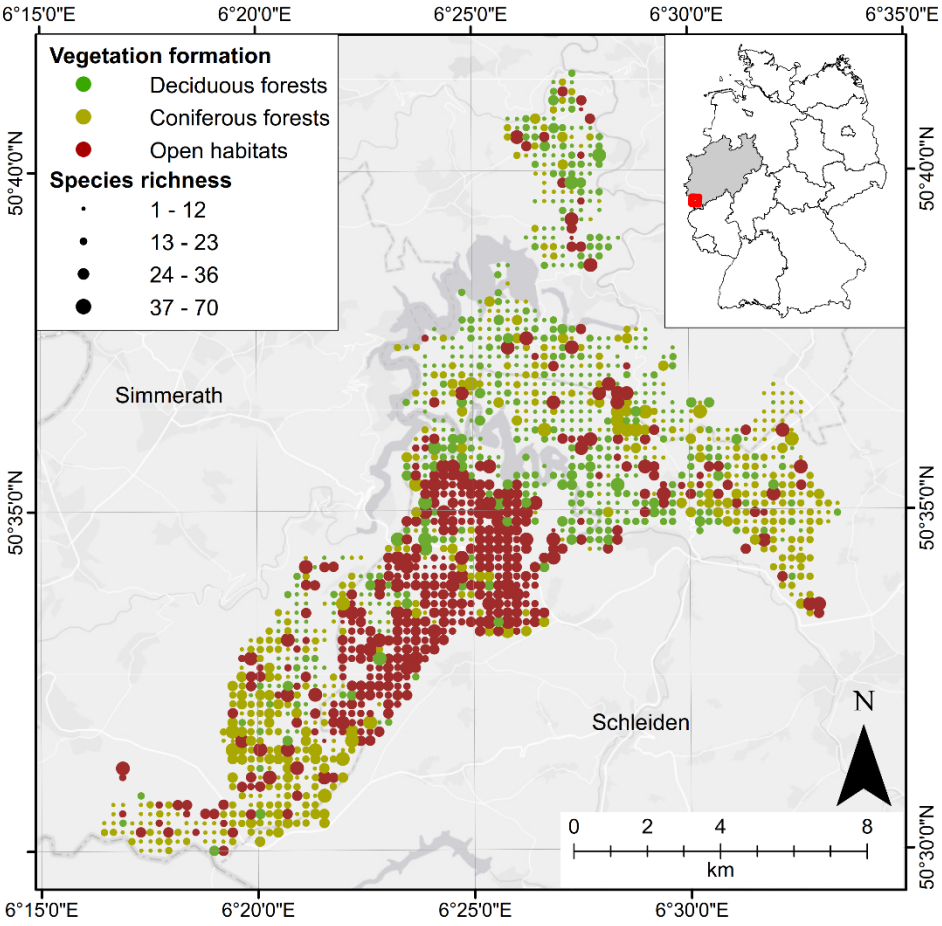


Fig. 1. Location of the 1,539 plots of the permanent plot inventory (PSI) within the Eifel National Park indicating distributions of species richness per vegetation formation (large map) and the National Park's location in Germany (small map). Sources: Basemap © ESRI (2014), DelLorme, HERE; Administrative boundaries © Bundesamt für Kartographie und Geodäsie (2013); Plot locations © Eifel National Park (2011).

Abb. 1. Lage der 1.539 Aufnahmeflächen der Permanenten Stichprobeninventur (PSI) innerhalb des Nationalparks Eifel mit Angabe zum Artenreichtum pro Vegetationsformation (große Karte) und der Lage des Untersuchungsgebiets in Deutschland (kleine Karte). Datenquellen: Grundlagenkarte © ESRI (2014), DelLorme, HERE; Bundesland- und Ländergrenzen © Bundesamt für Kartographie und Geodäsie (2013); Aufnahmepunkte © Nationalpark Eifel (2011).

NP area (Fig. 1). The vegetation was recorded by one of a total of five observers on 10 m × 10 m plots using a procedure later described by MEYER et al. (2013). For each plot, the cover of all vegetation layers was estimated in percentages by orthogonal projection. All non-woody and *Rubus* species irrespective of their height as well as woody plants of < 0.5 m height were assigned to the herb layer. Woody vegetation of > 0.5 m height was distinguished into lower and upper shrub layers (0.5–1.5 m and 1.5–6 m) and a tree layer (> 6 m) which was optionally separated into lower and upper layers if

appropriate. In each layer, the cover of all vascular plant species was recorded in percent (MEYER et al. 2013). Lichen and bryophyte species were not identified but their overall ground cover was estimated for each plot. Data were stored in a database (Turboveg 2.102; HENNEKENS & SCHAMINÉE 2001); all relevés are available in vegetweb 2.0 (JANSEN et al. 2015).

Data processing – Prior to analysis, we checked the data set for errors and outliers and separated it into two subsets as it was too heterogeneous to be analysed in one step. The first subset comprised records with a tree cover > 30% (in the following "forests"), the second those with a tree cover < 30% (in the following "open habitats"). The forest subset was further separated into plots with dominance of deciduous or coniferous trees, respectively (cover of deciduous trees > cover of coniferous trees = deciduous forest; cover of coniferous trees > cover of deciduous trees = coniferous forest).

Vegetation classification – We classified the records of the three data subsets (deciduous forests, coniferous forests, open habitats) using the non-hierarchical k-means analysis of LLOYD (1957, published 1982) in the software Juice (TICHÝ 2002). To reduce the effect of dominant species, we applied a square-root transformation. In a first step, the classification resulted in 27 clusters for open habitats, 15 clusters for deciduous forests, and 17 clusters for coniferous forests. This analysis step allowed for the separation of forest sites according to tree species dominances. In a second step, the clustering was supervised and – if reasonable – further k-means cluster analyses for separate vegetation units were conducted to identify detailed differences between data subsets. The second-step analyses of forests by k-means we performed using presence/absence data only, as this resulted in the best interpretable separation of units. For further analyses of open habitat plots we used a square-root transformation. For a more detailed description on the analyses performed for the particular data subsets see SCHMIEDEL et al. (2016).

Results of the classification are shown in tabular form; tables with > 25 records are presented as synoptic tables with frequency (constancy) values. Through the clustering in the first step, forests were separated in tables according to the dominant tree species. In some cases (e.g. for mixed oak forests) this resulted in the same plant community being represented in more than one synoptic table.

Differential species for the particular vegetation units were determined using the algorithm of TSIRIPIDIS et al. (2009). Whenever possible, we assigned identified vegetation units to established phytosociological syntaxa by comparison with relevant phytosociological literature (OBERDORFER 1978, 1983, 1992, DIERSCHKE 1985, 1989, 1997, ZERBE 1994, HÄRDTLE et al. 1997, MÖSELER 1998, WEBER 1998, 1999, BERG et al. 2001, 2004, PEPPLER-LISBACH & PETERSEN 2001, BURKART et al. 2004, CHYTRÝ 2007, 2009, 2013, WILLNER & GRABHERR 2007, HAVEMAN et al. 2017) and expert judgement. Taxonomic reference is WISSKIRCHEN & HAEUPLER (1998). The syntaxonomy of classes, orders and alliances follows MUCINA et al. (2016), that of associations follows CHYTRÝ (2007, 2009, 2013), DIERSCHKE (1997) and RENNWALD (2000).

For all vegetation units we calculated minimum, maximum and mean species richness using R (R CORE TEAM 2017).

Ordination – We performed non-metric Multidimensional Scaling (NMDS) for the two most frequent phytosociological classes (> 200 plots each) in the study area (*Carpino-Fagetea sylvaticae*, *Molinio-Arrhenatheretea*) as well as for the most common coniferous forest type (spruce forest). The ordination was performed using R software and R-packages 'vegan' (OKSANEN et al. 2018) and 'goeveg' (GORAL & SCHELLENBERG 2017). We tested the number of dimensions to be used in NMDS using the function 'dimcheckMDS' ('goeveg' package); the quality of the NMDS was judged by 'stress' value. We obtained best results for all analysed groups for three NMDS axes (stress < 0.2).

Analysis of vegetation structure and ecological conditions – Available information on vegetation structure (cover of vegetation layers, vegetation height) was summarised for the different vegetation units. Furthermore, we calculated Ellenberg Indicator Values (EIV; ELLENBERG et al. 2001) for light (EIV L), nutrients (EIV N), soil reaction (EIV R) and moisture (EIV M) per vegetation unit using Juice (TICHÝ 2002).

3. Results and discussion

3.1 Species richness and density

Out of the 484 vascular plant taxa occurring in the data set, 421 were determined to species and 40 to genus level. Additionally, 23 aggregate species were recorded. According to NATIONALPARKFORSTAMT EIFEL (2014) the Eifel NP hosts about 850 vascular plant species, thus about 50% of the species known in the area were recorded during PSI sampling. Out of the 444 species and aggregate species 96% are native or archaeophytes and 4% neophytes (established in the Modern Age, i.e. since c. 1500). The proportion of non-native species is thus much lower than the 14.1% reported for the whole of Germany (BFN 2016) but corresponds to findings by other studies on forest reserves in Rhineland-Palatinate, Lower Saxony and Hesse that report of a proportion of 1–8% neophytes (SCHMIDT 2012, SCHMIDT et al. 2019). The analysis of WAGNER et al. (2017) revealed similarly low proportions of neophytes in various types of European woodlands.

About 6% of the species (26) are red listed as Threatened for North Rhine Westphalia; further ten species are listed as V (*Vorwarnliste*; RAABE et al. 2010), approximately equivalent to Near Threatened. The most frequently recorded Red List species is *Rhinanthus minor* that was found in 3.3% of the plots. Out of the 444 (aggregate) species, 123 herbaceous species occur only in open habitats; a further 71 taxa are only infrequently found in forests. Thus, almost half of the species (44%) of the data set are mainly associated with open habitats.

The most frequent plant name in the data set is *Rubus fruticosus* agg., recorded in 52% of the 1,539 plots (Table 1). As species belonging to this aggregate had not been distinguished, possible ecological interpretations based on different taxa of this heterogeneous species group are not possible. Other frequently encountered species are *Dryopteris carthusiana* (47%), *Agrostis capillaris* (45%), *Rubus idaeus* (43%), *Deschampsia flexuosa* (40%) and *Luzula luzuloides* (38%) – all but *Rubus idaeus* indicators for nutrient- and base-poor conditions (cf. EIV in Table 1).

Table 1. Frequency of the ten most abundant species of vascular plants reported for the 1,539 records of the PSI. EIV L/M/R/N = Ellenberg Indicator Value for light/soil moisture/soil reaction/nutrient content (ELLENBERG et al. 2001).

Tabelle 1. Vorkommenshäufigkeit der zehn häufigsten Gefäßpflanzenarten in den 1.539 PSI-Aufnahmen. *EIV L/M/R/N* = Ellenberg-Zeigerwerte für Licht/Feuchte/Bodenreaktion/Nährstoffe (ELLENBERG et al. 2001).

Taxon	Frequency	Proportion (%)	EIV L	EIV M	EIV R	EIV N
Rubus fruticosus agg.	792	51.5	n/a	n/a	n/a	n/a
Picea abies	732	47.6	5	x	x	x
Dryopteris carthusiana	720	46.8	5	x	4	3
Agrostis capillaris	696	45.2	7	x	4	4
Rubus idaeus	662	43.0	7	x	x	6
Fagus sylvatica	659	42.8	3	5	x	x
Deschampsia flexuosa	620	40.3	6	x	2	3
Sorbus aucuparia	601	39.1	6	x	4	x
Luzula luzuloides	587	38.1	4	5	3	4
Quercus petraea	457	29.7	6	5	x	x

Table 2. Number of plots per vegetation type (*n*), total and proportional number of species per vegetation type (taxa determined up to genus level only not included), proportion of species with cover values ≥ 10% and mean (± standard deviation, SD), minimum and maximum species richness per 100 m² averaged over all plots (Total) as well as the data subsets of deciduous and coniferous forests and open habitats.

Tabelle 2. Anzahl von Aufnahmen pro Vegetationstyp (*n*), Gesamtartenzahl (*No. of species [total];* exklusive der nur auf Gattungsebene bestimmten Taxa) und prozentualer Anteil (*% of species*) pro Vegetationstyp, Anteil von Arten mit Deckungswerten ≥ 10 % *(% of species with cover ≥ 10 %*) und mittlerer (± Standardabweichung, SD), minimaler und maximaler Artenreichtum pro 100 m² gemittelt über alle Aufnahmen (*Total*) und für die Teildatensätze der Laubwälder (*Deciduous forests*), Nadelwälder (*Coniferous forests*) und Offenland-Habitate (*Open habitats*).

	Total	Deciduous forests	Coniferous forests	Open habitats
No. of plots (*n*)	1539	554	554	431
No. of species (total)	444	278	253	397
% of species	100	62.6	57.0	89.4
% of species with cover ≥ 10%	31.1	27.7	19.8	23.9
Species richness per plot				
Mean	18.3	12.9	16.0	28.3
SD	± 11.2	± 8.7	± 9.3	± 9.6
Minimum	1	1	1	9
Maximum	70	53	65	70

The complete data set comprises eleven records containing only a single species whereas the most species-rich plot hosts 70 species per 100 m² (cf. Fig. 2). On average, each vegetation plot hosts 18 (± 11) plant species (Table 2). A large proportion of species feature very low cover values; only c. 30% of species in the data set hold a cover value ≥ 10% (Table 2).

Out of the 1,539 records 554 each were assigned to the subsets of deciduous and coniferous forests, respectively; open habitats are represented by 431 records (Table 2). Total as well as average species numbers are highest in open habitats (397 species; 28 species per 100 m²; Table 2, cf. also Fig. 1), species richness of forest habitats is significantly lower. Interestingly, average species numbers within coniferous forests with 16 vascular plant species per 100 m² is higher than that of deciduous forests (13 species) although total species numbers are higher for deciduous forests (278 taxa) than for coniferous forests (253 taxa). The large standard deviations of 9 species compared to the small mean species numbers highlight the considerable variation in richness of the forest data subsets (Table 2).

3.2 Phytosociological and ecological characterisation of vegetation units

Due to the grid-based inventory design, the number of records assigned to the different vegetation units was very imbalanced (cf. Fig. 3, Table 3–4). In the following, we only consider vegetation units of deciduous forests and open habitats belonging to phytosociological alliances represented by ≥ 10 records in greater detail (cf. Table 3). For coniferous forests, all vegetation units except for two minor units representing old spruce and larch stands, each with beech rejuvenation, are presented. For descriptions of the latter and of further rare vegetation types see SCHMIEDEL et al. (2016).

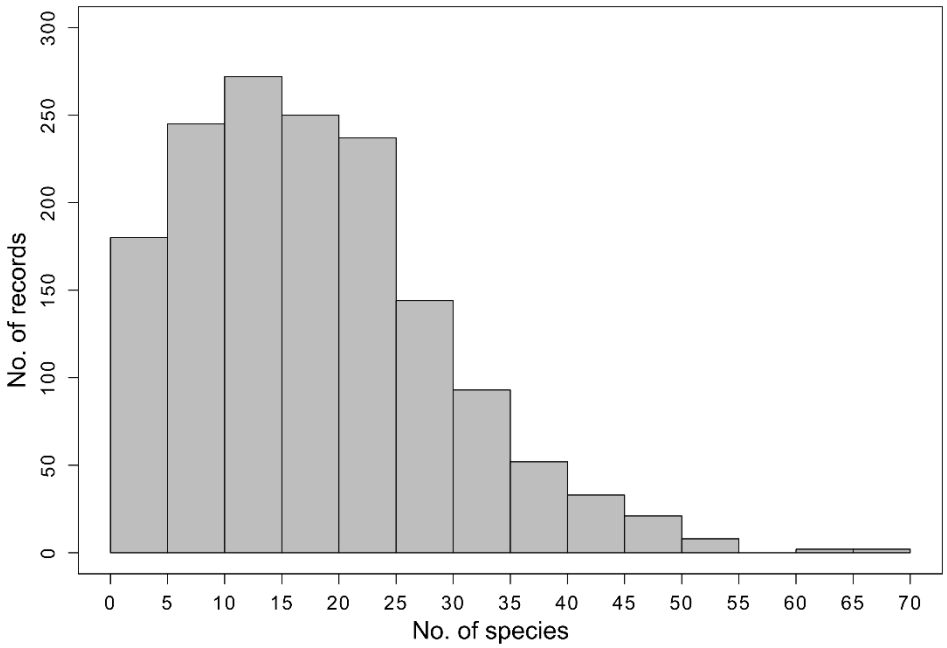


Fig. 2. Histogram of the number of PSI records with different numbers of vascular plant species in the Eifel National Park (n = 1,539).

Abb. 2. Histogramm der Verteilung des Gefäßpflanzen-Artenreichtums pro PSI-Aufnahme innerhalb des Nationalparks Eifel (n = 1.539).

3.2.1 Deciduous forests

In total, we assigned 330 out of 554 records of deciduous forests to the class of mesic deciduous and mixed forests, *Carpino-Fagetea sylvaticae*, with the two most frequently occurring alliances being *Luzulo-Fagion sylvaticae* (beech forests on acidic, nutrient-poor soils; 228 records) and *Carpinion betuli* (oak-hornbeam and mesic oak forests, 58 records; Fig. 3, Table 3). More nutrient-rich beech forests of the alliance *Fagion sylvaticae* are represented by only 19 records. A further 180 records belong to the class of acidophytic oak and oak-birch forests on nutrient-poor soils, *Quercetea robori-petraeae* and its alliance *Quercion roboris*. Other deciduous forest types were found to occur with very low proportions (Fig. 3, Table 3).

Luzulo-Fagion sylvaticae and *Fagion sylvaticae*

About 45% of the deciduous forest records (247) are dominated by *Fagus sylvatica*. Out of these records, > 90% belong to the alliance *Luzulo-Fagion sylvaticae* and its association *Luzulo-Fagetum* (group 1 in Fig. 4), whereas only 19 records represent the alliance *Fagion sylvaticae* and its association *Galio odorati-Fagetum* (group 2 in Fig. 4). While these communities were found to be floristically reasonably distinct (Supplements S1–S2), there is a marked overlap in NMDS (Fig. 4) suggesting the presence of transitional records and considerable floristic and ecological similarity.

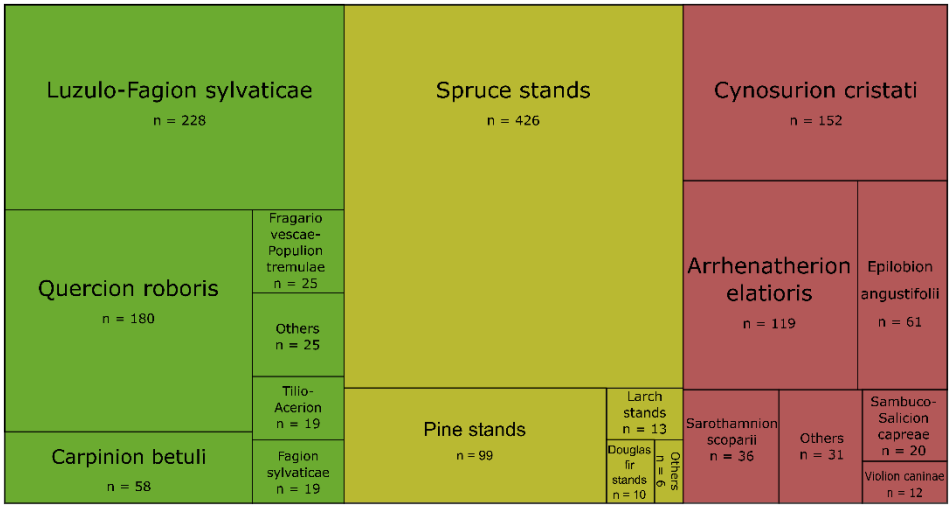


Fig. 3. Proportions of vegetation types represented by the PSI data set of the Eifel National Park. The size of the boxes corresponds to the number of records (*n*) belonging to the different vegetation units. For deciduous forests (dark green) and open habitats (red) phytosociological alliances are given; names of coniferous forest stands (light green) refer to the dominant tree species.

Abb. 3. Anteil von Vegetationstypen auf Grundlage der Vegetationsaufnahmen der PSI des Nationalparks Eifel. Die Größe der Boxen entspricht der Anzahl von Aufnahmen, die der jeweiligen Vegetationseinheit angehören. Die Vegetationseinheiten von Laubwäldern (dunkelgrün) und Offenländern (rot) sind durch die Namen pflanzensoziologischer Verbände repräsentiert; die Benennung der Nadelwaldbestände (hellgrün) erfolgt unter Berücksichtigung der dominanten Baumart.

We identified all *Luzulo-Fagetum* records as its sub-association *Luzulo-Fagetum typicum* with five variants (LuzFag1–5, Supplement S1). In contrast to the findings of KRAUSE & MÖSELER (1995) in the Northern Eifel, we could not identify the sub-association *Luzulo-Fagetum milietosum*.

Of the five variants, unit **LuzFag5**, the most frequently recorded one, comprises extremely species-poor beech forests with an average richness of only 4 (± 3) species. The stands are extremely dense (cf. low EIV L, Supplement S1). The lack of a shrub, herb and moss layer is reminiscent of what has been termed *Luzulo-Fagetum "*nudum*"*, where beech is outcompeting other species by its dense fine roots in the topsoil (LEUSCHNER 1999). This type of *Luzulo-Fagetum* has also been identified by MÖSELER (1998) in the Northern Eifel. In NMDS, the records of this unit gather at the outer right side of the ordination plot and, in contrast to those of the other *Luzulo-Fagetum* units, do not overlap with plots assigned to the *Galio odorati-Fagetum* (Fig. 4).

LuzFag4 is the second most frequent of the *Luzulo-Fagetum* units. It is slightly richer in species (9 ± 3) than LuzFag5 and similarly dense. It represents the typical variant of the *Luzulo-Fagetum* without any differential species of its own (cf. KRAUSE & MÖSELER 1995, MÖSELER 1998). Besides *Fagus* juveniles, only *Luzula luzuloides, Festuca altissima, Rubus fruticosus* agg. and *Oxalis acetosella* are frequent (Supplement S1), all with low cover values. KRAUSE & MÖSELER (1995) found similar species numbers of 8.5 species/plot for this variant. However, while in their analysis bryophyte species were considered, in the PSI data bryophytes have been disregarded.

Table 3. Overview of deciduous forest communities of the Eifel National Park based on the permanent plot inventory of 2011, code used in phytosociological tables of the study (code; n.p. = the unit is not presented in detail in this study) and the number of records (no. records) associated with each level. Two records dominated by *Quercus robur* due to their undergrowth were assigned to communities of open and scrub habitats, respectively; therefore, total number of records is 552 instead of 554. C = class, O = order, A = alliance, Ass = association, SubAss = sub-association. n/a = records could not be assigned to a particular association but are associated with an alliance/order.

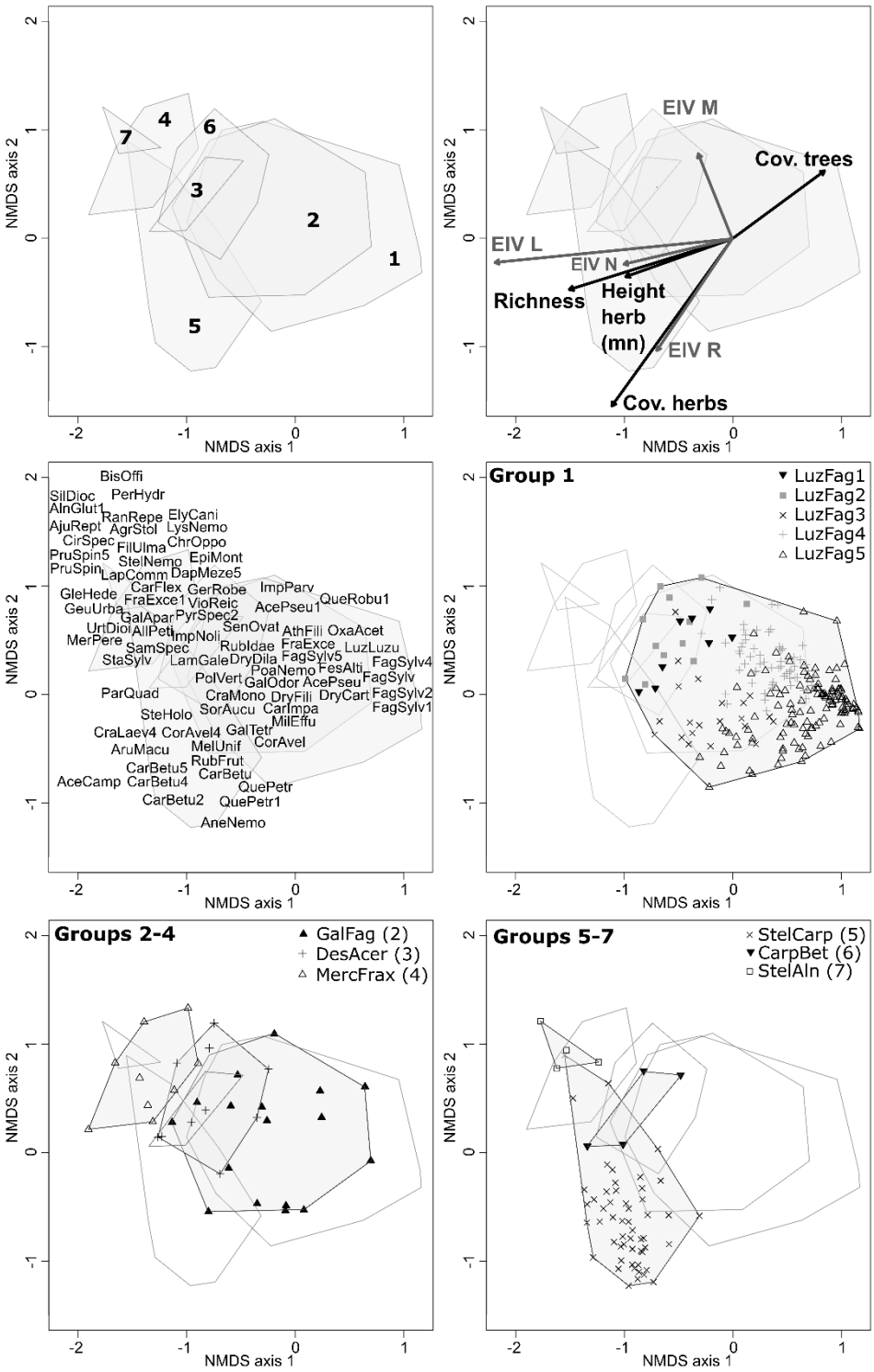
Tabelle 3. Überblick über die im Rahmen der Permanenten Stichprobeninventur (PSI) in 2011 erfassten Laubwaldgesellschaften des Nationalparks Eifel. *Code* = Bezeichnung der Vegetationseinheit in der Studie (n.p. = diese Einheit wird im vorliegenden Artikel nicht im Detail vorgestellt); *No. records* = Anzahl von Aufnahmen, die der jeweiligen Vegetationseinheit angehören. Zwei Vegetationsaufnahmen mit Dominanz von *Quercus robur* wurden aufgrund ihres Unterwuchses den Offenland-Habitaten zugeordnet, so dass hier nur 552 der 554 Aufnahmen des Laubwald-Datensatzes Berücksichtigung finden. C = Klasse, O = Ordnung, A = Verband, Ass = Assoziation, SubAss = Sub-Assoziation. n/a = Aufnahmen konnten keiner Assoziation, sondern nur einem Verband/einer Ordnung zugeordnet werden.

Syntaxonomic unit	**Code**	**No. records**
C: *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968		**330**
O: *Alno-Fraxinetalia excelsioris* Passarge 1968		6
A: *Alnion incanae* Pawlowski et al. 1928		6
Ass: *Carici remotae-Fraxinetum* W. Koch 1926 ex Faber 1937	CarFrax	2
Ass: *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957	StelAln	4
O: *Carpinetalia betuli* P. Fukarek 1968		58
A: *Carpinion betuli* Issler 1931		58
Ass: *Galio-Carpinetum* Oberd. 1957	GalCarp	1
Ass: *Stellario-Carpinetum* Oberd. 1957		53
SubAss: *Stellario-Carpinetum luzuletosum*	StelCarp1	47
SubAss: *Stellario-Carpinetum stachyetosum*	StelCarp2	6
Ass: n/a	CarpBet	4
O: *Fagetalia sylvaticae* Pawłowski 1928		19
A: *Fagion sylvaticae* Luquet 1926		19
Ass: *Galio odorati-Fagetum* Sougnez et Thill 1959		19
SubAss: *Galio odorati-Fagetum circaeetosum*	GalFag1	1
SubAss: *Galio odorati-Fagetum luzuletosum*	GalFag3	10
SubAss: *Galio odorati-Fagetum typicum*	GalFag2/4	8
O: *Aceretalia pseudoplatani* Moor 1976 nom. conserv. propos.		19
A: *Tilio-Acerion* Klika 1955		19
Ass: *Deschampsio cespitosae-Aceretum* Bohn 1984	DesAcer	10
Ass: *Mercuriali perennis-Fraxinetum excelsioris* (Klika 1942) Husová in Moravec et al. 1982	MercFrax	9
O: *Luzulo-Fagetalia sylvaticae* Scamoni et Passarge 1959		228
A: *Luzulo-Fagion sylvaticae* Lohmeyer et Tx. in Tx. 1954		228
Ass: *Luzulo-Fagetum* Meusel 1937		228
SubAss: *Luzulo-Fagetum typicum*	LuzFag1–5	228
C: *Quercetea robori-petraeae* Br.-Bl. et Tx. ex Oberd. 1957		**180**
O: *Quercetalia roboris* Tx. 1931		180
A: *Quercion roboris* Malcuit 1929		180
Ass: *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.	BetQuerc1/2	45
Ass: *Luzulo-Quercetum petraeae* Hilitzer 1932	LuzQuerc1/2	66
Ass: n/a	QuercRob1/2	69

Syntaxonomic unit	Code	No. records
C: *Brachypodio pinnati-Betuletea pendulae* Ermakov et al. 1991		**25**
O: *Fragario vescae-Populetalia tremulae* Willner et Mucina in Willner et al. 2016 prov.		25
A: *Fragario vescae-Populion tremulae* Willner et Mucina ined.		25
Ass: *Cytisus scoparius-Sorbus aucuparia-Betula pendula* pioneer forests	CytBet	19
Ass: *Vaccinium myrtillus-Betula pendula* pioneer forests	VacBet	6
C: *Alnetea glutinosae* Br.-Bl. et Tx. ex Westhoff et al. 1946		**4**
O: *Alnetalia glutinosae* Tx. 1937		1
A: *Alnion glutinosae* Malcuit 1929		1
Ass: *Thelypterido palustris-Alnetum glutinosae* Klika 1940	n.p.	1
O: *Sphagno-Betuletalia pubescentis* Scamoni et Passarge 1959		3
A: *Betulion pubescentis* Lohmeyer et Tx. ex Scamoni et Passarge 1959		3
Ass: n/a	n.p.	3
C: *Robinietea* Jurko ex Hadač et Sofron1980		**4**
O: *Sambucetalia racemosae* Oberd. ex Doing 1962		3
A: *Sambuco-Salicion capreae* Tx. et Neumann ex Oberd. 1957		2
Ass: *Piceo abietis-Sorbetum aucupariae* Oberdorfer 1978	n.p.	1
Ass: *Prunus avium-Rubus fruticosus* stand	n.p.	1
A: Open forest of *Quercus robur* undergrown with elements of *Sambucetalia*		
Ass: n/a	n.p.	1
O: *Chelidonio-Robinietalia pseudoacaciae* Jurko ex Hadač et Sofron 1980		1
A: *Balloto nigrae-Robinion pseudoacaciae* Hadač et Sofron 1980		1
Ass: *Arrhenathero elatioris-Robinietum pseudoacaciae* Šimonovič et al. ex Vítková et Kolbek 2010	n.p.	1
C: *Salicetea purpureae* Moor 1958		**1**
O: *Salicetalia purpureae* Moor 1958		1
A: *Salicion albae* Soó 1930		1
Ass: *Salicetum fragilis* Passarge 1957	n.p.	1
Other forests		**9**
Stands of *Quercus rubra*	QueRub	8
Stands of *Prunus avium*	n.p.	1

The other *Luzulo-Fagetum* variants are represented by relatively few records each. **LuzFag1** and **LuzFag2** share a better developed herb layer and are also richer in species due to somewhat higher light levels on the forest floor. The former unit is rich in species indicating extremely nutrient- and base-poor soil conditions and features some deforestation plants as well as conifer and oak rejuvenation. The species composition of the latter unit indicates an increased nutrient availability and is rich in fern species (*Athyrium filix-femina*, *Dryopteris carthusiana*) indicating humid conditions. Both variants have also been described by KRAUSE & MÖSELER (1995) for the Northern Eifel. Unit **LuzFag3** with on average 12 (± 5) species is intermediate between the more species-rich LuzFag1–2 and the extremely species-poor LuzFag4–5. EIV reflect this intermediate position (cf. Supplement S1).

The few records belonging to the *Galio odorati-Fagetum* in the classification were assembled in our analysis into four vegetation units (GalFag1–4). These represent different sub-associations as shown in Supplement S2. We merged the subunits for NMDS analyses (group 2, "GalFag" in Fig. 4). Despite a strong floristic overlap with several of the aforementioned *Luzulo-Fagetum* variants the *Galio odorati-Fagetum* is distinguished from


NMDS axis 1
NMDS axis 2
1
2
3
4
5
6
7
EIV M
Cov. trees
EIV L
EIV N
Richness
Height herb (mn)
EIV R
Cov. herbs
BisOffi
SilDioc
PerHydr
AlnGlut1
RanRepe
ElyCani
AjuRept
AgrStol
LysNemo
CirSpec
FilUlma
ChrOppo
PruSpin5
StelNemo
EpiMont
PruSpin
LapComm
DapMeze5
CarFlex
GerRobe
ImpParv
GleHede
FraExce1
VioReic
QueRobu1
GeuUrba
GalApar
PyrSpec2
AcePseu1
UrtDioi
AllPeti
SenOvat
AthFili
OxaAcet
MerPere
ImpNoli
SamSpec
RubIdae
FraExce
LuzLuzu
StaSylv
LamGale
DryDila
FagSylv5
FagSylv4
PoaNemo
FesAlti
PolVert
GalOdor
AcePseu
FagSylv
ParQuad
CraMono
DryFili
DryCart
FagSylv2
SorAucu
CarImpa
FagSylv1
SteHolo
MilEffu
CraLaev4
CorAvel4
GalTetr
AruMacu
MelUnif
CorAvel
CarBetu5
RubFrut
CarBetu
AceCamp
CarBetu4
QuePetr
CarBetu2
QuePetr1
AneNemo
Group 1
LuzFag1
LuzFag2
LuzFag3
LuzFag4
LuzFag5
Groups 2-4
GalFag (2)
DesAcer (3)
MercFrax (4)
Groups 5-7
StelCarp (5)
CarpBet (6)
StelAln (7)

the *Luzulo-Fagetum* by several species of base- and more nutrient-rich soils (e.g. *Melica uniflora*, *Galium odoratum*, *Anemone nemorosa*, *Carex sylvatica* and *Lamium galeobdolon* agg.). The *Galio odorati-Fagetum* records appear in the centre of the NMDS diagram (group 2 in Fig. 4), intermediate between the species-poor *Luzulo-Fagetum* and the usually more species-rich and diverse units of the other *Carpino-Fagetea* forests.

Unit **GalFag3**, with 10 records the largest *Galio odorati-Fagetum* subunit, shares a poorly developed herb layer of only 8%, a fairly low species richness and a high frequency of *Luzula luzuloides* with the *Luzulo-Fagetum* but features some more basiphilous species such as *Melica uniflora*, *Viola reichenbachiana* and *Carex sylvatica* (Supplement S2). It thus represents the *Galio odorati-Fagetum luzuletosum* described by KRAUSE & SCHUMACHER (1998) and MÖSELER (1998) for the Northern Eifel. The aforementioned studies report on average species number of 16 and 19 per record and confirm that this sub-association is the most common one in the region whereas the *Galio odorati-Fagetum typicum* is less frequent. In the present data set, the typical variant of the *Galio odorati-Fagetum* which has no own differential species is represented by only seven records (unit **GalFag2**). It is well differentiated from the *Luzulo-Fagetum* by the presence of species like *Melica uniflora* and *Galium odoratum* and the absence of *Luzula luzuloides* and other indicators of base-poor soils. The records are comparatively species-poor (13 ± 6) which corresponds to the findings of KRAUSE & SCHUMACHER (1998) who suggest that this sub-association is less rich in species than the *Galio odorati-Fagetum luzuletosum* due to the lack of acidophytes. Unit **GalFag4** resembles the former unit but is dominated by *Pteridium aquilinum* with a ground cover of 75% (Supplement S2).

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Fig. 4. First and second axes of 3-dimensional NMDS (stress 0.157) of records assigned to class *Carpino-Fagetea* (see Table 3 für explanations on group names). Groups (associations and alliances) determined by k-means analysis are represented by envelopes; as only groups with > 2 records are shown, the *Galio-Carpinetum* and the *Carici remotae-Fraxinetum excelsioris* are missing in the plot. Variables describing vegetation structure (black arrows) and Ellenberg Indicator Values (grey arrows) for light (EIV L), nutrients (EIV N), soil reaction (EIV R) and moisture (EIV M) were fitted to ordination space. Out of the 310 species in the data subset only positively differentiating species with frequency > 50% are shown (cf. Supplement E1 for translation of abbreviations of names; numbers added to the names of woody species give information about the vegetation layer in which the species is occurring with 1/2 = upper/lower tree layer, 4/5 = upper/lower shrub layer, if no number is given the species is present in the herb layer).

Abb. 4. Erste und zweite Achse der 3-dimensionalen NMDS (stress-Wert 0,157) der zur Klasse *Carpino-Fagetea* zugeordneten Aufnahmen (s. Tab. 3 für Erläuterungen der Gruppenbezeichnungen). Die durch den *k-means*-Algorithmus bestimmten Gruppen (Assoziationen und Verbände) sind mit Umrahmungen dargestellt; da nur Gruppen mit > 2 Aufnahmen gezeigt werden, fehlen die Assoziationen *Galio-Carpinetum* und *Carici remotae-Fraxinetum excelsioris* in der Darstellung. Variablen zur Vegetationsstruktur (schwarze Pfeile) und Ellenberg-Zeigerwerte (graue Pfeile) für Licht (EIV L), Nährstoffe (EIV N), Bodenreaktion (EIV R) und Feuchte (EIV M) wurden dem Ordinationsraum *post hoc* zugefügt. Von den 310 Arten des zugrundeliegenden Datensatzes sind nur die positiv differenzierenden Arten > 50 % Stetigkeit dargestellt (vgl. Anhang E1 für eine Übersetzung der Abkürzungen; die nachgestellten Nummern geben Hinweis auf die Vegetationsschicht, in der die jeweilige Gehölzart vertreten ist: 1/2 = hohe/niedrige Baumschicht, 4/5 = hohe/niedrige Strauchschicht, wenn keine Nummer angegeben ist, tritt die Art in der Krautschicht auf).

Sub-association *Galio odorati-Fagetum circaeetosum* is represented by only a single record (**GalFag1**) and is differentiated from the other units by species indicating moist, nutrient- and base-rich conditions such as *Impatiens noli-tangere* and *Chrysosplenium oppositifolium*.

Tilio-Acerion

The alliance *Tilio-Acerion* (maple-ash-lime forests of screes and ravines) is represented by 19 records that can be distinguished into two associations. The tree layer of both units is dominated by *Acer pseudoplatanus* and *Fraxinus excelsior* whereas other tree species occur only infrequently (Supplement S3). Species dominating the herb layer of the *Mercuriali perennis-Fraxinetum* (**MercFrax**, 30 ± 6 species; 9 records) such as *Urtica dioica*, *Galium aparine*, *Melica uniflora* and *Geranium robertianum* indicate nutrient- and base-rich conditions, also reflected by EIV R and EIV N (Supplement S3). The stands feature a relatively well-developed herb (34%) as well as moss layer (5%).

The *Deschampsio-Aceretum* records (**DesAcer**, 17 ± 5 species) have a dense tree layer (85%) and correspondingly a sparse herb layer of only 12% (Supplement S3). Nutrient-indicating species are less frequent than in the former association whereas indicators for acidic soil conditions such as *Luzula luzuloides* are common.

Carpinion betuli

The alliance of oak-hornbeam and mesic oak forests, *Carpinion betuli*, is represented by 58 records out of which 53 were assigned to the *Stellario-Carpinetum betuli* and only one to the *Galio-Carpinetum betuli*. Four records (unit **CarpBet**) could be assigned only to the alliance due to their lack of differential species. Most records are dominated by *Quercus petraea* and placed in Supplement S4, whereas records dominated by *Quercus robur* are presented in Supplement S5.

The tree layer of the *Stellario-Carpinetum* records is usually dominated by *Quercus petraea* and *Carpinus betulus*. In the NMDS diagram, the records cluster in the lower left of the ordination plot and are associated with increasing species richness, herb layer cover and EIV R (group 5 in Fig. 4, Supplement S4).

Based on the composition of the herb layer, two sub-associations are distinguishable.

The *Stellario-Carpinetum luzuletosum* (**StelCarp1** in Supplement S4; 47 records) comprises relatively species-poor stands with on average 14 (± 4) species, approaching base-poor oak forests. Besides species indicating moderately base-rich to moderately acidic soils such as *Melica uniflora, Dryopteris filix-mas* and *Milium effusum* also *Luzula luzuloides* occurs and distinguishes this unit from StelCarp2. In contrast, records assigned to the *Stellario-Carpinetum stachyetosum* (**StelCarp2** in Supplement S4; 6 records) contain many indicators for nutrient- and base-rich conditions such as *Geum urbanum*, *Alliaria petiolata*, *Urtica dioica* and *Moehringia trinervia*. *Luzula luzuloides* is completely missing. Records are comparatively species-rich (29 ± 13) which matches findings in southern Lower Saxony (species numbers of the association 23–40, 26–41 and 21–45 according to DIERSCHKE [1985, 1986] and PREISING et al. [2003], respectively).

While classified among the *Carpinion*, the single record of the vegetation unit **GalCarp** (Supplement S5) besides *Quercus robur* includes a fair amount of *Fagus sylvatica*. The record presumably represents a secondary *Galio-Carpinetum* derived from former coppicing.

Alnion incanae

Riparian forests of the alliance *Alnion incanae* are represented by only six records, of which two belong to the *Carici remotae-Fraxinetum* (**CarFrax**) and four to the *Stellario nemorum-Alnetum glutinosae* (**StelAlne**) (Supplement S6). Both units feature a dense tree cover of ≥ 85% and a well-developed herb layer of > 55% (Supplement S6), the *Carici remotae-Fraxinetum* also sometimes has a dense moss layer (28%). *Alnus glutinosa* dominates the tree layer of both associations and is accompanied by several herb species indicating nutrient-rich conditions, e.g. *Geranium robertianum* and *Geum urbanum*. In the *Carici remotae-Fraxinetum* species indicating rather wet conditions, e.g. *Bistorta officinalis*, *Persicaria hydropiper* and *Lysimachia nemorum*, are much more frequent than in the *Stellario nemorum-Alnetum* and species richness with on average 53 (± 1) species is extremely high (Supplement S6).

Wetness indicators are less frequent in StelAlne, which is also reflected by the lower EIV M (Supplement S6). StelAlne records gather in the upper left edge of the NMDS diagram and are associated with increasing EIV M, EIV N and EIV L (group 7 in Fig. 4).

Quercion roboris

Acidophilous oak forests of the alliance *Quercion roboris* are represented by 180 records out of which 45 were assigned to the association *Betulo pendulae-Quercetum roboris* and 66 to the *Luzulo-Quercetum petraeae*. A further 69 records lack their own differential species and were assigned to the alliance. Due to the tree species-based grouping of the data set, the *Betulo pendulae-Quercetum roboris* is represented in two synoptic tables (**BetQuerc1** in Supplement S4 and **BetQuerc2** Supplement S5) although their herb layers, composed of species indicating acidic and nutrient-poor conditions (*Agrostis capillaris*, *Holcus mollis*, *Deschampsia flexuosa*, *Galium saxatile*, *Vaccinium myrtillus*; cf. also mean EIV R and EIV N), are quite similar. Information on species richness of acidophilous oak forests are only sporadically found in the literature. For the *Betulo pendulae-Quercetum*, 15–17 species per plot have been reported by BERG et al. (2001, 2004) and PREISING et al. (2003) which corresponds to our findings.

The tree layer of records assigned to the *Luzulo-Quercetum petraeae* is dominated by *Quercus robur* (Supplement S4). We distinguished two floristically distinct vegetation units: the herb layer of unit **LuzQuerc1** is composed of species of nutrient- and very base-poor conditions such as, e.g. *Hypericum pulchrum*, *Veronica officinalis*, *Cytisus scoparius* and *Luzula luzuloides*, as reflected by low EIV N and EIV R. Records are generally species poor (14 ± 5 species). The herb layer is poorly, the moss layer well developed (Supplement S4). In unit **LuzQuerc2** species of nutrient- and base-poor conditions and others indicating moderate nutrient availability and with it the transition to oak-hornbeam forests are present.

For *Luzulo-Quercetum* forests of southern Lower Saxony DIERSCHKE (1985) reported 21 species per plot, PREISING et al. (2003) mentioned 19–29 species. Thus, species numbers of this forest type in the NP Eifel are comparably low.

Some oak-dominated *Quercion roboris* records, classified as **QuercRob1** (Supplement S4) and **QuercRob2** (Supplement S5), were species-poor without differential species; they were not assigned to a particular association.

Fragario vescae-Populion tremulae

In total, 25 records of the data set represent pioneer forests constituted mainly of *Betula pendula*. These can be assigned to the extrazonal temperate deciduous birch-poplar woods on mineral soils of Europe, *Fragario vescae-Populion tremulae*, an alliance suggested, as yet informally, by Willner and Mucina in MUCINA et al. (2016). Validly described phytosociological associations of this alliance appear to be lacking in the literature. These pioneer birch forests are represented by two vegetation units, CytBet and VacBet. The *Cytisus scoparius-Sorbus aucuparia-Betula pendula* pioneer forest (**CytBet**) has a moderately developed herb layer but, as is to be expected in successional forests, is rich in juveniles of various tree and shrub species, e.g. *Fagus sylvatica*, *Acer pseudoplatanus* and *Prunus avium* (Supplement S7). They are likely to initiate the development to forests of later successional stages. Further important constituents are *Pteridium aquilinum* and *Lonicera periclymenum*, which differentiate this unit from the subsequent one, VacBet. Species such as *Digitalis purpurea* and *Cytisus scoparius*, indicative for light conditions, may be remnants of the former vegetation of deforested and abandoned sites. CytBet shows how some of the open habitats discussed below (units ArrElat3 and ArrElat4, Chap. *Arrhenatheretalia elatioris*) might develop in the future.

The *Vaccinium myrtillus-Betula pendula* pioneer forest (**VacBet**) is composed of six records only (Supplement S7). The herb layer, though species-poor, is denser (average cover 60%) than in CytBet and is dominated by *Vaccinium myrtillus* and *Deschampsia flexuosa*. Positively differentiating are *Maianthemum bifolium* and saplings of *Quercus robur*.

***Quercus rubra* stands**

In contrast to the aforementioned forest types of native tree species, eight records with dominance of the North American *Quercus rubra* are present in the data set. Like the coniferous non site-native forests addressed in Chap. 3.2.2 these stands result from planting and are conventionally not assigned to the phytosociological system. The records feature a dense tree but sparse shrub, herb and moss layer. Besides saplings of different tree species various graminoid species are present, mostly acidophytes such as *Luzula luzuloides*, *Poa nemoralis*, *Deschampsia flexuosa* and *Agrostis capillaris* (Supplement S8).

Others

Due to the grid-based inventory several deciduous forest plant communities belonging to the classes *Alnetea glutinosae*, *Robinietea* and *Salicetea purpureae* that occur with low surface area proportions in the Eifel NP are represented in the data set by only 1–3 records each and are not addressed in this article (but mentioned in Table 3). For more information on these units, see SCHMIEDEL et al. (2016).

3.2.2 Coniferous forests

Non site-native coniferous forests are represented by 554 records of which 78% are dominated by Norway spruce (*Picea abies*), and 18% by Scots Pine (*Pinus sylvestris*). Other conifers occur infrequently (Fig. 3).

Picea abies forests

The records dominated by Norway spruce (*Picea abies*; Fig. 3) were assigned to four vegetation units, of which **PicAbie1**, referred to as "species-poor spruce forest", is the most common unit comprising 140 records. It is characterised by poor shrub and herb layers and a dense tree layer of 78% (Supplement S9). Species richness with 7 (± 5) species is low and we found no positively differentiating species (Supplement S9). The unit resembles the *Galio harcynici-Culto-Piceetum leucobryetosum* proposed by ZERBE (1994) although comparison is difficult as there is no information on bryophyte and lichen species in the NP data set. In NMDS, records of this cluster gather on the left side of the ordination plot in the direction of increasing tree cover and decreasing species richness (Fig. 5).

The further three vegetation units each comprise similar numbers of records (89–104). Unit **PicAbie2**, referred to as "*Vaccinium myrtillus*-spruce forest" represents spruce stands on acidic and nutrient-poor soils (Supplement S9). It is characterised by a much denser herb layer (26%) than PicAbie1. Dominating species are *Vaccinium myrtillus*, *Deschampsia flexuosa* and *Luzula luzuloides* (Supplement S9) indicating nutrient- and base-poor conditions. It resembles the *Galio harcynici-Culto-Piceetum typicum* found by ZERBE (1994) in the Northern Eifel. PicAbie2 largely overlaps with PicAbie1 in the NMDS diagram but is located somewhat more to the centre (Fig. 5), thus approaching the more species-rich units described below.

Unit **PicAbie3** shares several species with the former unit but also features many species indicating nutrient-rich conditions such as *Senecio ovatus*, *Epilobium angustifolium* and *Mycelis muralis*. It is referred to as "*Digitalis purpurea*-spruce forest". The herb layer cover with 27% and the mean species richness with 25 (± 7) species are comparatively high. PicAbie3 as well as PicAbie4 in NMDS gather on the right side of the ordination diagram, corresponding to increased species richness and nutrient supply, which can also be seen from EIV N (cf. Fig. 5 and Supplement S9). This trend strengthens in unit **PicAbie4**, referred to as "*Rubus idaeus-Rubus fruticosus*-spruce forest", which is characterised by a high abundance of *Rubus* and the presence of several species indicating nutrient-rich and moderately base-rich conditions, e.g. *Urtica dioica*, *Dryopteris filix-mas* and *Poa nemoralis* (Supplement S9).

Pinus sylvestris forests

Forests of Scots pine (*Pinus sylvestris*) are represented by 99 records grouped into five vegetation units that largely vary in their tree cover. **PinSylv1**, referred to as "*Dryopteris dilatata*-pine forest", represents relatively dense pine stands with an average tree cover of 70% (Supplement S10). This is reflected by the lowest mean EIV L compared to the subsequent units PinSylv2–5 (Supplement S10). Species dominating indicate moderate nutrient levels and acidic soil. Ferns (e.g. *Dryopteris dilatata*, *D. filix-mas* and *Athyrium filix-femina*) are common among the positively differentiating species, which all are linked to moderately nutrient-rich and moist conditions. Units PinSylv2 and PinSylv3 both represent relatively open forests with a canopy cover < 50%. Accordingly, the herb layer is well developed (Supplement S10). **PinSylv2**, referred to as "*Epilobium angustifolium*-pine forest", is quite species-rich with many species of woodland clearings such as *Epilobium angustifolium*, *E. montanum* and *Digitalis purpurea* indicating high nutrient availability and light conditions (Supplement S10). In **PinSylv3**, referred to as "*Rubus idaeus-Rubus fruticosus*-pine

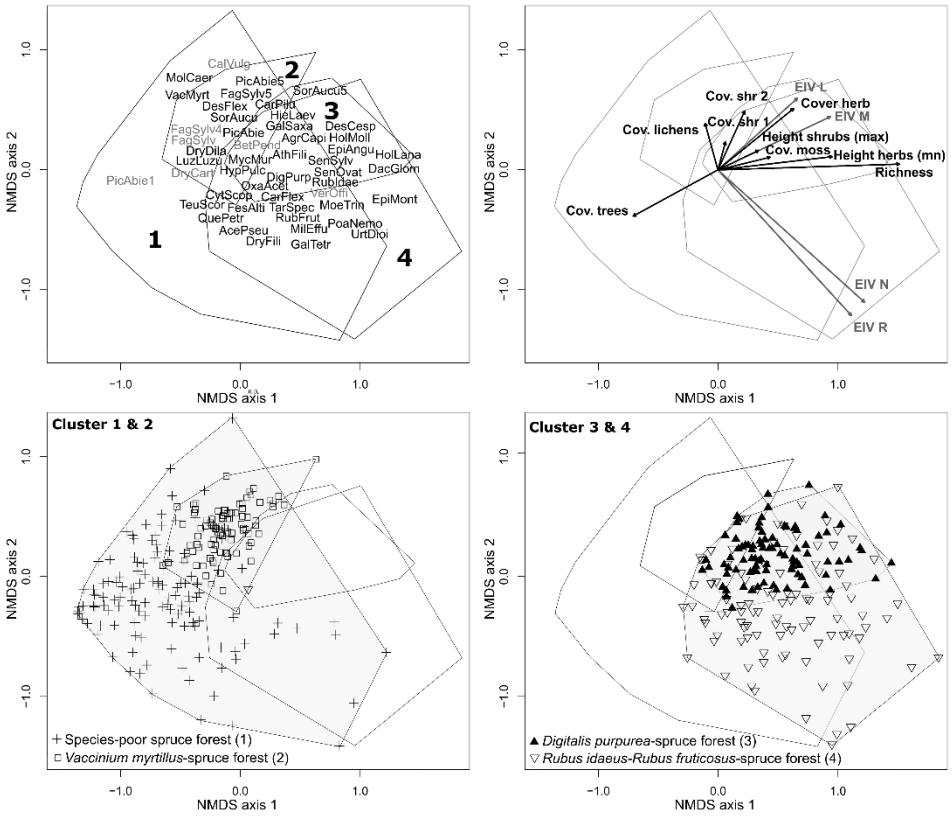

Fig. 5. First and second axes of 3-dimensional NMDS (stress 0.164) of records of spruce forests. Groups determined by k-means analysis are represented by envelopes. Variables describing vegetation structure (black arrows) and Ellenberg Indicator Values (grey arrows) for light (EIV L), nutrients (EIV N), soil reaction (EIV R) and moisture (EIV M) were fitted to ordination space. Out of the 344 species in the data subset only positively differentiating (black) and constant species with frequency > 20% (grey) are shown (cf. Supplement E1 for translation of abbreviations of names; the numbers added to the names of woody species give information about the vegetation layer in which the species is occurring with 1/2 = upper/lower tree layer, 4/5 = upper/lower shrub layer, if no number is given the species is present in the herb layer).

Abb. 5. Erste und zweite Achse der 3-dimensionalen NMDS (stress-Wert 0,164) der Aufnahmen aus Fichtenwäldern. Die durch den *k-means*-Algorithmus bestimmten Vegetationseinheiten sind mit Umrahmungen dargestellt. Variablen zur Vegetationsstruktur (schwarze Pfeile) und Ellenberg-Zeigerwerte (graue Pfeile) für Licht (EIV L), Nährstoffe (EIV N), Bodenreaktion (EIV R) und Feuchte (EIV M) wurden dem Ordinationsraum *post hoc* zugefügt. Von den 344 Arten des zugrundeliegenden Datensatzes sind nur die positiv differenzierenden (schwarz) sowie Begleitarten > 20 % Stetigkeit (grau) dargestellt (vgl. Anhang E1 für eine Übersetzung der Abkürzungen; die nachgestellten Nummern geben Hinweis auf die Vegetationsschicht, in der die jeweilige Gehölzart vertreten ist: 1/2 = hohe/niedrige Baumschicht, 4/5 = hohe/niedrige Strauchschicht, wenn keine Nummer angegeben ist, tritt die Art in der Krautschicht auf).

forest", those species are still present but with lower abundance, while *Rubus fruticosus* agg., *R. idaeus* and the fern species *Dryopteris dilatata* and *Athyrium filix-femina* are frequent and abundant (Supplement S10).

Records of **PinSylv4**, referred to as "*Vaccinium myrtillus*-pine forest", are quite species-poor (9 ± 3 species; Supplement S10). The tree layer with 62% cover is denser than in PinSylv2–3 and, accordingly, the herb layer is less developed. There are only very few positively co-differentiating species, e.g. *Vaccinium myrtillus* and *Deschampsia flexuosa*, indicating acidic and nutrient-poor soil (cf. also low EIV N and EIV R, Supplement S10).

PinSylv5, referred to as "*Calluna vulgaris*-pine forest", with a tree cover < 30% by definition was classified as an open habitat (Chap. Data processing). However, owing to the floristic similarity to the other pine forest units, PinSylv5 is addressed here as pine forest. The seven records have a tree cover of only 16% on average; the herb and shrub layers accordingly are well developed (Supplement S10). *Vaccinium myrtillus* and *Deschampsia flexuosa* are abundant in the herb layer, *Pinus* and *Betula* saplings in the shrub layer; *Calluna vulgaris* is particularly abundant in two records.

Floristic composition of the pine forests in Eifel NP resembles that described for the *Deschampsia flexuosa-Pinus sylvestris* community belonging to the *Dicrano-Pinion* (Libbert 1932) Matuszkiewicz 1962 nom. cons. prop. (cf. HEINKEN 2008). However, the lack of information on bryophyte and lichen species in the NP data set hampers this comparison.

Stands of *Larix decidua* and *Larix kaempferi*

A few larch plantations are present in the data set. In nine records, the tree layer is formed by European larch (*Larix decidua*; **LarDeci**), in four by Japanese larch (*L. kaempferi*; **LarKaem**). These two units are similar in floristic composition and are dominated by *Rubus fruticosus* agg., *Dryopteris dilatata* and *D. carthusiana* (Supplement S11). In comparison with other non site-native coniferous forests in the NP LarDeci records are relatively species-rich with on average 19 (± 6) and 29 species in maximum; LarKaem has 13 (± 4) species.

Stands of *Pseudotsuga menziesii*

Eight records dominated by North American Douglas fir (*Pseudotsuga menziesii*) are present in the data set (Supplement S12). The herb layer is dominated by *Dryopteris carthusiana*, *Rubus fruticosus* agg., *R. idaeus*, *Digitalis purpurea*, and *Luzula luzuloides*. There is a wide range in species richness (1 to > 20) with, on average, 14 (± 10) species per record (Supplement S12). The National Park has scheduled the removal of seed trees of Douglas fir to reduce the establishment of seedlings (NATIONALPARKFORSTAMT EIFEL 2014).

3.2.3 Open habitats

The sample comprising 431 plots of open habitats consists chiefly of grassland of the class *Molinio-Arrhenatheretea* (282 records) with the *Arrhenatheretalia elatioris* being the most common order (Fig. 3, Table 4). Vegetation of woodland clearances is represented by 69 records, 90% of them belonging to the *Galeopsio-Senecionetalia sylvatici*. Scrub communities of the class *Franguletea* are represented by 36 records of the *Rubetalia plicati* and 29 of the *Sambucetalia racemosae*. Sixteen records belong to the *Nardetalia* (Fig. 3, Table 4). Other communities are represented by very few records and are not discussed here but listed in Table 4. For information on these rare communities see SCHMIEDEL et al. (2016).

Table 4. Overview of communities of open habitats of the Eifel National Park based on the permanent plot inventory of 2011, code used in phytosociological tables of the study (code; n.p. = the unit is not presented in detail in this study) and the number of records (no. records) associated with each level. C = class, O = order, A = alliance, Ass = association, SubAss = sub-association. n/a = records could not be assigned to a particular association/alliance but are associated with an alliance/order.

Tabelle 4. Überblick über die im Rahmen der Permanenten Stichprobeninventur (PSI) in 2011 erfassten Offenland-Gesellschaften des Nationalparks Eifel. *Code* = Bezeichnung der Vegetationseinheit in der Studie (n.p. = diese Einheit wird im vorliegenden Artikel nicht im Detail vorgestellt); *No. records* = Anzahl von Aufnahmen, die der jeweiligen Vegetationseinheit angehören. C = Klasse, O = Ordnung, A = Verband, Ass = Assoziation, SubAss = Sub-Assoziation. n/a = Aufnahmen konnten keiner Assoziation/keinem Verband, sondern nur einem Verband/einer Ordnung zugeordnet werden.

Syntaxonomic unit	Code	No. records
C: *Molinio-Arrhenatheretea* Tx. 1937		**282**
O: *Arrhenatheretalia elatioris* Tx. 1931		277
A: *Arrhenatherion elatioris* Luquet 1926		119
Ass: *Arrhenatheretum elatioris* Braun 1915	ArrElat1–3	119
A: n/a (Mosaic of grasslands of order *Arrhenatheretalia elatioris*)		6
Ass: n/a (Mosaic of grasslands of order *Arrhenatheretalia elatioris*)	n.p.	6
A: *Cynosurion cristati* Tx. 1947		152
Ass: *Festuca rubra-Agrostis capillaris* community	FesAgrC	87
Ass: *Festuco-Cynosuretum* Tx. in Büker 1942 em. Meis. 1966	FesCyn	38
Ass: *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936	LolCyn	27
Ass: n/a (Open forest of *Quercus robur* undergrown with elements of *Cynosurion*)	n.p.	1
O: *Molinietalia caeruleae* Koch 1926		5
A: *Calthion palustris* Tx. 1937		3
Ass: *Crepido paludosae-Juncetum acutiflori* Oberdorfer 1957	n.p.	1
Ass: Mosaic of grasslands of alliance *Calthion*	n.p.	1
Ass: *Calthion* community	n.p.	1
A: *Molinion caeruleae* Koch 1926		2
Ass: *Junco effusi-Molinietum caeruleae* Tüxen 1954	n.p.	2
C: *Epilobietea angustifolii* Tx. et Preising ex von Rochow 1951		**69**
O: *Galeopsio-Senecionetalia sylvatici* Passarge 1981 nom. conserv. propos.		61
A: *Epilobion angustifolii* Oberd. 1957		61
Ass: *Epilobio-Digitalietum purpureae* Schwickerath 1944	EpiDigi1–5	54
Ass: *Pteridietum aquilini* Jouanne et Chouard 1929	PteAqui	7
O: *Circaeo lutetianae-Stachyetalia sylvaticae* Passarge 1967 nom. conserv. propos.		7
A: *Aegopodion podagrariae* Tx. 1967 nom. conserv. propos.		7
Ass: *Phalarido-Petasitetum hybridi* Schwickerath 1933 nom. mutat. propos.	n.p.	1
Ass: *Urtico-Aegopodietum* Tx. ex Görs 1968	n.p.	6
O: *Convolvuletalia sepium* Tx. ex Moor 1958		1
A: *Petasition officinalis* Sillinger 1933		1
Ass: n/a (*Phalaris arundinacea* community)	n.p.	1
C: *Franguletea* Doing ex Westhoff in Westhoff et Den Held 1969		**37**
O: *Rubetalia plicati* Weber in Pott 1995		36
A: *Sarothamnion scoparii* Oberd. 1957	SarScop1+2	36
O: *Salicetalia auritae* Doing 1962		1
A: *Salicion cinereae* T. Müller et Görs ex Passarge 1961		1
Ass: *Frangulo-Salicetum cinereae* Graebner et Hueck 1931 nom. invers. propos.	n.p.	1

Syntaxonomic unit	Code	No. records
C: *Robinietea* Jurko ex Hadač et Sofron1980		**20**
O: *Sambucetalia racemosae* Oberd. ex Doing 1962		20
A: *Sambuco-Salicion capreae* Tx. et Neumann ex Oberd. 1957		20
Ass: *Rubetum idaei* Pfeiffer 1936 sensu Oberd. 1973	RubIdae	9
Ass: *Senecioni ovati-Coryletum* Passarge 1979	SenCory	10
Ass: *Senecioni fuchsii-Sambucetum racemosae* Oberd. 1957	SenSamb	1
C: *Calluno-Ulicetea* Br.-Bl. et Tx. ex Klika et Hadač 1944		**17**
O: *Nardetalia strictae* Preising 1950		16
A: n/a		4
Ass: *Galium saxatile-Agrostis capillaris* community	GalAgrC	4
A: *Violion caninae* Schwickerath 1944		12
Ass: *Agrostis capillaris-Luzula luzuloides* community	AgrLuzC	12
O: *Vaccinio myrtilli-Genistetalia pilosae* Schubert ex Passarge 1964		1
A: *Calluno-Genistion pilosae* P. Duvigneaud 1945		1
Ass: *Vaccinio-Callunetum* Büker 1942 nom. invers. propos.	n.p.	1
C: *Phragmito-Magnocaricetea* Klika in Klika et Novák 1941		**3**
O: *Phragmitetalia* Koch 1926		2
A: *Magnocaricion elatae* Koch 1926		2
Ass: *Carici elatae-Calamagrostietum canescentis* Jílek 1958	n.p.	2
O: *Nasturtio-Glycerietalia* Pignatti 1953		1
A: *Glycerio-Sparganion* Br.-Bl. et Sissingh in Boer 1942	n.p.	1
C: *Crataego-Prunetea* Tx. 1962 nom. conserv. propos.		**3**
O: *Prunetalia spinosae* Tx. 1952	n.p.	3

Arrhenatheretalia elatioris

Among the 282 *Molinio-Arrhenatheretea* records, 98% were assigned to the *Arrhenatheretalia elatioris* and only 2% to the *Molinietalia caeruleae* (Table 4, Fig. 3). Only the *Arrhenatheretalia* are presented in more detail here; information on the *Molinietalia* can be obtained from SCHMIEDEL et al. (2016). Records of the *Arrhenatheretalia elatioris* were classified to six different (sub-)associations of the alliances *Cynosurion cristati* and *Arrhenatherion elatioris* (Table 4, Supplement S13).

The most common unit contains species-poor meadows dominated by *Festuca rubra* agg. and *Agrostis capillaris* (**FesAgrC**). *Festuca rubra-Agrostis capillaris* grasslands have been described by MÖSELER (1998) for the Northern Eifel. They are transitional between *Violion caninae* and *Cynosurion* grasslands (GLAVAC 1983, BECKER et al. 2012). Besides the eponymous grasses, species indicating nutrient-poor to moderately nutrient-rich conditions like *Anthoxanthum odoratum*, *Rumex acetosa*, *Trifolium pratense*, *Hypochaeris radicata* and *Vicia cracca*, are frequent (frequency > 50%) but low in cover (Supplement S13). Sites of FesAgrC are least nutrient-rich when compared with all other units of the *Arrhenatheretalia* (cf. EIV N in Supplement S13), indicated by the presence of, e.g. *Luzula campestris* and *Rhinanthus minor*. Records cluster on the left side of the NMDS diagram (Fig. 6) and are associated with EIV L but negatively correlated with EIV N as well as increasing species richness.

Unit **FesCyn**, represented by 38 records, concerns pastures floristically similar to FesAgrC (cf. overlap of records in Fig. 6 and Supplement S13) but is more species-rich. The vegetation is dominated by low growing to medium-sized grasses such as *F. rubra* agg.,

A. capillaris, *H. lanatus*, *Cynosurus cristatus* and *Trisetum flavescens* (Supplement S13). Species rather sensitive to trampling and grazing, e.g. *Centaurea jacea*, *Lathyrus pratensis* and *Vicia hirsuta*, are present with very low frequencies. In contrast, and in line with their association with sheep pasture, rosette-forming plants more adapted to grazing occur with higher frequencies and underline the assignment of this grassland type to the association *Festuco-Cynosuretum*. According to MÖSELER (1998) this community is comparably rare in the Northern Eifel.

The floristic composition of **LolCyn** grasslands is similar to that of FesCyn but is richer in, and sometimes dominated by, nutrient-demanding plants such as *Lolium perenne*, *Trifolium pratense*, *T. repens*, *Holcus lanatus* and *Poa pratensis* (cf. also EIV N, Supplement S13). As in FesCyn, several species insensitive to trampling and grazing are more or less common whereas species known to be sensitive to this impact are almost completely absent (Supplement S13). Pastures of this type represent the association *Lolio-Cynosuretum*.

On (formerly) mown sites, meadows of the association *Arrhenatheretum elatioris* can be found. The three vegetation units distinguished here constitute different successional stages. ArrhElat2 and ArrhElat3 both represent abandoned *Arrhenatheretum* grasslands whereas ArrElat1 shows almost no signs of successional development. Records of **ArrElat1** cluster in the centre of the NMDS diagram and therefore share plant species with most other grassland units (Fig. 6). In contrast to the *Cynosurion* units dominated by low-growing grasses, tall grasses such as *Dactylis glomerata* and *Arrhenatherum elatius* are abundant in this and the other units of the *Arrhenatheretum elatioris*; they are accompanied by the medium-sized grasses *Holcus lanatus* and *Agrostis capillaris* (Supplement S13). Species insensitive to grazing and trampling are less common than in the *Cynosurion* grasslands whereas those more sensitive to grazing but well adapted to mowing, e.g. *Alopecurus pratensis* and *Rumex acetosa*, are more common.

While still dominated by *Arrhenatherum elatius*, the low grasses *Agrostis capillaris* and *Festuca rubra* agg. are noticeably less frequent in **ArrhElat2** than in ArrElat1 and nutrient-indicating and grazing- and mowing-sensitive species are present. The floristic composition in combination with the frequent presence of a shrub layer of *Cytisus scoparius* indicate the recent abandonment of these sites. In NMDS (Fig. 6), they gather at the lower-right edge of the ordination diagram and are associated with increasing plant height.

Within unit **ArrhElat3** the trend caused by abandonment is enhanced. All records feature a high proportion of woody species (average shrub cover 38%). As in ArrhElat2, *C. scoparius* dominates the shrub layer, now accompanied by *Prunus spinosa*, *Cratagus monogyna* and *Rubus fruticosus* agg., the latter with high cover proportions. The herb layer is formed by tall grasses (*Dactylis glomerata*, *Arrhenatherum elatius*). Nutrient-demanding species following abandonment have increased; species of nutrient-poor sites are completely absent (Supplement S13). Species richness (34 ± 10) outnumbers that of the other *Arrhenatheretalia* grasslands. ArrhElat3 records gather at the top-right side of the NMDS ordination plot (Fig. 6) and are associated with increasing EIV N and increasing shrub cover and height. Without mowing or grazing, succession is likely to move on towards pioneer forests similar to those described in Chap. *Fragario vescae-Populion tremulae*.

In addition to the described *Arrhenatheretalia* grassland units, further six PSI records were classified to that order. They appear to represent sites with very patchy and heterogeneous vegetation composed of various phytosociological syntaxa; they are not detailed here but mentioned in Table 4.

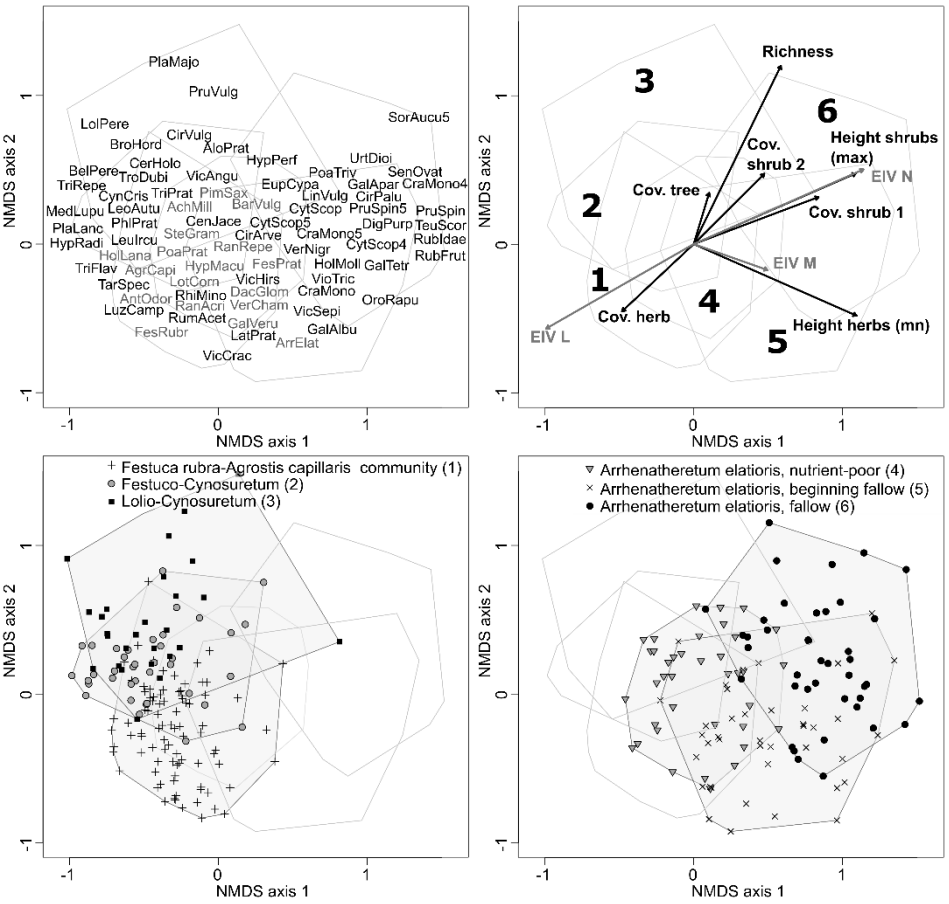

Fig. 6. First and second axes of 3-dimensional NMDS (stress 0.160) of records assigned to *Arrhenatheretalia elatioris* grasslands. Groups determined by k-means analysis are represented by envelopes. Six records representing extremely heterogeneous sites of *Arrhenatheretalia* grassland mosaics are not included in the plot. Variables describing vegetation structure (black arrows) and Ellenberg Indicator Values (grey arrows) for light (EIV L), nutrients (EIV N) and moisture (EIV M) were fitted to ordination space; only significant variables are shown. Out of the 321 species in the data subset only positively differentiating (black) and constant species with frequency > 20% (grey) are shown (cf. Supplement E1 for meaning of abbreviations of names; numbers added to the names of woody species give information about the layer in which the species was occurring with 4/5 = upper/lower shrub layer; if no number is given the species is present in the herb layer).

Abb. 6. Erste und zweite Achse der 3-dimensionalen NMDS (stress-Wert 0,160) der Aufnahmen der Ordnung *Arrhenatheretalia elatioris*. Die durch den *k-means*-Algorithmus bestimmten Vegetationseinheiten sind mit Umrahmungen dargestellt. Sechs sehr heterogene Aufnahmen (*Arrhenatheretalia*-Grünland-Mosaik) wurden nicht in die NMDS übernommen. Variablen zur Vegetationsstruktur (schwarze Pfeile) und Ellenberg-Zeigerwerte (graue Pfeile) für Licht (EIV L), Nährstoffe (EIV N), und Feuchte (EIV M) wurden dem Ordinationsraum *post hoc* zugefügt. Von den 321 Arten des zugrundeliegenden Datensatzes sind nur die positiv differenzierenden (schwarz) sowie Begleitarten > 20 % Stetigkeit (grau) dargestellt (vgl. Anhang E1 für eine Übersetzung der Abkürzungen; die nachgestellten Nummern geben Hinweis auf die Vegetationsschicht, in der die jeweilige Gehölzart vertreten ist, wobei 4/5 = hohe/niedrige Strauchschicht, wenn keine Nummer angegeben ist, tritt die Art in der Krautschicht auf).

Galeopsio-Senecionetalia sylvatici

The class *Epilobietea angustifolii* is represented by 69 records of which 88% belong to the *Galeopsio-Senecionetalia sylvatici*; the other records were assigned to orders *Circaeo lutetianae-Stachyetalia sylvaticae* and *Convolvuletalia sepium* (cf. Table 4) and are not presented here; for information see SCHMIEDEL et al. (2016).

The *Galeopsio-Senecionetalia*, with its alliance *Epilobion angustifolii*, is represented by the *Epilobio-Digitalietum purpureae*, and the *Pteridietum aquilini*. The *Epilobio-Digitalietum purpureae* can be separated into five different subunits describing early successional (**EpiDigi1**) as well as typical stages (EpiDigi2/3), some of them with remnant trees (EpiDigi4/5). **EpiDigi2** represents vegetation of nutrient-rich sites dominated by *Epilobium angustifolium*, *Rubus idaeus*, *Digitalis purpurea* and *Senecio ovatus* (Supplement S14) whereas **EpiDigi3** encompasses nutrient-poorer and less species-rich sites with *Deschampsia flexuosa*, *Vaccinium myrtillus* and *Galium saxatile*.

EpiDigi4 and **EpiDigi5** both represent successional stages with remnant forest trees. EpiDigi4 reflects the development in more or less deforested open spruce forests; EpiDigi5 is its counterpart in former beech forests. The cover of the tree layer in these units is < 30%.

Representative sites of the *Pteridietum aquilini* (**PteAqui** 7 records; Supplement S14) are dominated by *Pteridium aquilinum*; the only other species with considerable cover are brambles (*Rubus idaeus*, *R. fruticosus* agg.).

Rubetalia plicati

The *Franguletea* are represented by 37 records, with all but one (*Salicetalia auritae*, not presented here) belonging to the *Rubetalia plicati* (Table 4). *Rubetalia plicati* records were grouped into two units both representing the *Sarothamnion scoparii* (SarScop1 and SarScop2). Floristically, the units resemble the *Epilobio-Digitalietum* as well as the *Rubetum idaei* described in the following section, but *Rubus fruticosus* agg. is dominant. As species within *R. fruticosus* agg.were not determined during the inventory, we could not identify further associations. Within **SarScop1**, both *R. fruticosus* agg. and *R. idaeus* are equally abundant, and other species like *Agrostis capillaris* or *Teucrium scorodonia* are frequent but with very low cover (Supplement S14). In **SarScop2**, *R. fruticosus* agg. is the only important constituent and *R. idaeus* is less abundant; other species are even less frequent than in SarScop1.

Sambucetalia racemosae

All 20 records assigned to the *Sambucetalia racemosae* belong to the *Sambuco-Salicion capreae* (Table 4). They have been split into three associations, of which the *Senecioni ovati-Coryletum* is the most frequent, followed by the *Rubetum idaei*. The *Senecioni fuchsii-Sambucetum racemosae* is represented by only one record in the data set and is not discussed here.

Like the *Sarothamnion* units described in the former section, the *Rubetum idaei* (**RubIdae**) floristically resembles the *Epilobio-Digitalietum*. *Rubus idaeus* is dominant, while unidentified brambles of the *R. fruticosus* aggregate are frequently present but with low ground cover. Besides *R. idaeus* only *Agrostis capillaris* and *Holcus mollis* are abundant. As in the units before, species of woodland clearances such as *Epilobium angustifolium* are present. Furthermore, several species of high light conditions (e.g. *Calluna vulgaris*,

Senecio ovatus and *Hypericum maculatum*) as well as of shadier habitats (e.g. *Dryopteris filix-mas*) are present. Some plots of RubIdae as well as of SarScop1 may represent complexes of *Sambuco-Salicion* and *Sarothamnion scoparii* vegetation.

The *Senecioni ovati-Coryletum*, **SenCory**, is dominated by *Corylus avellana* forming dense shrub or – in a single plot – a low tree canopy (Supplement S15). Species common in the herb layer are e.g. *Senecio ovatus*, *Galeopsis tetrahit* as well as *Rubus idaeus* and *R. fruticosus* agg.

Nardetalia strictae

The *Calluno-Ulicetea* are represented by only 17 records out of which 16 belong to the order *Nardetalia strictae* and only one to the *Vaccinio myrtilli-Genistetalia pilosae* (not discussed; Tab. 4). The *Nardetalia* grasslands are represented by two vegetation units tentatively referred to as *Galium saxatile-Agrostis capillaris* community (GalAgrC) and *Agrostis capillaris-Luzula luzuloides* community (AgrLuzC). The former, similarly to FesAgrC described in Chap. *Arrhenatheretalia elatioris*, is dominated by the grass *Agrostis capillaris* (Supplement S16). *Festuca rubra* agg. and other grasses of medium height are very rare and tall grasses like *Arrhenatherum elatius* completely absent from this unit. Several species common in *Nardus* grasslands such as *Galium saxatile*, *Deschampsia flexuosa*, *Carex pilulifera*, *Hypericum perforatum* and *Calluna vulgaris*, occur in **GalAgrC** justifying its assignment to the *Nardetalia*. Following GLAVAC (1983), it may be assumed that grasslands of this type developed from *Festuca rubra-Agrostis capillaris*-grasslands (cf. Chap. *Arrhenatheretalia elatioris*) by intensified grazing. Unit **AgrLuzC**, similar to GalAgrC, is dominated by *A. capillaris*. Several species of nutrient-poor grasslands are also present such as *Luzula campestris*, which is frequent in AgrLuzC but lacking in GalAgrC (Supplement S16). The species composition resembles somewhat ruderalised *Nardus* grasslands; some sites are deforested with very few remnant trees.

3.3 Representativeness of sampling plots

The vegetation types of the Eifel NP classified in this study are very unevenly represented in terms of sample number by the PSI plots. The 1,539 PSI records were grouped into 84 vegetation types. The most common unit (PicAbie1) encompasses 140 records whereas 22 vegetation types comprise just one record each. As the PSI records are placed on a regular grid spanning the area of the whole NP, the proportion of vegetation types derived from PSI sample numbers approximately reflects the actual frequency and surface area proportions of these types in the field. Rare and small-scale vegetation types of fens, springs or riparian forests, wet grasslands as well as heathlands quite accidentally may or may not have been recorded by the grid-based sampling and are thus only represented by few plots, if any. Several other rare vegetation types known to be present in the NP (NATIONALPARKFORSTAMT EIFEL 2014) like rock face vegetation, *Nardus*-rich grasslands, freshwater vegetation and mountain meadows as well as habitats of mostly linear dimensions, were not recorded by the PSI sampling design or were disregarded by the classification approach. For example, it turned out that only two of the 1,539 PSI records approximately matched the floristic composition of the *Geranio sylvatici-Trisetetum*, an association of mountain meadows initially considered characteristic for the open landscape of the upland area of the Eifel NP. Owing to their floristic similarity, these two plots were classified along with *Arrhenatheretum elatioris* meadows in the process of numerical classification.

The absence of several rare vegetation types and species (e.g. rare front-edge occurrences of submediterranean *Sorbus torminalis*; HAEUPLER et al. 2003) of conservation priority shows that it is important to complement the present permanent plot design of the PSI by a more specific monitoring to survey the flora and vegetation of the NP more completely. With such additional investigations aiming at capturing rare species and/or small-scale types of vegetation, the number of sampling plots of as yet poorly represented vegetation types could be increased in a systematic way, which might also help to assess the representativeness of rare records.

3.4 Heterogeneity of plots and data set

The PSI records used in this analysis form a data set that is heterogeneous on different levels. First, as explained before, vegetation types are unequally well represented due to the grid-based sampling design. Second, the fieldwork methodology (cf. Chap. Data sources) did not respect principles of plot homogeneity as in phytosociological sampling (DIERSCHKE 1994). Thus, sampling plots may encompass mosaics or other patterns of different vegetation types. This within-plot heterogeneity is presumably particularly high in open and transitional habitats due to the rather large plot size of 100 m². Whilst this plot size is quite large for grasslands and heathlands, it might be too small to capture the complete species composition of forest sites.

Both aforementioned issues constrain the applicability of numerical classification as well as the allocation of the classified units to phytosociological syntaxa. As a single classification of the whole data set did not work out satisfactorily, we applied manual steps during the classification procedure. To reduce the heterogeneity of the data set, we manually separated it into subsamples prior to the analysis as described in Chap. Data processing. This is a somewhat subjective approach that, for the present data set, delivered plausible results. Furthermore, in the first classification of the deciduous and coniferous forest plots, vegetation units were separated by the cluster algorithm according to tree species dominances. We then analysed the resulting units in more detail, while retaining the separation of plots dominated by one particular tree species, irrespective of the phytosociological context. This resulted in the classificatory separation of otherwise floristically similar records that turned out to belong to a single phytosociological (sub)association. Nevertheless, we pursued this approach to avoid further manual steps in the procedure.

Apart from these methodological issues in data analysis, further constraints arose from the methodology of data sampling. As bryophyte and lichen species had not been recorded (but only the total cover of all bryophytes and lichens in a plot), the assignment to a syntaxon remains debatable for some plant communities where cryptogams are of high relevance for syntaxonomic identification. As a monitoring system for bryophyte and lichen species has been recently established in the NP (and for the Hainich and Kellerwald-Edersee NPs; DREHWALD et al. 2015), this knowledge gap might be filled in the future. Similar problems arose from the non-identification of bramble species of *R. fruticosus* agg. in the field. MATZKE-HAJEK (2017) recently provided an overview of the *Rubus* species of the Eifel NP that might facilitate the identification of this taxon group in future vegetation inventories. Moreover, due to the long fieldwork period (cf. Chap. Data sources) some vascular plants flowering early in spring might have been overlooked. As the data were sampled by five different observers an observer effect (cf. SEIDLING et al. 2014) cannot be ruled out.

3.5 Management versus natural development

Our classification approach demonstrated that, due to the young age of the Eifel NP and the silvicultural and military use in its recent past, some vegetation types evidently still reflect strong human influence. Structures of managed forests, both coniferous and deciduous, prevail in large parts of the NP (SPORS et al. 2018). Other areas of the NP contain open habitats established and formerly maintained through grazing, mowing and military use. As IUCN definitions demand 75% of the NP area to be in a natural or at least near-natural state 30 years after establishment, NP managers have to decide how to best achieve this goal (EUROPARC DEUTSCHLAND E.V. 2013), i.e. whether no active management is allowed at all ("leave nature as it is"; German: "Natur Natur sein lassen"), or whether to control and direct natural development. EUROPARC DEUTSCHLAND E.V. (2013) concluded that for NPs with a long history of land use an immediate complete abandonment is rarely feasible. In the NP Eifel, the effects of large ungulate populations and the abundance, and ample rejuvenation, of non-native tree species are points of discussion. There are various studies on the influence of ungulates on successional processes in National Parks (e.g. MANN 2009, EUROPARC DEUTSCHLAND E.V. 2011, 2013, EHRHART et al. 2016). MAUERHOF (2016) estimated a density of 10 red deer (*Cervus elaphus*) per 100 ha in the NP Eifel where also roe deer (*Capreolus capreolus*), mouflon (*Ovis gmelini musimon*) and wild boar (*Sus scrofa*) occur. A particular monitoring concept is applied in the NP Eifel to evaluate the browsing influence of the animals on the vegetation (MAUERHOF 2016). Preliminary findings suggest that young native tree species are more frequently browsed than the non-site-native conifers (spruce and Douglas fir), thus hampering the competitiveness of the native deciduous trees, a situation potentially jeopardising the NP's conservation targets. Thus, ungulate densities are controlled through selective shooting (NATIONALPARKFORSTAMT EIFEL 2014) and mature trees of Douglas fir and Norway spruce are selectively removed to reduce the propagule pressure and pave the way for the rejuvenation of native tree species. This management will be continued in the coniferous forest areas of the NP for some years before natural processes are allowed to take over. It is expected that after 2034, thirty years after establishing the NP, most parts will be exempted from human intervention and management will be retained in only c. 13% of the area, specifically where species-rich open habitats of high nature conservation value are present that for their viability depend on extensive management (NATIONALPARKFORSTAMT EIFEL 2014). Other open habitats in the NP zones without management will be subjected to succession: processes that are already underway and reflected by several of the classified vegetation types. As shown in Chap. *Arrhenatheretalia elatioris*, vascular plant species richness of abandoned successional grasslands is currently high but is likely to decrease under altered light conditions in climax forest communities. At the same time, natural development processes will facilitate the expansion or establishment of species depending on structures and functions of extensive old growth forests, which are represented, if at all, only infrequently and in small quantities in the managed landscape outside the NP. In particular, different species groups on decaying and dead wood, e.g. lignicolous fungi, lichens and bryophytes, or saproxylic beetles and other xylobiont invertebrates (cf. WALENTOWSKI et al. 2010) will benefit from this process, underlining the necessity of a careful selection of bioindicators for comprehensive ecological long-term monitoring.

4. Conclusions

From the results of our classification of the 1,539 PSI plots, the diverse vegetation composition of the Eifel NP and its biogeographical context become apparent. Although PSI data have not primarily been sampled to be used for phytosociological analysis and despite the methodological shortcomings of the sample described above, the numerical classification of the data gave plausible results and allowed us to distinguish 84 vegetation units. Deciduous forests and open vegetation comprise about 64% of the PSI records, and were assigned to 29 phytosociological associations of 25 alliances, 18 orders and 11 classes. A further 36% of the plots are dominated by plantations or stands of spontaneously germinated, non-native or non site-native, coniferous or deciduous trees that we classified into 25 vegetation units considered insignificant in terms of syntaxonomy. The major advantage of the systematic sampling design is the quantitative and total-area consideration of otherwise often disregarded types of vegetation such as pioneer and heavily disturbed forests, deforested and abandoned habitats. Vegetation of deforested sites such as the *Epilobio-Digitalietum* for instance shows remarkable variation, as do successional stages of pre-forest, abandoned grasslands and formerly intensively managed plantation forests in transition. From the high proportion of such vegetation types in a systematic sample it appears that neglected or marginalised plant communities are well worth considered in various-scale vegetation surveys.

Monitoring vegetation development in the Eifel NP under changed/ceased management will remain an interesting and important field of research in the next years. Data from the next PSI will enable temporal comparisons, further insight in the developmental phases of (near-)natural forest ecosystems and the prediction of the speed and spatial dimensions of habitat change related to local successional processes.

Erweiterte deutsche Zusammenfassung

Einleitung – Im Rahmen der ersten Permanenten Stichprobeninventur (PSI; 2011–2013) des seit 2004 bestehenden Nationalparks Eifel wurde neben der Waldstruktur auch die Vegetationszusammensetzung auf 1.539 Probeflächen erfasst. Diese auf einem regelmäßigen Raster (250 m × 250 m) angeordneten je 100 m² großen Aufnahmeflächen sind über das gesamte Gebiet des Nationalparks verteilt. Sie bilden die Grundlage für Analysen zum Status quo der floristischen Diversität und des Zustands der Vegetation. Die vorliegende Untersuchung geht in diesem Zusammenhang folgenden Fragestellungen nach: (1) Welche Pflanzengesellschaften lassen sich auf Grundlage der 1.539 Vegetationsaufnahmen im Nationalpark Eifel unterscheiden? (2) Welche Pflanzengesellschaften sind häufig vertreten, welche nur selten? (3) Wie lassen sich die Pflanzengesellschaften ökologisch charakterisieren, und was lässt sich auf dieser Grundlage über die Vegetationsentwicklung im Nationalpark aussagen?

Methoden – Der Gesamtdatensatz wurde vor Beginn der Analysen anhand der Baumschichtdeckung in offene und baumdominierte Bestände getrennt (Schwellenwert Gesamtbaumschichtdeckung 30 %). Letzterer Teildatensatz wurde anhand des Deckungsanteils von Laub- und Nadelgehölzen weiterhin in Laub- und Nadelwaldbestände getrennt. Die drei Teildatensätze wurden im Folgenden mittels numerischer Klassifikation (*k-means*-Analyse) klassifiziert. Die Benennung der entstandenen Einheiten erfolgte durch Literaturabgleich.

Ergebnisse – Der Gesamtdatensatz umfasst 484 Gefäßpflanzen, von denen 444 auf Ebene der Art bzw. Artengruppe und weitere 40 auf Gattungsniveau bestimmt wurden. Von den 444 Arten(gruppen) sind ca. 4 % Neophyten. Etwa 6 % der Arten stehen auf der Roten Liste, weitere 10 Arten auf der Vorwarnliste (RAABE et al. 2010). Die Artenzahlen pro Vegetationsaufnahme variieren stark: 11 Aufnahmen enthalten nur eine einzige Art, die artenreichste umfasst 70 Arten pro 100 m².

Die Klassifikation ergab 84 Vegetationseinheiten. Die Vegetationseinheiten der Offenländer und Laubwälder lassen sich 29 beschriebenen Assoziationen, 25 Verbänden, 18 Ordnungen und 11 Klassen zuordnen; Forstbestände wurden zu 25 Vegetationseinheiten gruppiert, jedoch nicht in das pflanzensoziologische System eingegliedert.

Aufgrund der rasterbasierten Lage der PSI-Probeflächen ergibt sich eine sehr unterschiedliche Anzahl von Vegetationsaufnahmen je Vegetationseinheit. Häufigste Pflanzengesellschaft ist der Hainsimsen-Buchenwald (*Luzulo-Fagetum*), gefolgt von Fichtenforsten und Eichenwäldern. Neben den genannten Waldtypen nehmen Glatthaferwiesen (*Arrhenatheretum elatioris*) bedeutende Flächenanteile des Nationalparks ein.

Schlussfolgerung – Aufgrund seines noch jungen Alters und der damit noch nicht lange zurückliegenden, teils intensiven Waldnutzung, weist der „Entwicklungsnationalpark" Eifel neben ausgedehnten Laubwäldern aus heimischen Arten vielfach noch stark anthropogen geprägte Waldvegetation aus nicht bodenständigen Baumarten auf. Die natürliche Fortentwicklung dieser Bestände wird durch gezieltes Management unterstützt. Naturschutzfachlich besonders wertvolle Offenländer werden zukünftig durch extensive Nutzung erhalten, andere Offenland-Bereiche ihrer natürlichen Sukzession überlassen. Teile der Vegetation des Nationalparks werden somit in den kommenden Jahren großen Veränderungen unterliegen. Die vorliegende Untersuchung bildet die Basis für einen Vergleich der aktuellen mit der im Rahmen zukünftiger PSI zu erfassenden Vegetation.

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Author contribution statement

All authors together conceived the presented contents. I.S. performed the analyses, E.B. and F.G. verified the methods and results. All authors discussed the results, in particular the assignment of the vegetation units to phytosociological syntaxa described in literature, and contributed to the final manuscript.

Supplements

Supplement S1. Synoptic table of vegetation units of the *Luzulo-Fagetum* Meusel 1937.

Beilage S1. Übersichtstabelle der Vegetationseinheiten des *Luzulo-Fagetum* Meusel 1937.

Supplement S2. Vegetation table of the *Galio odorati-Fagetum* Sougnez et Thill 1959.

Beilage S2. Vegetationstabelle des *Galio odorati-Fagetum* Sougnez et Thill 1959.

Supplement S3. Vegetation table of the *Mercuriali perennis-Fraxinetum excelsioris* (Klika 1942) Husová in Moravec et al. 1982 (MercFrax) and the *Deschampsio cespitosae-Aceretum* Bohn 1984 (DesAcer).

Beilage S3. Vegetationstabelle des *Mercuriali perennis-Fraxinetum excelsioris* (Klika 1942) Husová in Moravec et al. 1982 (MercFrax) und des *Deschampsio cespitosae-Aceretum* Bohn 1984 (DesAcer).

Supplement S4. Synoptic table of vegetation units with dominance of *Quercus petraea* (LuzQuerc1/2 = *Luzulo-Quercetum petraeae* Hilitzer 1932; BetQuerc1 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; QuercRob1 = *Quercion roboris* Malcuit 1929; StelCarp1/2 = *Stellario-Carpinetum* Oberd. 1957).

Beilage S4. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Quercus petraea* (LuzQuerc1/2 = *Luzulo-Quercetum petraeae* Hilitzer 1932; BetQuerc1 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; QuercRob1 = *Quercion roboris* Malcuit 1929; StelCarp1/2 = *Stellario-Carpinetum* Oberd. 1957).

Supplement S5. Vegetation table of vegetation units with dominance of *Quercus robur* (QuercRob2 = *Quercion roboris* Malcuit 1929; BetQuerc2 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; CarpBet = *Carpinion betuli* Issler 1931; GalCarp = *Galio-Carpinetum* Oberd. 1957).

Beilage S5. Vegetationstabelle der Aufnahmen mit Dominanz von *Quercus robur* (QuercRob2 = *Quercion roboris* Malcuit 1929; BetQuerc2 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; CarpBet = *Carpinion betuli* Issler 1931; GalCarp = *Galio-Carpinetum* Oberd. 1957).

Supplement S6. Vegetation table of the *Carici remotae-Fraxinetum* W. Koch 1926 ex Faber 1937 (CarFrax) and the *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957 (StelAlne).

Beilage S6. Vegetationstabelle des *Carici remotae-Fraxinetum* W. Koch 1926 ex Faber 1937 (CarFrax) und des *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957 (StelAlne).

Supplement S7. Synoptic table of vegetation units with dominance of *Betula pendula* (CytBet = *Cytisus scoparius-Sorbus aucuparia-Betula pendula* pioneer forests; VacBet = *Vaccinium myrtillus-Betula pendula* pioneer forests).

Beilage S7. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Betula pendula* (CytBet = *Cytisus scoparius-Sorbus aucuparia-Betula pendula*-Pionierwälder; VacBet = *Vaccinium myrtillus-Betula pendula*-Pionierwälder).

Supplement S8. Vegetation table of relevés with dominance of *Quercus rubra* (QueRub).

Beilage S8. Vegetationstabelle von Aufnahmen mit Dominanz von *Quercus rubra (*QueRub).

Supplement S9. Synoptic table of vegetation units with dominance of *Picea abies* (PicAbie1–4).

Beilage S9. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Picea abies* (PicAbie1–4).

Supplement S10. Synoptic table of vegetation units with dominance of *Pinus sylvestris* (PinSylv1–5).

Beilage S10. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Pinus sylvestris* (PinSylv 1–5).

Supplement S11. Vegetation table of relevés with dominance of *Larix decidua* (LarDeci) and *Larix kaempferi* (LarKaem).

Beilage S11. Vegetationstabelle von Aufnahmen mit Dominanz von *Larix decidua* (LarDeci) und *Larix kaempferi* (LarKaem).

Supplement S12. Vegetation table of relevés with dominance of *Pseudotsuga menziesii* (PseMenz).

Beilage S12. Vegetationstabelle von Aufnahmen mit Dominanz von *Pseudotsuga menziesii* (PseMen).

Supplement S13. Synoptic table of vegetation units of class *Molinio-Arrhenatheretea* Tx. 1937 (FesAgrC1 = *Festuca rubra-Agrostis capillaris* community; FesCyn = *Festuco-Cynosuretum* Tx. in Büker 1942 em. Meis. 1966; LolCyn = *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936; ArrElat1-3 = *Arrhenatheretum elatioris* Braun 1915).

Beilage S13. Übersichtstabelle der Vegetationseinheiten der Klasse *Molinio-Arrhenatheretea* Tx. 1937 (FesAgrC1 = *Festuca rubra-Agrostis capillaris* community; FesCyn = *Festuco-Cynosuretum* Tx. in Büker 1942 em. Meis. 1966; LolCyn = *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936; ArrElat1-3 = *Arrhenatheretum elatioris* Braun 1915).

Supplement S14. Synoptic table of vegetation units of woodland clearings (EpiDigi1-5 = *Epilobio-Digitaliet*um *purpureae* Schwickerath 1944; RubIdae = *Rubetum idaei* Pfeiffer 1936 sensu Oberd. 1973; SarScop1-2 = *Sarothamnion scoparii* Oberd. 1957; PteAqui = *Pteridietum aquilini* Jouanne et Chouard 1929).

Beilage S14. Übersichtstabelle der Vegetationseinheiten der Schlagfluren (EpiDigi1-5 = *Epilobio-Digitalietum purpureae* Schwickerath 1944; RubIdae = *Rubetum idaei* Pfeiffer 1936 sensu Oberd. 1973; SarScop1-2 = *Sarothamnion scoparii* Oberd. 1957; PteAqui = *Pteridietum aquilini* Jouanne et Chouard 1929).

Supplement S15. Vegetation table of relevés of *Senecioni ovati-Coryletum* Passarge 1979 (SenCory) and *Senecioni fuchsii-Sambucetum racemosae* Oberd. 1957 (SenSamb).

Beilage S15. Vegetationstabelle von Aufnahmen des *Senecioni ovati-Coryletum* Passarge 1979 (SenCory) und des *Senecioni fuchsii-Sambucetum racemosae* Oberd. 1957 (SenSamb).

Supplement S16. Vegetation table of relevés of *Galium saxatile-Agrostis capillaris* community (GalAgrC) and *Agrostis capillaris-Luzula luzuloides* community (AgrLuzC).

Beilage S16. Vegetationstabelle von Aufnahmen der *Galium saxatile-Agrostis capillaris*- (GalAgrC) und der *Agrostis capillaris-Luzula luzuloides*-Gesellschaft (AgrLuzC).

Additional supporting information may be found in the online version of this article.

Zusätzliche unterstützende Information ist in der Online-Version dieses Artikels zu finden.

Supplement E1. Abbreviation and full species name of species in PSI records.

Anhang E1. Abkürzung und ausgeschriebene Namen der Arten in den PSI-Stichproben.

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Supplement S1. Synoptic table of vegetation units of the *Luzulo-Fagetum* Meusel 1937 in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, negatively differentiating ones in red.

Beilage S1. Übersichtstabelle der Vegetationseinheiten des *Luzulo-Fagetum* Meusel 1937 im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, negativ differenzierende rot hinterlegt.

		1	**2**	**3**	**4**	**5**
		LuzFag1	**LuzFag2**	**LuzFag3**	**LuzFag4**	**LuzFag5**
Number of relevés		8	12	21	61	126
Species richness						
Average		22.4	21.3	12.4	9.4	4.4
Standard deviation		6	2.9	5.2	3.1	2.7
Minimum		13	15	4	5	1
Maximum		31	25	24	17	12
EIV L		5.3	4.7	4.4	3.8	3.9
EIV M		5.1	5.3	5	5.2	5.1
EIV R		3.6	4.8	4.9	4.1	3.6
EIV N		4.5	5.8	5.2	5.2	4.1
Tree layer total		70	74.6	87.1	86.8	92
Shrub layer 1		3.6	8	2.9	8.2	1.8
Shrub layer 2		1.9	3.4	1.6	2.9	0.2
Herb layer		16.1	18.8	9.6	4.7	0.6
Moss layer		2.8	1.3	2.9	0.7	0.4
Tree layer						
Fagus sylvatica	T1	100	100	100	98	99
Fagus sylvatica	T2	25	*8*	**48**	**62**	**60**
Quercus petraea	T1	*25*	*17*	**76**	*8*	*17*
Carpinus betulus	T2	*0*	**25**	5	*0*	6
Picea abies	T1	*0*	**25**	5	13	9
Shrub layer						
Fagus sylvatica	S1	63	33	62	52	33
Fagus sylvatica	S2	**63**	**92**	**57**	**85**	*9*
Picea abies	S2	**50**	*8*	*0*	*10*	*1*
Picea abies	S1	**38**	*0*	*0*	*8*	*2*
Cytisus scoparius	S1	**25**	*0*	*0*	*0*	*0*
Sorbus aucuparia	S2	**25**	**33**	10	*3*	*0*
Cytisus scoparius	S2	**25**	*0*	*0*	*0*	*0*
Betula pendula	S1	**25**	8	*0*	*0*	*0*
Carpinus betulus	S2	13	**42**	*10*	*0*	*0*
Corylus avellana	S2	*0*	**33**	*0*	*2*	*0*
Carpinus betulus	S1	*0*	**25**	5	*2*	*1*
Corylus avellana	S1	*0*	**25**	10	*2*	6
Herb layer						
D 1						
Deschampsia flexuosa	H	**100**	*17*	*19*	*18*	*6*
Carex pilulifera	H	**88**	*8*	*5*	*10*	*0*
Vaccinium myrtillus	H	**75**	*0*	*5*	*2*	*2*
Cytisus scoparius	H	**63**	*8*	*19*	*0*	*5*
Agrostis capillaris	H	**63**	33	*14*	*13*	*1*
Acer pseudoplatanus	H	**63**	50	48	33	*20*
Calluna vulgaris	H	**50**	*0*	*0*	*0*	*0*
Mycelis muralis	H	**38**	17	10	*7*	*0*
Galeopsis tetrahit	H	**38**	25	14	*7*	10
Hypericum pulchrum	H	**38**	17	*5*	*2*	*2*
Viola riviniana	H	**25**	*0*	10	*2*	4
Pseudotsuga menziesii	H	**25**	8	5	7	*1*
Crataegus monogyna	H	**25**	*0*	5	*0*	3
Populus tremula	H	**25**	*0*	*0*	*0*	*0*
Holcus mollis	H	**25**	*0*	10	*0*	*0*
Malus sylvestris agg.	H	**25**	*0*	10	*2*	*0*
Betula pendula	H	**25**	*0*	*0*	*0*	*1*
Galium saxatile	H	**25**	*0*	5	3	*1*
D 1, 2						
Rubus idaeus	H	**100**	**100**	*14*	*26*	*3*
Sorbus aucuparia	H	**88**	**75**	38	*18*	*9*
Digitalis purpurea	H	**63**	**50**	*5*	*5*	*2*
Senecio ovatus	H	**50**	**50**	19	*10*	*2*
Dryopteris dilatata	H	**38**	**67**	*10*	*11*	*4*
Urtica dioica	H	**25**	**25**	5	3	*1*
D 1, 3						
Quercus petraea	H	**75**	*17*	**62**	*8*	*11*
Teucrium scorodonia	H	**50**	17	**24**	*2*	*0*
D 1, 2, 4						
Picea abies	H	**88**	**42**	*14*	**38**	*2*
D 2						
Dryopteris carthusiana	H	38	**92**	*14*	41	*25*
Athyrium filix-femina	H	*13*	**92**	*10*	*25*	*5*
Dryopteris filix-mas	H	*25*	**83**	*29*	*18*	*13*
Moehringia trinervia	H	*0*	**58**	24	*2*	*6*
Scrophularia nodosa	H	*0*	**50**	*10*	*2*	*0*
Sambucus racemosa	H	*0*	**33**	*0*	*0*	*1*
Epilobium montanum	H	*0*	**25**	*0*	5	*0*
Stellaria holostea	H	13	**25**	19	*2*	*1*
Stachys sylvatica	H	*0*	**25**	5	*0*	*0*
Lamium galeobdolon agg.	H	*0*	**25**	5	*2*	*2*
D 2, 3						
Prunus avium	H	25	**50**	**57**	*8*	21
D 3						
Carpinus betulus	H	25	17	**48**	*5*	*5*
D 2,4						
Milium effusum	H	*0*	**50**	19	**33**	*6*
Oxalis acetosella	H	25	**42**	*14*	**61**	*6*
D 2-4						
Poa nemoralis	H	25	**42**	**62**	**34**	*6*
D 1-4						
Fagus sylvatica	H	**100**	**92**	**90**	**93**	*33*
Rubus fruticosus agg.	H	**63**	**75**	**100**	**67**	*10*
D 1, 4						
Luzula luzuloides	H	**100**	67	38	**90**	*17*
D 2-5						
Festuca altissima	H	*0*	**42**	**57**	**70**	**22**
Constant species (>20% frequency)						
Fraxinus excelsior	H	13	25	14	15	6

Supplement S2. Vegetation table of the *Galio odorati-Fagetum* Sougnez et Thill 1959 in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S2. Vegetationstabelle des *Galio odorati-Fagetum* Sougnez et Thill 1959 im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1	**2**							**3**										**4**
		GalFag1	**GalFag2**							**GalFag3**										**GalFag4**
Number of samples		1	7							10										1
Species richness																				
Average		30	13.1							16.4										33
Standard deviation		-	5.9							6.7										-
Minimum		30	5							9										33
Maximum		30	21							28										33
EIV L		4.4	4							4.2										5.1
EIV M		6.2	5.1							5.1										5.4
EIV R		6	5.7							5.1										4.5
EIVN		6.5	5.7							5.4										4.5
Tree layer total		60	89.9							88										40
Shrub layer 1		5	0.7							1.2										0
Shrub layer 2		0.5	1.2							1										0.5
Herb layer		60	21.4							8.4										80
Moss layer		0.5	0.6							2.4										0.5
PSI No.		1690	1702	1605	1696	1757	1564	1508	1478	1592	1211	1725	1693	1501	1259	1575	1296	1507	1704	1375
Tree layer																				
Fagus sylvatica	T1	55	30	75	75	70	65	90	100	40	50	60	40	75	90	75	.	90	45	25
Fagus sylvatica	T2	.	.	r	.	.	3	.	15	15	9	.	25	.	.	1	95	5	.	.
Carpinus betulus	T2	10	20	.	45	.	1	.	.	.	.	15	5	.	.	.	.	.	.	.
Quercus petraea	T1	.	50	.	25	20	5	.	.	50		30	30	.	.	.	.	.	55	15
Fraxinus excelsior	T1	.	.	.	.	.	.	.	.	.	55	.	.	.	.	.	.	.	.	.
Betula pendula	T1	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	5	.	.	.
Prunus avium	T1	.	.	.	.	.	25	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus betulus	T1	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer pseudoplatanus	T1	15	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Shrub layer																				
Corylus avellana	S1	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus betulus	S1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Acer pseudoplatanus	S1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fagus sylvatica	S2	.	.	5	.	0.5	0.5	2	.	.	1	2	.	.	.	.	2	4	.	+
Fagus sylvatica	S1	r	.	1	.	.	.	1	.	.	3	2	.	.	.	.	3	3	.	.
Carpinus betulus	S2	.	.	.	.	+	r	.	.	.	.	0.5	.	.	.	.	.	r	.	.
Sambucus nigra	S1	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ilex aquifolium	S2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Herb layer																				
DS against Luzulo-Fag.																				
Melica uniflora	H	.	65	1	0.5	0.5	0.5	0.5	.	.	.	10	0.5	.	.	.	.	0.5	0.5	.
Carex sylvatica	H	r	.	+	.	.	+	.	.	0.5	.	.	4	.	.	+	.	.	.	.
Galium odoratum	H	.	.	2	.	.	.	0.5	.	0.5	.	.	.	.	.	.	0.5	+	.	.
Anemone nemorosa	H	.	1	.	1	0.5	.	.	0.5	.	.	.	0.5	.	.	.	.	.	0.5	0.5
Lamium galeobdolon agg.	H	0.5	+	.	.	.	.	0.5	r	.	0.5	+	.	.	.	.	.	.	.	.
Hordelymus europaeus	H	.	.	0.5	.	.	.	0.5	.	.	.	.	.	.	r	+	.	.	.	.
Viola reichenbachiana	H	.	0.5	.	.	.	.	+	.	0.5	.	.	+	0.5	0.5	.	0.5	.	.	0.5
Mycelis muralis	H	.	.	.	.	r	.	.	.	0.5	+	.	.	+	.	.	.	.	.	.
DS Galio-F. luzuletosum																				
Luzula luzuloides	H	.	.	.	.	.	.	.	.	5	2	2	0.5	2	0.5	0.5	0.5	1	0.5	.
DS G.-F. circaeetosum																				
Impatiens noli-tangere	H	40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chrysosplenium oppositifolium	H	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Circaea lutetiana	H	0.5	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex remota	H	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Urtica dioica	H	7	.	0.5	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.
Veronica montana	H	0.5	.	r	.	.	.	.	.	+	.	.	.	r	.	.	.	.	.	.
DS G.-F. typicum																				
Pteridium aquilinum	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75
Constant species																				
Rubus fruticosus agg.	H	0.5	10	30	.	2	0.5	2	.	1	0.5	20	0.5		+	0.5	+	0.5	5	0.5
Fagus sylvatica	H	+	+	5	0.5	0.5	.	5	.	0.5	.	0.5	0.5	0.5	1	0.5	0.5	4	r	0.5
Carpinus betulus	H	0.5	0.5	.	r	r	.	.	.	r	+	0.5	0.5	.	.	.	r	.	r	+
Prunus avium	H	.	r	.	r	+	0.5	r	.	+	0.5	+	.	.	.	.	.	.	r	.
Quercus petraea	H	.	+	.	0.5	+	.	.	.	0.5	.	+	0.5	.	.	.	.	+	0.5	+
Oxalis acetosella	H	0.5	.	.	.	.	.	.	.	1	0.5	.	.	+	0.5	.	0.5	.	.	0.5
Festuca altissima	H	.	.	1	.	+	.	0.5	.	.	1	.	0.5	.	0.5	.	.	0.5	.	.
Milium effusum	H	.	+	2	0.5	+	.	0.5	+	.	.	+	+	+	0.5	.	.	0.5	0.5	+
Poa nemoralis	H	0.5	.	2	+	+	.	.	.	0.5	0.5	.	+	0.5	0.5	.	.	0.5	.	.
Dryopteris carthusiana	H	.	.	.	.	.	.	.	.	.	0.5	r	+	.	.	.	0.5	r	r	+
Moehringia trinervia	H	.	.	0.5	.	.	.	.	.	.	0.5	.	+	.	.	.	.	.	.	0.5
Rubus idaeus	H	.	.	0.5	.	.	.	0.5	.	+	.	.	.	.	.	.	+	0.5	.	0.5
Senecio ovatus	H	+	.	r	.	.	.	r	.	.	r	.	0.5	.	.	.	.	.	.	r
Dryopteris filix-mas	H	+	.	.	.	.	1	r	.	.	10	1	.	.	.	.	r	.	.	.
Galeopsis tetrahit	H	.	.	r	.	.	.	.	.	0.5	0.5	+	r	.	.	.	.	.	.	.
Fraxinus excelsior	H	.	.	.	.	r	.	r	.	r	.	.	.	+	.	0.5	.	.	.	.
Galium aparine agg.	H	0.5	0.5	+	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.
Acer pseudoplatanus	H	1	.	.	.	.	.	+	0.5	.	1	.	.	.	.	r	.	.	.	.
Athyrium filix-femina	H	3	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	r	.	.	r
Geranium robertianum	H	0.5	0.5	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.
Geum urbanum	H	0.5	0.5	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Agrostis capillaris	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	+	.	0.5
Dactylis glomerata	H	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	.	+	.	.	r
Luzula sylvatica	H	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
Rumex sanguineus	H	r	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.
Dryopteris dilatata	H	r	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.
Holcus mollis	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Deschampsia cespitosa	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Alliaria petiolata	H	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardamine flexuosa	H	0.5	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex pilulifera	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	+	.	.
Epilobium montanum	H	.	.	.	.	.	.	.	.	+	0.5	.	.	.	.	.	.	.	.	.
Lonicera periclymenum	H	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
Ajuga reptans	H	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5
Stellaria holostea	H	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.	.
Picea abies	H	.	.	.	.	.	.	.	.	+	.	r	.	+	.	.	.	r	.	.
Betula pendula	H	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	.	.
Vaccinium myrtillus	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+
Teucrium scorodonia	H	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+

Other species (< 1 occurrence and ≤ 1 % cover)

S1: Carpinus betulus 1725: r; Quercus petraea 1725: r

S2: Crataegus laevigata 1690: r; Ilex aquifolium 1757 r; Picea abies 1375: r; Rosa canina 1507: r

H: Ranunculus ficaria 1690: r; Cardamine amara 1690: r; Veronica beccabunga 1690: r; Hedera helix 1757: r; Potentilla sterilis 1375: r; Holcus mollis 1375: r; Taraxacum spec. 1375: r; Lathyrus linifolius 1375: r; Lysimachia nummularia 1375: r; Lysimachia vulgaris 1375: r; Prunus spinosa 1375: r; Deschampsia cespitosa 1375: r; Euphorbia amygdaloides 1375: r; Campanula rotundifolia 1375: r; Molinia caerulea 1375: r; Elymus caninus 1605: r; Pseudotsuga menziesii 1508: r; Dactylis spec. 1605: r; Sorbus aucuparia 1508: r; Sambucus racemosa 1605: r; Vicia sepium 1592: r; Quercus rubra 1575: r; Galium album 1507: r; Rosa canina 1507: r; Prunella vulgaris 1592: r; Lapsana communis 1592: r; Rumex obtusifolius 1592: r; Stellaria media agg. 1592: r; Viola riviniana 1211: r; Holcus lanatus 1296: r; Digitalis purpurea 1296: r; Acer platanoides 1211: r; Polygonatum verticillatum 1211: r; Carex muricata agg. 1259: r; Hypericum pulchrum 1693: r; Malus sylvestris agg. 1259: r; Fragaria vesca 1592: r; Scrophularia nodosa 1725: r

Supplement S3. Vegetation table of the *Mercuriali perennis-Fraxinetum excelsioris* (Klika 1942) Husová in Moravec et al. 1982 (MercFrax) and the *Deschampsio cespitosae-Aceretum* Bohn 1984 (DesAcer) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S3. Vegetationstabelle des *Mercuriali perennis-Fraxinetum excelsioris* (Klika 1942) Husová in Moravec et al. 1982 (MercFrax) und des *Deschampsio cespitosae-Aceretum* Bohn 1984 (DesAcer) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1									2									
		MercFrax									DesAcer									
Number of samples		9									10									
Species richness																				
Average		30.4									16.9									
Standard deviation		6.3									5.1									
Minimum		21									9									
Maximum		37									25									
EIV L		4.9									4.3									
EIV M		5.3									5.4									
EIV R		6.2									5.1									
EIV N		6.3									5.8									
Tree layer total		76.1									84.5									
Shrub layer 1		11									4.5									
Shrub layer 2		0.4									0.5									
Herb layer		34.4									12.3									
Moss layer		4.9									5.4									
PSI-No.		1350	932	1582	1719	1715	1026	1474	911	1031	1230	1030	859	5	1698	1583	1456	1450	1742	902
Tree layer																				
Acer pseudoplatanus	T1	.	.	.	.	90	10	90	25	75	90	20	85	45	85	80	90	80	85	45
Fraxinus excelsior	T1	65	20	80	75	.	50	.	30	1	.	.	.	.	.	.	.	.	.	2
Quercus petraea	T1	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.
Acer campestre	T2	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.	.
Sorbus torminalis	T1	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.
Acer pseudoplatanus	T2	.	.	.	5	.	.	.	.	4	.	30	.	.	3	15	10	15	.	.
Carpinus betulus	T1	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	40
Tilia cordata	T2	.	.	.	.	.	.	.	.	.	.	.	.	.	10	10	.	.	.	.
Carpinus betulus	T2	.	.	.	2	.	.	.	.	10	.	.	.	.	5	.	.	.	.	25
Fagus sylvatica	T2	.	.	15	.	.	5	.	.	.	.	.	.	.	5	.	10	.	.	.
Populus tremula	T2	.	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sambucus nigra	T2	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus aucuparia	T2	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
Tilia cordata	T1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Prunus avium	T1	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alnus incana	T2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Fagus sylvatica	T1	.	.	.	.	.	5	.	.	.	.	25	.	.	.	.	.	.	.	.
Picea abies	T1	3	.	.	.	.	.	.	.	.	.	.	.	25	.	.	.	.	.	.
Shrub layer																				
Corylus avellana	S1	.	10	2	2	.	15	.	6	.	.	15	.	.	.	.	.	.	4	8
Crataegus monogyna	S1	.	50	.	6	.	1	.	.	1	.	.	1	.	.	.	.	.	.	.
Fraxinus excelsior	S2	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	.
Fagus sylvatica	S2	.	.	.	r	.	r	.	.	.	.	.	.	1	r	.	.	.	+	.
Crataegus monogyna	S2	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer pseudoplatanus	S1	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fagus sylvatica	S1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	r	6
Carpinus betulus	S1	.	.	.	.	.	.	.	.	.	.	.	.	.	r	2	.	.	.	.
Carpinus betulus	S2	.	+	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	+	.
Crataegus laevigata	S1	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Acer pseudoplatanus	S2	.	.	.	.	.	.	.	r	.	.	.	.	.	.	+	.	+	.	.
Herb layer																				
Urtica dioica	H	0.5	0.5	+	+	0.5	+	0.5	+	2	.	r	.	.	.	.	.	.	.	.
Geranium robertianum	H	10	3	0.5	.	0.5	0.5	+	0.5	0.5	.	.	.	.	.	.	.	.	.	.
Galium aparine	H	r	1	0.5	0.5	+	+	r	.	.	.	.	.	.	.	.	.	.	.	.
Geum urbanum	H	1	0.5	.	0.5	0.5	0.5	0.5	.	0.5	.	.	.	.	.	.	.	.	.	.
Fraxinus excelsior	H	r	6	0.5	15	0.5	0.5	.	+	0.5	.	.	+	.	+	1	.	+	0.5	.
Viola reichenbachiana	H	0.5	.	0.5	0.5	+	0.5	0.5	.	.	0.5	.	.	.	+	.	.	.	0.5	.
Alliaria petiolata	H	2	.	.	0.5	3	+	0.5	2	0.5	.	.	.	.	.	.	.	.	.	.
Melica uniflora	H	1	.	0.5	45	+	.	.	2	.	.	.	.	.	.	.	.	.	1	.
Epilobium montanum	H	r	.	0.5	.	.	0.5	.	.	+	.	.	.	.	.	r	.	.	.	.
Poa trivialis	H	.	0.5	.	.	0.5	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.
Viola riviniana	H	.	2	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	1	.	.
Glechoma hederacea	H	8	.	.	0.5	0.5	.	.	.	.	.	.	20	.	.	.	.	.	.	.
Taraxacum spec.	H	r	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.
Torilis japonica	H	2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mycelis muralis	H	1	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	H	+	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardamine impatiens	H	r	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dactylis glomerata	H	.	0.5	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Stellaria media agg.	H	0.5	.	.	.	+	0.5	0.5	.	.	.	.	.	0.5	.	.	.	.	.	.
Ajuga reptans	H	+	.	.	.	+	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.
Crataegus monogyna	H	1	1	.	.	.	+	.	.	r	.	.	.	.	.	.	.	.	.	.
Sambucus nigra	H	.	+	.	.	r	.	+	r	.	.	.	.	.	.	.	.	.	.	.
Corylus avellana	H	.	+	.	+	r	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Fragaria vesca	H	+	.	.	.	r	+	.	.	.	.	.	.	.	.	.	.	+	.	.
Carex sylvatica	H	1	r	.	r	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Acer pseudoplatanus	H	.	0.5	r	+	1	1	+	+	r	0.5	0.5	0.5	0.5	0.5	0.5	+	.	0.5	.
Rubus fruticosus agg.	H	0.5	10	+	1	.	4	0.5	1	3	2	+	.	.	2	0.5	0.5	0.5	45	.
Poa nemoralis	H	1	0.5	0.5	.	.	0.5	.	0.5	0.5	0.5	.	0.5	.	r	.	+	2	0.5	.
Carpinus betulus	H	.	0.5	.	0.5	0.5	0.5	.	0.5	.	.	0.5	0.5	.	r	.	.	.	+	.
Stellaria holostea	H	0.5	.	.	0.5	2	.	.	0.5	.	0.5	.	0.5	.	.	.	.	.	0.5	.
Oxalis acetosella	H	.	.	.	0.5	0.5	2	+	.	.	0.5	0.5	.	.	0.5	0.5	.	.	.	0.5
Dryopteris filix-mas	H	+	.	30	r	3	7	.	.	2	.	1	0.5	.	4	1	r	.	0.5	.
Milium effusum	H	.	.	.	+	0.5	+	.	.	.	.	.	0.5	.	+	r	0.5	5	0.5	.
Lamium galeobdolon agg.	H	1	+	+	2	+	1	.	.	.	.	0.5	0.5	.	.	+	.	.	+	.
Senecio ovatus	H	.	3	+	.	0.5	+	+	.	0.5	0.5	.	1	.	+	.	.	+	4	.
Galeopsis tetrahit	H	.	0.5	+	.	.	+	r	+	0.5	.	.	.	+	.	.	.	.	0.5	.
Luzula luzuloides	H	0.5	.	.	.	.	.	+	.	.	0.5	.	.	2	0.5	+	+	0.5	+	.
Dryopteris carthusiana	H	.	.	.	.	.	+	.	.	r	r	+	r	0.5	.	.	.	.	r	0.5
Dryopteris dilatata	H	.	.	.	.	r	.	.	.	.	.	.	.	1	.	.	.	.	.	0.5
Moehringia trinervia	H	.	+	0.5	+	.	.	.	.	.	.	.	0.5	.	r	0.5	.	.	0.5	.
Prunus avium	H	.	.	.	r	+	+	.	.	.	.	.	.	.	0.5	0.5	.	.	r	.
Cynoglossum germanicum	H	0.5	.	.	.	.	.	0.5	.	.	.	.	.	.	.	.	.	0.5	.	.
Picea abies	H	.	.	.	.	.	.	.	.	.	0.5	.	.	0.5	.	.	.	0.5	.	.
Hordelymus europaeus	H	0.5	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	0.5	.	.
Rubus idaeus	H	.	1	.	.	.	+	.	.	.	.	.	.	0.5	.	+	.	.	r	.
Fagus sylvatica	H	.	.	.	+	+	0.5	.	.	.	.	0.5	.	.	+	.	r	r	+	.
Lapsana communis	H	.	.	.	.	.	.	.	0.5	+	.	.	.	.	.	+	.	+	.	.
Festuca altissima	H	.	.	4	.	.	.	+	.	.	.	.	.	.	.	1	+	2	.	.
Ranunculus ficaria	H	.	.	.	7	50	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.
Impatiens noli-tangere	H	.	.	.	.	6	5	.	.	.	.	.	0.5	.	.	.	.	.	.	.
Adoxa moschatellina	H	.	.	.	3	0.5	.	.	.	.	.	.	.	.	.	.	.	.	r	.
Anemone nemorosa	H	.	.	.	0.5	1	.	.	.	.	.	.	0.5	.	.	.	.	.	.	.
Ranunculus repens	H	.	0.5	.	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ulmus glabra	H	.	.	.	.	0.5	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.
Athyrium filix-femina	H	.	.	+	.	.	0.5	.	.	.	.	1	.	.	+	.	.	.	.	r
Stachys sylvatica	H	.	.	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus aucuparia	H	.	.	.	.	.	+	.	.	.	+	.	.	0.5	.	.	.	.	.	.
Quercus petraea	H	r	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	r	.
Vicia sepium	H	+	.	.	.	.	.	r	.	.	.	.	0.5	.	.	.	.	.	.	.
Cardamine flexuosa	H	.	.	r	.	.	.	.	.	+	.	.	.	r	.	.	.	.	.	.
Mercurialis perennis	H	.	.	15	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Deschampsia flexuosa	H	.	.	.	.	.	.	.	.	.	0.5	.	.	5	.	.	.	.	.	.
Agrostis capillaris	H	.	.	.	.	.	.	.	.	+	.	.	.	4	.	.	.	.	.	.
Vaccinium myrtillus	H	.	.	.	.	.	.	.	.	.	+	.	.	0.5	.	.	.	.	.	.
Polygonatum verticillatum	H	.	.	.	.	.	0.5	.	.	.	+	.	.	.	.	.	.	.	.	.
Valeriana procurrens	H	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa chaixii	H	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.	r	.	.	.
Juncus effusus	H	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.
Deschampsia cespitosa	H	.	.	.	.	.	r	.	.	.	.	.	.	+	.	.	.	.	.	.
Acer platanoides	H	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Digitalis purpurea	H	r	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Veronica montana	H	.	.	.	.	.	.	r	.	.	+	.	.	.	.	.	.	.	.	.
Pteridium aquilinum	H	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stellaria nemorum	H	.	.	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.

Other species (< 1 occurrence and ≤ 1 % cover)

T1: Prunus avium 1719: +; Sorbus aria 1031: r

T2: Alnus incana 1031: +

S1: Fraxinus excelsior 1030: r; Picea abies 1583: r

S2: Quercus spec. 1230: r; Ulmus glabra 1698: r; Corylus avellana 1742: r; Picea abies 1230: r; Daphne mezereum 1230: r; Rosa spec. 932: r; Sambucus nigra 932: r; Crataegus laevigata 911: r; Sorbus torminalis 911: r; Acer campestre 911: r; Prunus spinosa 932: r

H: Polystichum setiferum 902: r; Galium saxatile 5: r; Poa annua 5: r; Lysimachia nemorum 1230: r; Hypericum perforatum 5: r; Festuca rubra agg. 5: r; Luzula multiflora 5: r; Luzula sylvatica 1742: r; Hieracium laevigatum 5: r; Quercus rubra 1742: r; Galium odoratum 1742: r; Digitalis grandiflora 911: r; Teucrium scorodonia 932: r; Rosa arvensis 1715: r; Ranunculus auricomus agg. 1715: r; Rumex obtusifolius 1031: r; Cytisus scoparius 911: r; Acer campestre 911: r; Arum maculatum 1719: r; Pseudotsuga menziesii 1026: r; Polystichum aculeatum 1582: r; Hypericum humifusum 932: r; Primula veris 932: r; Convolvulus arvensis 911: r; Asplenium trichomanes 1031: r; Rosa canina 911: r; Potentilla sterilis 911: r; Circaea lutetiana 14: r; Brachypodium sylvaticum 3: r; Rumex sanguineus 4: r; Clinopodium vulgare 11: r; Carex muricata agg. 1032: r; Phyteuma nigrum 1715: r; Sorbus torminalis 911: r; Rosa spec. 911: r; Euphorbia amygdaloides 1350: r; Anthoxanthum odoratum 1031: r; Hypericum maculatum agg. 1350: r; Epilobium angustifolium 932: r; Crataegus laevigata 911: r; Filipendula ulmaria 1715: r; Polygonatum multiflorum 1719: r; Lathyrus spec. 911: r; Galium album 932: r; Convallaria majalis 911: r; Cirsium vulgare 932: r

Supplement S4. Synoptic table of vegetation units with dominance of *Quercus petraea* (LuzQuerc1/2 = *Luzulo-Quercetum petraeae* Hilitzer 1932; BetQuerc1 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; QuercRob1 = *Quercion roboris* Malcuit 1929; StelCarp1/2 = *Stellario-Carpinetum* Oberd. 1957) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, negatively differentiating ones in red.

Beilage S4. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Quercus petraea* (LuzQuerc1/2 = *Luzulo-Quercetum petraeae* Hilitzer 1932; BetQuerc1 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; QuercRob1 = *Quercion roboris* Malcuit 1929; StelCarp1/2 = *Stellario-Carpinetum* Oberd. 1957) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, negativ differenzierende rot hinterlegt.

		1	2	3	4	5	6
		LuzQuerc1	**BetQuerc1**	**QuercRob1**	**LuzQuerc2**	**StelCarp1**	**StelCarp2**
Number of samples		45	37	69	21	47	6
Species richness							
Average		14	15.2	9.9	23.9	13.8	28.5
Standard deviation		4.8	5.5	4.7	8.9	4.2	12.8
Minimum		7	6	3	13	8	13
Maximum		26	28	22	52	22	45
EIV L		5.5	5.2	4.9	5.6	4.6	5.3
EIV M		4.7	5.1	5	4.9	5.1	5.4
EIV R		3.5	3.6	4.5	5	5.1	5.3
EIV N		3.6	4	4.8	5	5.2	5.7
Tree layer total		73.6	77.4	85.4	73.6	81.9	69.2
Shrub layer 1		0.5	3.9	2.2	10.6	11	19.4
Shrub layer 2		0.2	1.4	0.4	0.6	0.9	1.8
Herb layer		9.2	26.4	12.5	26.9	22.4	40
Moss layer		12.9	5.8	1.4	4.2	0.5	0.8
Tree layer							
Quercus petraea	T1	98	92	92	90	94	67
Carpinus betulus	T2	*11*	*5*	**55**	*10*	**68**	*17*
Carpinus betulus	T1	*9*	*3*	**47**	29	**40**	**33**
Shrub layer							
Fagus sylvatica	S1	*7*	**35**	*7*	10	17	17
Picea abies	S2	*0*	**27**	*0*	*0*	*2*	*0*
Sorbus aucuparia	S2	*2*	**46**	*5*	*19*	*11*	**83**
Crataegus monogyna	S1	*2*	*0*	*3*	**29**	*2*	17
Crataegus monogyna	S2	*0*	3	7	**24**	6	*0*
Corylus avellana	S1	*0*	*8*	*8*	**38**	26	**67**
Carpinus betulus	S2	*2*	*3*	*3*	*10*	**40**	*0*
Carpinus betulus	S1	*2*	*3*	18	*0*	**36**	*0*
Corylus avellana	S2	*0*	8	*2*	14	**26**	**33**
Sorbus aucuparia	S1	*2*	*14*	*2*	*10*	*0*	**50**
Crataegus laevigata	S2	*2*	*0*	*0*	*0*	13	**33**
Fagus sylvatica	S2	13	38	17	14	32	33
Herb layer							
D 1							
Anthoxanthum odoratum Hypericum	H	**64**	14	*12*	29	*6*	*0*
pulchrum	H	**33**	*5*	*5*	10	*0*	17
Hieracium murorum	H	**29**	*0*	7	5	*0*	*0*
Veronica officinalis	H	**27**	5	*2*	19	*0*	*0*
D 1, 4, (6)							
Teucrium scorodonia	H	**91**	*19*	*8*	**76**	*6*	*17*
Cytisus scoparius	H	**78**	*14*	*10*	**71**	*6*	*0*
Quercus petraea	H	**96**	76	68	**95**	77	*33*
Agrostis capillaris	H	**49**	19	*7*	**33**	*4*	**33**
D 1,2, (4), (6)							
Picea abies	H	**42**	**35**	*5*	10	*6*	*0*
Sorbus aucuparia	H	**47**	**51**	*3*	**62**	*21*	**83**
D 2							
Vaccinium myrtillus	H	*29*	**86**	*5*	*14*	*13*	*17*
Dryopteris dilatata	H	*0*	**30**	*5*	*0*	13	17
Carex pilulifera	H	13	**30**	*2*	*5*	*4*	*0*
Pteridium aquilinum	H	*0*	**22**	*0*	5	*0*	*0*
D 1-4,6							
Deschampsia flexuosa	H	**93**	**81**	**32**	**57**	*4*	**33**
D 4,5							
Melica uniflora	H	*4*	*11*	28	**33**	**72**	*0*
D 4							
Crataegus monogyna	H	*2*	*5*	*8*	**62**	*4*	*17*
Fraxinus excelsior	H	*2*	*0*	10	**38**	*4*	17
Digitalis purpurea	H	13	*5*	8	**33**	*2*	*0*
Prunus spinosa	H	*4*	*3*	*0*	**33**	*0*	17
Viola riviniana	H	*2*	8	*2*	**24**	*2*	*0*
Poa chaixii	H	*0*	3	12	**24**	9	*0*
Stellaria holostea	H	*9*	*16*	*8*	**62**	32	33
Melampyrum pratense	H	24	27	7	**29**	*4*	17
Acer pseudoplatanus	H	*9*	19	27	**62**	43	33
D 4,6							
Poa nemoralis	H	*29*	*14*	*27*	**90**	36	**67**
Galeopsis tetrahit	H	*13*	*22*	*27*	**67**	43	**83**
Dactylis glomerata	H	*2*	*3*	*2*	**29**	*0*	**33**
Senecio ovatus	H	*2*	*5*	12	**29**	11	**50**
Lapsana communis	H	*0*	*0*	*2*	**24**	*0*	**50**
Viola reichenbachiana	H	*0*	*0*	7	**24**	*2*	**33**
D 1-5							
Luzula luzuloides	H	**56**	**46**	**40**	**29**	**21**	*0*
D 5							
Carpinus betulus	H	56	*16*	63	62	**87**	33
Dryopteris filix-mas	H	*9*	*11*	*8*	24	**47**	17
Anemone nemorosa	H	*2*	*14*	22	*10*	**64**	33
Festuca altissima	H	7	14	15	14	**28**	*0*
D (2),5,6							
Milium effusum	H	*4*	*5*	*7*	19	**64**	**50**
Dryopteris carthusiana	H	*11*	**59**	*3*	*19*	**51**	**67**
D 6							
Geum urbanum	H	*2*	*3*	*0*	*14*	*2*	**83**
Alliaria petiolata	H	*0*	*0*	*7*	*19*	*6*	**83**
Oxalis acetosella	H	*0*	*14*	*2*	*10*	*13*	**67**
Urtica dioica	H	*0*	*5*	*3*	*19*	*11*	**67**
Moehringia trinervia	H	*7*	*11*	*12*	*10*	*11*	**67**
Geranium robertianum	H	*0*	*3*	*2*	*5*	*0*	**50**
Viburnum opulus	H	*0*	*0*	*0*	*0*	*0*	**33**
Glechoma hederacea	H	*0*	*0*	*2*	*0*	*0*	**33**
Ranunculus repens	H	*0*	*0*	*0*	10	*0*	**33**
Epilobium montanum	H	*2*	*5*	*2*	14	*0*	**33**
Cardamine impatiens	H	*0*	*0*	*2*	*0*	*0*	**33**
Stachys sylvatica	H	*0*	*0*	*0*	*0*	*2*	**33**
Galium aparine	H	*0*	*3*	*2*	10	13	**33**
Poa trivialis	H	*0*	*3*	*0*	*5*	*0*	**33**
Ajuga reptans	H	*0*	*0*	*0*	*5*	*0*	**33**
Athyrium filix-femina	H	*2*	14	*3*	10	17	**33**
Rubus idaeus	H	*11*	41	*10*	33	*17*	**67**
Fagus sylvatica	H	53	49	*17*	38	32	**67**
Constant species (>20% frequency)							
Rubus fruticosus agg.	H	53	86	62	67	96	67
Prunus avium	H	31	22	25	62	47	33
Holcus mollis	H	20	16	12	38	13	17
Lonicera periclymenum	H	20	24	27	29	23	33

Supplement S5. Vegetation table of vegetation units with dominance of *Quercus robur* (QuercRob2 = *Quercion roboris* Malcuit 1929; BetQuerc2 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; CarpBet = *Carpinion betuli* Issler 1931; GalCarp = *Galio-Carpinetum* Oberd. 1957) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S5. Vegetationstabelle der Aufnahmen mit Dominanz von *Quercus robur* (QuercRob2 = *Quercion roboris* Malcuit 1929; BetQuerc2 = *Betulo pendulae-Quercetum roboris* Tx. 1930 nom. invers. propos.; CarpBet = *Carpinion betuli* Issler 1931; GalCarp = *Galio-Carpinetum* Oberd. 1957) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1									**2**						**3**				**4**
		QuercRob2									**BetQuerc2**						**CarpBet**				**GalCarp**
Number of samples		9									6						4				1
Species richness																					
Average		11.2									21.8						20				34
Standard deviation		4.3									8						3.5				-
Minimum		3									13						15				34
Maximum		18									36						23				34
EIV L		4.5									5.7						4.7				4.2
EIV M		5.1									5						5.2				5.4
EIV R		4									4						4.9				6.1
EIV N		5									4.5						5.8				6.3
Tree layer total		74.4									85.8						88.8				85
Shrub layer 1		10.5									3.8						2.9				60
Shrub layer 2		2.7									2.3						0.5				2
Herb layer		21.2									39.8						12.5				10
Moss layer		0.6									10.8						0.6				0
PSI-No.		1071	1139	311	1612	1554	1611	1249	1120	1070	1103	811	243	772	270	308	828	873	1391	1102	1115
Tree layer																					
Quercus robur	T1	50	45	60	50	60	40	55	70	40	20	70	85	45	90	85	45	65	45	70	45
Fagus sylvatica	T1	15	45	10	40	.	+	.	2	.	.	.	.	.	.	.	.	.	40	.	50
Fagus sylvatica	T2	.	15	90	10	.	.	60	.	7	.	.	.	.	.	.	20	.	25	4	10
Quercus petraea	T1	10	.	.	15	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.
Carpinus betulus	T2	.	.	.	.	.	.	15	5	8	.	.	.	.	.	.	.	25	.	.	.
Corylus avellana	T2	.	9	.	.	.	.	.	.	.	7	.	.	.	.	.	.	.	.	75	.
Picea abies	T1	.	.	.	.	.	.	.	.	10	.	25	.	.	.	.	25	.	.	.	.
Carpinus betulus	T1	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	7	.	.	.
Betula pendula	T1	.	.	.	.	.	.	.	5	.	10	.	.	.	.	.	.	.	.	.	.
Quercus x rosacea	T1	.	.	.	.	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.
Crataegus monogyna	T2	.	.	.	.	.	.	.	.	.	50	.	.	.	.	.	.	.	.	.	.
Pyrus spec.	T2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Shrub layer																					
Sorbus aucuparia	S1	.	.	.	.	.	.	.	2	r	.	.	r	.	.	.	.	.	.	.	.
Sorbus aucuparia	S2	.	.	.	.	.	r	.	.	r	r	r	.	.	0.5	.	0.5	0.5	.	.	.
Picea abies	S2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
Acer pseudoplatanus	S2	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.
Corylus avellana	S2	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	r	.	.	.
Carpinus betulus	S1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	r	.	1
Corylus avellana	S1	50	10	.	.	.	.	.	.	2	.	.	.	.	.	.	.	8	.	1	60
Carpinus betulus	S2	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	0.5	.	.	r
Crataegus laevigata	S1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Fagus sylvatica	S1	.	.	.	+	5	20	.	5	.	.	.	.	.	.	.	.	.	.	.	2
Fagus sylvatica	S2	.	.	.	1	20	2	1	.	.	.	.	.	.	+	0.5	.	.	.	.	2
Crataegus monogyna	S1	.	.	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.	.	.	.
Crataegus monogyna	S2	.	.	.	.	.	.	.	.	.	5	+	.	.	.	.	.	.	.	.	.
Cytisus scoparius	S2	.	.	.	.	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	.
Frangula alnus	S1	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	S2	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Prunus spinosa	S1	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.
Herb layer																					
Agrostis capillaris	H	.	.	.	.	.	.	.	.	.	5	2	+	0.5	0.5	0.5	.	.	.	.	.
Deschampsia flexuosa	H	.	.	.	.	.	.	.	.	.	1	4	1	2	0.5	5	.	.	.	.	.
Holcus mollis	H	.	.	.	.	.	.	.	.	.	.	1	0.5	3	.	15	.	.	.	.	.
Galium saxatile	H	.	.	.	.	.	.	.	.	.	.	.	+	+	0.5	0.5	.	.	.	.	.
Vaccinium myrtillus	H	.	.	.	.	.	.	.	.	.	.	.	0.5	.	1	0.5	.	.	.	.	.
Prunus avium	H	.	0.5	.	.	.	.	.	.	.	+	+	.	+	.	r	.	+	.	+	.
Moehringia trinervia	H	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	.	0.5	.	.	+	.	.
Dryopteris dilatata	H	.	.	.	.	.	.	.	.	.	r	.	0.5	.	.	r	1	.	.	.	.
Mycelis muralis	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.
Viola riviniana	H	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	r	.	r	.	.	.
Melica uniflora	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	0.5	.	0.5	0.5
Lamium galeobdolon agg.	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	0.5	2
Polygonatum verticillatum	H	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	0.5	.	.	r
Anemone nemorosa	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.5	0.5	.	.	0.5
Sambucus spec.	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	0.5	.	r
Athyrium filix-femina	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	0.5
Mercurialis perennis	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Prunus spinosa	H	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	r
Glechoma hederacea	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4
Epilobium montanum	H	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.	r
Galium aparine	H	.	.	.	.	.	0.5	.	.	.	0.5	.	.	.	.	.	.	.	.	.	.
Dactylis glomerata	H	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
Crataegus monogyna	H	.	.	.	.	.	.	.	.	.	2	+	.	.	.	.	.	.	.	.	.
Cytisus scoparius	H	.	.	.	.	.	.	.	.	.	+	.	.	0.5	.	.	.	.	.	.	.
Urtica dioica	H	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+
Carex remota	H	.	.	.	+	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poa chaixii	H	0.5	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula sylvatica	H	.	.	.	0.5	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula luzuloides	H	.	.	.	+	.	1	.	.	0.5	.	.	0.5	.	3	45	.	.	.	.	.
Teucrium scorodonia	H	.	.	.	r	.	1	.	.	.	.	0.5	.	1	.	.	.	.	.	.	.
Milium effusum	H	.	.	.	.	0.5	1	0.5	.	.	.	.	.	.	.	.	0.5	.	.	.	.
Quercus spec.	H	.	r	.	.	.	.	r	.	.	.	.	.	+	.	.	.	.	.	+	.
Lonicera periclymenum	H	.	.	.	.	.	3	.	.	1	.	.	.	.	.	.	.	.	.	r	.
Impatiens noli-tangere	H	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Sorbus aucuparia	H	0.5	r	.	.	.	r	.	.	0.5	+	1	+	.	0.5	+	0.5	0.5	+	+	.
Carpinus betulus	H	r	.	.	.	.	.	0.5	.	+	.	.	.	1	.	.	.	0.5	.	r	0.5
Quercus robur	H	r	.	.	r	.	r	.	.	.	0.5	+	.	.	.	+	.	+	.	.	.
Festuca altissima	H	0.5	.	.	.	+	.	.	.	0.5	.	.	.	.	.	+	.	.	3	.	r
Corylus avellana	H	r	0.5	r	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	0.5
Picea abies	H	.	r	.	.	.	.	.	.	+	.	0.5	+	r	0.5	0.5	+	+	.	.	.
Dryopteris carthusiana	H	1	.	.	.	.	.	.	.	+	1	0.5	1	.	0.5	+	0.5	+	.	1	.
Senecio ovatus	H	.	.	.	.	.	.	.	.	.	0.5	+	.	.	0.5	.	.	0.5	r	0.5	.
Digitalis purpurea	H	.	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	1	.	.
Dryopteris filix-mas	H	.	.	.	.	.	r	.	.	.	1	.	.	.	.	.	.	+	7	1	0.5
Fagus sylvatica	H	+	0.5	0.5	2	1	+	0.5	r	r	r	.	.	r	+	.	.	.	.	0.5	0.5
Acer pseudoplatanus	H	+	0.5	.	.	r	.	.	.	r	.	.	.	.	.	.	0.5	0.5	r	2	0.5
Rubus idaeus	H	0.5	.	.	+	30	4	.	.	.	0.5	.	.	.	65	2	.	.	+	r	.
Oxalis acetosella	H	.	.	.	.	2	3	.	.	.	.	.	.	.	20	0.5	8	0.5	1	.	0.5
Galeopsis tetrahit	H	.	.	.	.	.	+	.	.	.	0.5	0.5	r	0.5	0.5	0.5	+	+	0.5	0.5	r
Stellaria holostea	H	.	.	.	.	.	.	.	.	.	1	.	.	0.5	.	.	.	0.5	.	0.5	0.5
Rubus fruticosus agg.	H	8	0.5	.	3	50	65	0.5	0.5	10	25	15	0.5	+	+	+	7	8	1	0.5	0.5
Poa nemoralis	H	.	+	.	+	+	0.5	0.5	+	0.5	1	5	.	.	.	.	.	.	0.5	.	.

Other species (< 1 occurrence and ≤ 1 % cover)

T1: Acer pseudoplatanus 1249: r; Fraxinus excelsior 1071: r; Sorbus aucuparia 243: r

S1: Picea abies 828: r; Crataegus laevigata 1115: r; Cytisus scoparius 1103: r; Rosa spec. 1103: r; Frangula alnus 1103: +

S2: Sorbus aria 873: r; Sambucus racemosa 1391: r; Daphne mezereum 1115: r; Frangula alnus 1103: r; Quercus spec. 772: r; Quercus robur 1103: r; Rosa spec. 1103: r

H: Polygonatum multiflorum 1102: r; Fraxinus excelsior 1391: r; Sambucus nigra 1102: r; Hedera helix 873: r; Arum maculatum 1115: r; Paris quadrifolia 1115: r; Acer campestre 1115: r; Mercurialis perennis 1115: +; Cardamine flexuosa 1115: r; Galium odoratum 1115: r; Festuca rubra agg. 1103: r; Stellaria media agg. 1071: r; Cardamine impatiens 1115: r; Impatiens parviflora 1115: r; Geranium robertianum 1115: r; Geum urbanum 1103: r; Anthoxanthum odoratum 811: r; Alliaria petiolata 1115: r; Betula pendula 1103: r; Deschampsia cespitosa 270: r; Campanula rotundifolia 811: r; Potentilla erecta 1103: r; Clinopodium vulgare 1103: r; Malva moschata 1103: r; Pinus sylvestris 811: r; Sambucus racemosa 308: r; Scrophularia nodosa 1611: r; Crataegus laevigata 270: r; Veronica montana 1103: r; Luzula pilosa 1120: r; Carex sylvatica 1249: r; Rosa spec. 1103: r; Prunella vulgaris 1103: r; Poa pratensis 1103: r; Carex pilulifera 308: r; Torilis japonica 1103: r; Silene dioica 1103: r; Melampyrum pratense 772: r; Dactylis spec. 811: r; Carex muricata agg. 1612: r; Pseudotsuga menziesii 308: r; Hypericum perforatum 811: r; Calamagrostis arundinacea 308: r; Stellaria graminea 1103: r; Juncus effusus 1554: r; Brachypodium sylvaticum 1554: r

Supplement S6. Vegetation table of the *Carici remotae-Fraxinetum* W. Koch 1926 ex Faber 1937 (CarFrax) and the *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957 (StelAlne) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S6. Vegetationstabelle des *Carici remotae-Fraxinetum* W. Koch 1926 ex Faber 1937 (CarFrax) und des *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957 (StelAlne) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1		**2**			
		CarFrax		**StelAlne**			
Number of samples		2		4			
Species richness							
Average		52.5		32			
Standard deviation		0.7		9.1			
Minimum		52		24			
Maximum		53		44			
EIV L		5.3		5.3			
EIV M		6.4		5.7			
EIV R		6.1		6.1			
EIV N		6.3		6.3			
Tree layer total		90		85			
Shrub layer 1		1		8			
Shrub layer 2		3.5		2.6			
Herb layer		72.5		55.8			
Moss layer		27.5		3.9			
PSI-No.		768	771	489	789	854	1037
Tree layer							
Alnus glutinosa	T1	80	85	40	85	70	90
Alnus glutinosa	T2	.	.	.	.	.	.
Salix caprea	T1	.	.	50	.	5	.
Fraxinus excelsior	T1	.	.	.	.	10	.
Prunus avium	T1	.	.	.	.	.	6
Corylus avellana	T2	.	.	40	.	.	.
Fraxinus excelsior	T2	.	.	.	.	3	.
Carpinus betulus	T2	.	4	.	.	.	2
Picea abies	T1	15	.	.	.	1	.
Sorbus aucuparia	T2	.	7	.	.	.	.
Shrub layer							
Carpinus betulus	S2	1	0.5	.	.	.	.
Acer pseudoplatanus	S1	1	.	.	.	.	.
Fagus sylvatica	S2	2	.	.	.	.	.
Corylus avellana	S1	r	.	.	5	.	7
Corylus avellana	S2	+	.	.	0.5	.	.
Crataegus monogyna	S1	r	.	.	.	15	.
Sorbus aucuparia	S2	.	2	r	.	r	.
Acer pseudoplatanus	S2	3	.	.	r	.	.
Prunus spinosa	S2	.	.	0.5	r	2	.
Crataegus laevigata	S1	.	.	.	3	.	1
Crataegus monogyna	S2	.	.	.	.	5	.
Crataegus laevigata	S2	.	.	2	.	.	.
Prunus spinosa	S1	.	.	.	.	1	.
Carpinus betulus	S1	.	.	.	.	.	2
Frangula alnus	S2	.	.	.	.	.	.
Herb layer							
D 1							
Elymus caninus	H	0.5	0.5	.	.	.	.
Agrostis stolonifera	H	4	0.5	.	.	.	.
Dryopteris filix-mas	H	+	r	.	.	.	.
Circaea spec.	H	0.5	1	.	.	.	.
Lapsana communis	H	+	0.5	.	.	.	.
Bistorta officinalis	H	2	1	.	.	.	.
Glyceria fluitans agg.	H	2	.	.	.	.	.
Aegopodium podagraria	H	.	1	.	.	.	.
Lysimachia nemorum	H	0.5	+	.	.	.	2
Chrysosplenium oppositifolium	H	1	+	.	.	.	0.5
Persicaria hydropiper	H	0.5	0.5	.	.	.	0.5
D 1,2							
Geranium robertianum	H	0.5	2	6	0.5	+	r
Geum urbanum	H	0.5	0.5	4	0.5	r	0.5
Filipendula ulmaria	H	0.5	+	.	0.5	.	0.5
Ajuga reptans	H	0.5	5	2	1	.	0.5
Glechoma hederacea	H	1	20	0.5	2	0.5	2
Urtica dioica	H	0.5	20	70	.	r	0.5
Stachys sylvatica	H	+	0.5	0.5	1	.	+
Stellaria nemorum	H	10	60	.	20	.	+
Lamium galeobdolon agg.	H	1	2	.	0.5	.	0.5
Crataegus monogyna	H	+	r	.	.	0.5	.
Galium aparine	H	.	2	10	0.5	r	.
Silene dioica	H	1	0.5	0.5	0.5	.	.
Ranunculus repens	H	3	0.5	3	.	.	.
Impatiens noli-tangere	H	10	1	.	1	.	.
D 3							
Deschampsia flexuosa	H	.	.	.	.	.	0.5
Deschampsia cespitosa	H	.	.	.	7	.	.
Picea abies	H	0.5	.	.	.	.	.
Holcus lanatus	H	0.5	.	.	.	.	.
Galium palustre	H	2	.	.	.	.	.
Galium saxatile	H	.	.	.	.	.	.
Molinia caerulea	H	.	.	.	.	.	.
(presence in > 1 unit and cover ≥ 1 %)							
Senecio ovatus	H	3	10	1	6	15	0.5
Oxalis acetosella	H	5	0.5	0.5	0.5	.	3
Galeopsis tetrahit	H	.	3	+	0.5	0.5	r
Rubus fruticosus agg.	H	1	2	.	1	50	.
Athyrium filix-femina	H	2	2	.	r	.	1
Rubus idaeus	H	2	4	.	0.5	+	.
Alliaria petiolata	H	0.5	.	5	.	+	0.5
Epilobium montanum	H	+	.	+	.	+	r
Dryopteris dilatata	H	0.5	+	.	.	.	+
Acer pseudoplatanus	H	0.5	.	.	+	.	0.5
Stellaria holostea	H	0.5	.	.	0.5	.	0.5
Poa nemoralis	H	.	.	0.5	0.5	0.5	.
Sorbus aucuparia	H	.	+	.	.	+	.
Dryopteris carthusiana	H	1	.	.	.	.	+
Agrostis capillaris	H	.	0.5	0.5	.	.	.
Carex remota	H	.	0.5	.	.	.	+
Festuca gigantea	H	.	0.5	.	r	.	.
Lamium maculatum	H	.	0.5	.	+	.	.
Cirsium palustre	H	.	+	.	.	.	r
Dactylis glomerata	H	.	0.5	.	.	+	.
Carpinus betulus	H	0.5	.	.	.	.	+
Fagus sylvatica	H	1	.	.	.	.	r
Veronica beccabunga	H	0.5	.	.	.	.	0.5
Stellaria media agg.	H	0.5	.	.	.	1	.
Prunus spinosa	H	.	.	+	.	0.5	.
Sambucus nigra	H	.	.	.	.	0.5	+
Viola reichenbachiana	H	.	.	.	.	+	0.5
Brachypodium sylvaticum	H	.	.	.	5	.	0.5
Anemone nemorosa	H	.	.	.	0.5	.	0.5
Iris pseudacorus	H	.	.	.	4	.	.

Other species (< 1 occurrence and ≤ 1 % cover)

S1: Fagus sylvatica 768: r; Acer pseudoplatanus 768: r; Acer platanoides 768: r; Carpinus betulus 1037: +; Rosa tomentosa agg. 489: r; Prunus spinosa 854: r

S2: Rosa spec. 768: r; Acer platanoides 768: r; Fagus sylvatica 768: +; Fraxinus excelsior 1: r; Prunus avium 768: r; Crataegus laevigata 489: +; Crataegus monogyna 854: 789

H: Stachys palustris 768: r; Glyceria fluitans agg. 768: +; Cardamine flexuosa 771: r; Epilobium parviflorum 771: r; Fallopia convolvulus 771: r; Cardamine amara 768: r; Rumex spec. 768: r; Viola riviniana 768: r; Chenopodium polyspermum 771: r; Rumex crispus 771: r; Scrophularia nodosa 771: r; Mentha arvensis 768: r; Epilobium ciliatum 771: r; Prunella vulgaris 771: r; Quercus spec. 771: r; Crepis paludosa 768: r; Galium album 771: r; Aegopodium podagraria 771: r; Prunus avium 768: r; Plantago major s. major 771: r; Angelica sylvestris 771: r; Alchemilla vulgaris agg. 771: r; Euonymus europaea 789: r; Aconitum napellus 789: r; Betonica officinalis 1037: r; Rosa canina 854: r; Corylus avellana 1037: r; Carex sylvatica 1037: r; Milium effusum 789: r; Mercurialis perennis 1037: r; Melica uniflora 1037: r; Arctium minus 789: r; Festuca altissima 1037: r; Fraxinus excelsior 854: r; Cardamine impatiens 1037: r; Cytisus scoparius 854: r; Paris quadrifolia 1037: r; Rumex obtusifolius 1037: r; Veronica montana 854: r; Equisetum arvense 489: r; Holcus lanatus 768: r; Galium palustre 768: +; Picea abies 768: r; Deschampsia flexuosa 1037: r

Supplement S7. Synoptic table of vegetation units with dominance of *Betula pendula* (CytBet = *Cytisus scoparius-Sorbus aucuparia-Betula pendula* pioneer forests; VacBet = *Vaccinium myrtillus-Betula pendula* pioneer forests) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, negatively differentiating ones in red.

Beilage S7. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Betula pendula* (CytBet = *Cytisus scoparius-Sorbus aucuparia-Betula pendula*-Pionierwälder; VacBet = *Vaccinium myrtillus-Betula pendula*-Pionierwälder) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, negativ differenzierende rot hinterlegt.

		1	**2**
		CytBet	**VacBet**
Number of samples		19	6
Species richness			
Average		18.8	15.3
Standard deviation		9	4.8
Minimum		4	9
Maximum		39	21
EIV L		5.5	5.9
EIV M		5.3	5.2
EIV R		3.5	3.2
EIV N		4.1	3.7
Tree layer total		69.6	58.3
Shrub layer 1		7.4	3.3
Shrub layer 2		1.6	1.8
Herb layer		23.4	60
Moss layer		4.3	12.5
Tree layer			
Betula pendula	T1	95	100
Pinus sylvestris	T1	*16*	**83**
Fagus sylvatica	T1	**26**	*0*
Fagus sylvatica	T2	**21**	*0*
Picea abies	T1	**21**	*0*
Pinus sylvestris	T2	*0*	**33**
Quercus petraea	T2	*5*	**33**
Betula pendula	T2	16	33
Quercus petraea	T1	26	17
Shrub layer			
Picea abies	S2	**42**	*0*
Carpinus betulus	S2	**32**	*0*
Corylus avellana	S1	**26**	*0*
Picea abies	S1	**21**	*0*
Pinus sylvestris	S1	*0*	**33**
Quercus petraea	S2	*5*	**33**
Fagus sylvatica	S2	32	17
Corylus avellana	S2	32	17
Fagus sylvatica	S1	26	17
Betula pendula	S2	21	17
Sorbus aucuparia	S2	42	33
Betula pendula	S1	21	50
Herb layer			
D 1			
Cytisus scoparius	H	**47**	*0*
Fagus sylvatica	H	**37**	*0*
Acer pseudoplatanus	H	**26**	*0*
Digitalis purpurea	H	**26**	*0*
Prunus avium	H	**26**	*0*
Pteridium aquilinum	H	**21**	*0*
Lonicera periclymenum	H	**21**	*0*
D 2			
Quercus robur	H	*0*	**50**
Maianthemum bifolium	H	*0*	**33**
Constant species (>20% frequency)			
Deschampsia flexuosa	H	68	100
Dryopteris carthusiana	H	58	100
Vaccinium myrtillus	H	53	100
Rubus fruticosus agg.	H	84	83
Rubus idaeus	H	37	83
Galium saxatile	H	32	83
Sorbus aucuparia	H	74	33
Teucrium scorodonia	H	58	33
Agrostis capillaris	H	47	50
Quercus petraea	H	32	50
Dryopteris dilatata	H	16	50
Luzula luzuloides	H	42	17
Holcus mollis	H	37	17
Picea abies	H	37	33
Molinia caerulea	H	16	33
Hypericum pulchrum	H	26	33
Carpinus betulus	H	32	17
Poa nemoralis	H	32	17
Dryopteris filix-mas	H	26	17
Corylus avellana	H	26	17
Athyrium filix-femina	H	26	17
Carex pilulifera	H	26	17
Deschampsia cespitosa	H	21	17
Anthoxanthum odoratum	H	21	17

Supplement S8. Vegetation table of relevés with dominance of *Quercus rubra* (QueRub) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S8. Vegetationstabelle von Aufnahmen mit Dominanz von *Quercus rubra* (QueRub) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		QueRub
Number of samples		8
Species richness		
Average		14.3
Standard deviation		6.4
Minimum		7
Maximum		28
EIV L		5.3
EIV M		5
EIV R		3.6
EIV N		4.3
Tree layer total		86.8
Shrub layer 1		0.1
Shrub layer 2		0.1
Herb layer		8.3
Moss layer		5.8
PSI No.		1555 1560 1298 1205 1170 1299 1721 992
Tree layer		
Quercus rubra	T1	60 90 90 100 85 75 80 45
Acer pseudoplatanus	T1	. . . . . 15 . 70
Quercus rubra	T2	. . 1 . 10 . . .
Larix decidua	T1	. . . . 2 . . .
Betula pendula	T2	. . . . 2 . . .
Fagus sylvatica	T2	. . . . . 5 . .
Shrub layer		
Quercus rubra	S1	. . . . 1 . . .
Herb layer		
Rubus idaeus	H	2 . . . .
Dryopteris carthusiana	H	+ . . . . 0.5 . .
Vaccinium myrtillus	H	0.5 . . 0.5 0.5 . . .
Digitalis purpurea	H	0.5 . . . . . 0.5 +
Galeopsis tetrahit	H	+ . . . . + 0.5 .
Carpinus betulus	H	r . . . . . 0.5 +
Fagus sylvatica	H	. r . . . + + .
Luzula sylvatica	H	. 0.5 . . . . 0.5 .
Cytisus scoparius	H	. + ... r .
Viola riviniana	H	. + ... 0.5
Luzula luzuloides	H	10 0.5 3 . . 1 1 0.5
Poa nemoralis	H	0.5 0.5 + . . 1 0.5 0.5
Rubus fruticosus agg.	H	5 + 0.5 . . 10 0.5 .
Polygonatum verticillatum	H	. . 0.5 . . + . .
Sorbus aucuparia	H	. . r . r . . .
Deschampsia flexuosa	H	15 + 0.5 1 0.5 0.5 . .
Agrostis capillaris	H	3 0.5 0.5 0.5 . 0.5 . .
Picea abies	H	0.5 + + . r 0.5 . .
Quercus rubra	H	+ r . 0.5 + 0.5 . .
Teucrium scorodonia	H	0.5 0.5 + . . . 0.5 .
Acer pseudoplatanus	H	. . r 0.5
Betula pendula	H	. . . + . . . r
Dryopteris filix-mas	H	. . . . . . 0.5 0.5

Other species (< 1 occurrence and ≤ 1 % cover)

T1: Larix decidua 1170: +

T2: Betula pendula 1170: +

S1: Quercus rubra 1170: r

S2: Larix kaempferi 1555: r; Picea spec. 1555: r; Fagus sylvatica 1555: r

H: Hypericum perforatum 1560: r; Rubus idaeus 1555: +; Pinus sylvestris 1555: r; Veronica officinalis 1555: r; Larix kaempferi 1555: r; Betula spec. 1555: r; Picea spec. 1555: r; Juncus effusus 1555: r; Epilobium montanum 1555: r; Salix caprea 1555: r; Hordelymus europaeus 1555: r; Athyrium filix-femina 1555: r; Pseudotsuga menziesii 1555: r; Epilobium angustifolium 1555: r; Salix cinerea 1555: r; Luzula pilosa 1170: r; Mycelis muralis 1170: r; Prunus avium 1721: r; Galium aparine agg. 1721: r; Quercus petraea 1721: r; Anemone nemorosa 1299: r; Holcus mollis 1299: r; Oxalis acetosella 1299: r; Stellaria holostea 1299: r; Moehringia trinervia 1299: r; Poa chaixii 992: r; Senecio ovatus 992: r; Lathyrus linifolius 992: r; Carex pilulifera 1205: r; Taraxacum spec. 1205: r; Galium saxatile 1298: r; Festuca altissima 1298: r

Supplement S9. Synoptic table of vegetation units with dominance of *Picea abies* (PicAbie1-4) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, positively-negatively differentiating ones in orange and negatively differentiating ones in red.

Beilage S9. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Picea abies* (PicAbie1-4) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, positiv-negativ differenzierende orange und negativ differenzierende rot hinterlegt.

		1	2	3	4
		PicAbie1	**PicAbie2**	**PicAbie3**	**PicAbie 4**
Number of samples		140	93	89	104
Species richness					
Average		7.3	13	24.8	24.1
Standard deviation		5	3.4	7	8.5
Minimum		1	6	14	12
Maximum		28	23	50	65
EIV L		5.2	5.3	5.5	5.4
EIV M		4.1	5.3	5.4	5.2
EIV R		3.1	3.1	3.6	4.2
EIV N		3.7	4.1	5	5.2
Tree layer total		77.9	66.4	67.9	59
Shrub layer 1		0.7	2.6	1.7	1.2
Shrub layer 2		0.1	2.1	1.5	0.8
Herb layer		1.5	25.6	27	21.6
Moss layer		8	11.9	12.9	26.5
Tree layer					
Picea abies	T1	100	100	98	99
Shrub layer					
Picea abies	S2	*1*	**37**	**22**	13
Fagus sylvatica	S2	*6*	**33**	**43**	17
Sorbus aucuparia	S2	*1*	**28**	**34**	16
Fagus sylvatica	S1	8	22	21	12
Herb layer					
D 2					
Picea abies	H	*34*	**94**	84	83
Molinia caerulea	H	*3*	**32**	15	*3*
D 2-3					
Vaccinium myrtillus	H	*24*	**97**	**78**	*18*
Deschampsia flexuosa	H	*31*	**96**	**97**	48
Luzula luzuloides	H	*27*	**87**	**98**	57
Sorbus aucuparia	H	*24*	**90**	**83**	46
Carex pilulifera	H	*14*	**61**	**61**	33
D 2-4					
Dryopteris dilatata	H	*12*	**83**	**93**	**51**
Galium saxatile	H	*7*	**66**	**88**	**43**
D 3					
Mycelis muralis	H	*8*	*10*	**78**	*27*
Oxalis acetosella	H	*12*	19	**61**	49
Epilobium angustifolium	H	*4*	15	**60**	37
Hieracium laevigatum	H	*1*	*16*	**56**	*2*
Deschampsia cespitosa	H	*2*	*9*	**52**	*6*
Athyrium filix-femina	H	*7*	12	**48**	38
Cardamine flexuosa	H	*4*	*1*	**39**	10
Holcus lanatus	H	*1*	4	**25**	18
Senecio sylvaticus	H	*2*	6	**24**	9
Holcus mollis	H	4	*2*	**26**	13
D 3-4					
Dactylis glomerata	H	*2*	*2*	**34**	**24**
Senecio ovatus	H	*12*	*16*	**89**	**50**
Moehringia trinervia	H	*4*	*1*	**43**	**37**
Urtica dioica	H	*6*	*5*	**38**	**39**
Taraxacum spec.	H	13	*3*	**37**	**27**
Galeopsis tetrahit	H	*10*	*3*	**37**	**44**
Epilobium montanum	H	*1*	*0*	**27**	**28**
Rubus idaeus	H	*17*	39	**99**	**96**
Digitalis purpurea	H	*11*	38	**87**	**65**
Agrostis capillaris	H	*6*	32	**94**	**74**
D 4					
Rubus fruticosus agg.	H	*32*	*25*	*33*	**93**
Dryopteris filix-mas	H	*10*	*5*	25	**56**
Cytisus scoparius	H	*10*	*3*	21	**46**
Festuca altissima	H	*5*	*6*	13	**39**
Poa nemoralis	H	*2*	*1*	*8*	**39**
Milium effusum	H	*2*	*1*	*8*	**37**
Quercus petraea	H	10	8	*6*	**34**
Acer pseudoplatanus	H	11	*6*	13	**32**
Hypericum pulchrum	H	5	*3*	4	**27**
Teucrium scorodonia	H	21	*14*	33	**56**
Constant species (Frequency ≥ 20 %)					
Dryopteris carthusiana	H	44	92	99	79
Calluna vulgaris	H	4	27	4	4
Fagus sylvatica	H	11	24	25	27
Veronica officinalis	H	4	4	19	24
Betula pendula	H	4	16	16	23

Supplement S10. Synoptic table of vegetation units with dominance of *Pinus sylvestris* (PinSylv1-5) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, negatively differentiating ones in red.

Beilage S10. Übersichtstabelle der Vegetationseinheiten mit Dominanz von *Pinus sylvestris* (PinSylv 1-5) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, negativ differenzierende rot hinterlegt.

		1	2	3	4	5
		PinSylv1	**PinSylv2**	**PinSylv3**	**PinSylv4**	**PinSylv5**
Number of samples		11	13	39	29	7
Species richness						
Average		14.4	22.5	17.7	9.4	12.7
Standard deviation		4.5	6.5	4.1	2.8	3.4
Minimum		6	15	12	4	7
Maximum		20	40	32	15	17
EIV L		5.4	6.1	5.9	6.1	6.2
EIV M		5.2	5.2	5.4	5	5.6
EIV R		3.7	3.8	3.3	3	3.2
EIVN		4.6	4.7	4.2	3.4	3.5
Tree layer total		70	50	48.5	62.4	15.9
Shrub layer 1		3.3	4.9	5.3	4.4	15.8
Shrub layer 2		0.4	1.2	1.6	0.6	2.1
Herb layer		26.2	50.8	48.6	34	43.4
Moss layer		1.3	17.4	15.5	4.2	7.7
Tree layer						
Pinus sylvestris	B1	100	100	100	100	86
Quercus petraea	B2	**36**	*0*	**21**	7	*0*
Sorbus aucuparia	B2	**27**	*0*	**21**	*0*	14
Fagus sylvatica	B2	**27**	*0*	5	7	*0*
Pinus sylvestris	B2	*0*	**31**	**23**	**55**	**29**
Betula pendula	B1	*0*	8	*0*	14	**29**
Betula pendula	B2	73	69	64	69	57
Shrub layer						
Carpinus betulus	S1	**36**	*0*	*0*	*0*	*0*
Carpinus betulus	S2	**27**	*0*	*3*	*0*	*0*
Fagus sylvatica	S2	**27**	8	*3*	*3*	*0*
Pinus sylvestris	S2	*0*	**54**	*10*	*14*	**57**
Pseudotsuga menziesii	S2	*0*	**31**	15	*3*	*0*
Betula pubescens s. pubescens	S1	*0*	**31**	18	*3*	14
Sorbus aucuparia	S2	*0*	23	**54**	10	14
Sorbus aucuparia	S1	9	*0*	**21**	3	14
Picea abies	S1	*9*	23	33	21	**57**
Pinus sylvestris	S1	*0*	**77**	*18*	**62**	**86**
Picea abies	S2	*0*	**31**	**31**	**21**	**29**
Betula pendula	S1	*9*	**77**	**62**	**52**	**86**
Betula pendula	S2	*0*	**62**	**36**	**45**	**71**
Fagus sylvatica	S1	18	0	3	7	0
Herb layer						
D 1						
Carpinus betulus	H	**36**	15	5	0	0
Cytisus scoparius	H	**36**	8	3	7	14
Poa nemoralis	H	**36**	0	10	0	0
Lonicera periclymenum	H	**36**	0	15	0	0
Dryopteris filix-mas	H	**27**	8	5	0	14
Senecio ovatus	H	**27**	15	8	7	0
Ilex aquifolium	H	**27**	15	8	3	0
D 1,2						
Acer pseudoplatanus	H	**27**	**23**	18	7	0
D 2						
Sorbus aucuparia	H	45	**92**	59	34	43
Pinus sylvestris	H	0	**92**	15	28	29
Taraxacum spec.	H	0	**77**	8	3	14
Agrostis capillaris	H	18	**62**	31	7	29
Digitalis purpurea	H	0	**46**	8	0	0
Senecio sylvaticus	H	0	**46**	8	0	0
Pseudotsuga menziesii	H	0	**38**	18	3	0
Dactylis glomerata	H	0	**38**	5	0	0
Holcus mollis	H	9	**31**	0	0	0
Galium album	H	0	**31**	5	0	14
D 2,3						
Epilobium montanum	H	0	**46**	**23**	0	0
Quercus robur	H	0	**38**	**28**	17	0
Oxalis acetosella	H	18	**23**	**33**	3	0
D 3						
Hypericum pulchrum	H	0	8	**23**	0	0
Betula pubescens s. pubescens	H	0	8	**21**	7	14
Luzula luzuloides	H	0	15	**26**	7	0
D 1,3						
Dryopteris dilatata	H	**55**	23	**54**	10	14
Teucrium scorodonia	H	**45**	8	**23**	3	0
Athyrium filix-femina	H	**27**	8	**21**	0	0
D 2,5						
Betula pendula	H	9	**85**	21	24	**57**
Carex pilulifera	H	0	**23**	18	7	**29**
Luzula pilosa	H	0	**23**	18	17	**29**
D 2-4						
Galium saxatile	H	9	**85**	**77**	**34**	0
D 1-3,5						
Rubus idaeus	H	**45**	**100**	**95**	10	**57**
D 1-4						
Quercus petraea	H	**36**	**54**	**36**	**24**	0
D 2,3,5						
Epilobium angustifolium	H	0	**62**	**28**	7	**29**
Mycelis muralis	H	9	**62**	**31**	0	**29**
D 3,5						
Molinia caerulea	H	9	23	**41**	24	**57**
Trientalis europaea	H	0	15	**26**	10	**29**
D 4						
Quercus rubra	H	0	8	10	**21**	14
D 5						
Calluna vulgaris	H	0	15	23	10	**43**
Constant species (>20% frequency)						
Vaccinium myrtillus	H	64	100	100	97	100
Dryopteris carthusiana	H	55	100	92	69	57
Deschampsia flexuosa	H	45	100	100	79	100
Rubus fruticosus agg.	H	91	92	90	38	86
Picea abies	H	36	62	31	24	57

Supplement S11. Vegetation table of relevés with dominance of *Larix decidua* (LarDeci) and *Larix kaempferi* (LarKaem) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S11. Vegetationstabelle von Aufnahmen mit Dominanz von *Larix decidua* (LarDeci) und *Larix kaempferi* (LarKaem) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1									2			
		LarDeci									LarKaem			
Number of samples		9									4			
Species richness														
Average		19.2									13.3			
Standard deviation		6.4									4.3			
Minimum		10									9			
Maximum		29									17			
EIV L		5.7									5			
EIV M		4.9									5			
EIV R		3.7									4.1			
EIVN		4.4									4.5			
Tree layer total		56.1									61.3			
Shrub layer 1		5.3									8.8			
Shrub layer 2		1.7									0.6			
Herb layer		43.8									28			
Moss layer		7.5									5.3			
PSI No.	**Layer**	293	1094	1381	251	575	1006	706	1453	1517	806	1383	1617	1269
Tree layer														
Larix decidua	T1	**55**	**80**	**40**	**60**	**45**	**15**	**60**	**50**	**40**	.	.	.	.
Larix kaempferi	T1	.	.	.	.	.	.	.	.	.	**70**	**30**	**30**	**40**
Fagus sylvatica	T2	.	.	.	.	.	.	.	30	15	.	15	.	10
Picea abies	T1	.	.	.	.	.	.	.	6	.	.	.	.	.
Betula pendula	T1	4	.	.	.	.	.	.	.	.	.	.	.	.
Quercus rubra	T2	.	.	.	.	.	15	.	.	.	.	.	.	.
Pinus sylvestris	T1	.	.	.	.	.	.	.	.	.	.	5	.	.
Quercus petraea	T2	.	.	.	.	.	.	.	.	.	.	.	5	.
Sorbus aria	T2	.	.	.	.	.	.	.	.	.	.	.	10	.
Fagus sylvatica	T1	.	.	.	.	.	.	.	.	.	.	20	.	.
Corylus avellana	T2	.	.	.	.	.	.	.	.	.	30	.	.	.
Shrub layer														
Corylus avellana	S1	.	.	20	.	.	.	2	.	10	15	.	10	.
Picea abies	S1	.	.	.	2	.	.	.	3	.	.	.	.	7
Fagus sylvatica	S1	.	.	.	.	.	.	.	4	+	.	2	.	1
Betula pendula	S1	.	.	.	.	.	6	.	.	.	.	.	.	.
Cytisus scoparius	S2	.	.	.	.	1	r	r	.	.	.	.	.	.
Fagus sylvatica	S2	.	.	1	1	.	.	.	r	.	.	r	.	.
Picea abies	S2	.	.	.	1	.	.	.	.	1	.	+	.	2
Sorbus aucuparia	S2	.	.	.	.	+	.	1	r	.	.	.	.	.
Pseudotsuga menziesii	S2	.	.	.	+	.	7	.	.	.	.	.	.	.
Herb layer														
Rubus idaeus	H	.	r	2	6	.	65	.	0.5	.	.	+	.	+
Vaccinium myrtillus	H	.	2	.	2	.	5	.	+	.	.	.	.	60
Rubus fruticosus agg.	H	+	0.5	15	+	8	1	7	35	45	2	15	15	1
Deschampsia flexuosa	H	5	.	+	40	0.5	2	10	.	.	.	1	.	3
Agrostis capillaris	H	.	.	.	0.5	35	3	0.5	3	.	.	0.5	.	0.5
Dryopteris dilatata	H	.	+	2	+	.	2	+	3	15	.	.	.	+
Luzula luzuloides	H	0.5	.	1	15	r	.	.	0.5		.	0.5	.	.
Oxalis acetosella	H	.	1	+	.	.	.	.	15	2	.	+	.	0.5
Dryopteris carthusiana	H	0.5	0.5	1	1	.	0.5	1	3	5	.	1	8	0.5
Teucrium scorodonia	H	+	.	1	.	4	.	0.5	.	+	0.5	.	0.5	.
Dryopteris filix-mas	H	.	.	1	.	.	.	.	r	r	r	1	+	.
Sorbus aucuparia	H	0.5	r	.	+	.	.	0.5	r	r	.	.	.	.
Picea abies	H	+	.	.	0.5	.	0.5	.	.	+	.	0.5	.	+
Galeopsis tetrahit	H	r	.	r	.	.	r	.	0.5	.	0.5	.	.	.
Galium saxatile	H	.	.	.	0.5	1	+	0.5	.	.	.	.	.	.
Athyrium filix-femina	H	.	.	+	r	.	.	.	0.5	.	.	0.5	.	.
Quercus petraea	H	.	.	r	r	r	.	.	.	.	.	.	.	+
Holcus mollis	H	.	.	.	0.5	3	.	0.5	.	.	.	.	.	.
Milium effusum	H	.	.	.	.	.	.	.	2	1	.	0.5	.	.
Epilobium angustifolium	H	.	.	1	+	.	0.5	.	.	.	.	.	.	.
Digitalis purpurea	H	.	.	.	1	0.5	.	+	.	.	.	.	.	.
Quercus robur	H	.	r	.	.	.	.	0.5	.	+	.	.	.	.
Fagus sylvatica	H	.	.	.	r	.	.	r	.	.	.	0.5	.	.
Cytisus scoparius	H	.	.	.	.	0.5	.	r	.	.	+	.	.	.
Constant species (>20% frequency)														
Festuca altissima	H	.	.	.	.	.	.	.	5	0.5	.	.	.	.
Pteridium aquilinum	H	.	0.5	.	.	2	.	.	.	.	.	.	.	.
Cytisus scoparius	S1	.	.	.	.	r	1	.	.	.	.	.	.	.
Betula pendula	S2	.	.	.	.	.	1	.	.	.	.	.	.	+
Anthoxanthum odoratum	H	.	.	.	.	6	.	.	.	.	.	.	.	.
Senecio ovatus	H	.	.	.	4	.	.	.	.	.	.	.	.	.
Calluna vulgaris	H	.	.	.	.	.	4	.	.	.	.	.	.	.
Picea abies	T2	.	.	.	.	.	2	.	.	.	.	.	.	.
Betula pubescens s. pubescens	T1	.	.	.	.	.	.	2	.	.	.	.	.	.
Larix decidua	T2	.	2	.	.	.	.	.	.	.	.	.	.	.
Sorbus aucuparia	B1	.	2	.	.	.	.	.	.	.	.	.	.	.
Carpinus betulus	T2	.	.	.	.	.	.	.	.	.	.	.	2	.
Pseudotsuga menziesii	S1	.	.	.	.	.	2	.	.	.	.	.	.	.
Luzula sylvatica	H	.	.	.	.	.	.	.	.	.	.	.	2	.
Epilobium montanum	H	.	.	.	0.5	.	+	.	.	.	.	.	.	.
Festuca rubra agg.	H	.	.	.	0.5	+	.	.	.	.	.	.	.	.
Carex pilulifera	H	.	+	.	.	.	0.5	.	.	.	.	.	.	.
Lonicera periclymenum	H	.	.	.	.	.	.	R	0.5	.	.	.	.	.
Deschampsia cespitosa	H	.	.	.	+	.	.	.	.	.	.	.	.	0.5
Poa nemoralis	H	.	.	0.5	.	.	.	.	.	.	.	0.5	.	.
Corylus avellana	S2	.	.	.	.	.	.	0.5	.	+	.	.	.	.
Juncus effusus	H	.	.	.	.	.	+	.	+	.	.	.	.	.
Larix decidua	H	.	.	.	.	.	+	.	+	.	.	.	.	.
Acer pseudoplatanus	H	.	.	.	.	.	.	.	.	.	+	+	.	.

Other species (< 1 occurrence and ≤ 1 % cover)

T1: Sorbus aucuparia 1094: +; Betula pubescens s. pubescens 706: +

T2: Carpinus betulus 1617: +; Sorbus aucuparia 1094: r

S1: Sorbus aria 1617: r; Quercus robur 1381: r; Pseudotsuga menziesii 1006: +

S2: Ilex aquifolium 1269: r; Quercus petraea 1269: r; Quercus robur 1517: r; Larix decidua 1006: r; Malus spec. 706: r; Prunus spinosa 1517: r; Salix caprea 251: r

H: Betula pubescens s. pubescens 1269: r; Larix decidua 1094: +; Larix kaempferi 1383: r; Prunus avium 806: r; Hypericum pulchrum 1269: r; Acer platanoides 1383: r; Luzula sylvatica 1617: +; Quercus rubra 1006: r; Salix caprea 251: r; Holcus lanatus 1006: r; Rumex acetosella 706: r; Taraxacum spec. 251: r; Pseudotsuga menziesii 251: r; Betula pendula 1006: r; Galium album 706: r; Viola riviniana 706: r; Polygonatum multiflorum 1517: r; Senecio spec. 1453: r; Luzula pilosa 1094: r; Melica uniflora 1381: r; Malus sylvestris agg. 575: r; Danthonia decumbens 1006: r; Corylus avellana 1381: r; Quercus spec. 1006: r; Lapsana communis 251: r; Cirsium vulgare 251: r; Cirsium palustre 1006: r; Hypericum perforatum 575: r; Dactylis glomerata 251: r; Populus tremula 1006: r; Agrostis stolonifera 1006: r; Potentilla erecta 1006: r; Mycelis muralis 1006: r

Supplement S12. Vegetation table of relevés with dominance of *Pseudotsuga menziesii* (PseMenz) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S12. Vegetationstabelle von Aufnahmen mit Dominanz von *Pseudotsuga menziesii (PseMen)* im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		PseMenz									
Number of samples		10									
Species richness											
Average		14.1									
Standard deviation		10.1									
Minimum		1									
Maximum		28									
EIV L		4.4									
EIV M		4.1									
EIV R		2.9									
EIVN		3.7									
Tree layer total		67.5									
Shrub layer 1		0.3									
Shrub layer 2		0.4									
Herb layer		9.3									
Moss layer		3.7									
PSI No		900	502	211	209	793	1477	1566	1567	1699	1692
Tree layer											
Pseudotsuga menziesii	T1	95	95	60	50	70	45	40	35	90	80
Fagus sylvatica	T2	.	.	30	.	.	.	.	.	.	.
Sorbus aucuparia	T2	.	.	30	.	.	.	.	.	.	.
Pseudotsuga menziesii	T2	.	1	.	.	.	.	.	.	.	.
Shrub layer											
Fagus sylvatica	S2	.	.	r	2	.	.	.	.	.	.
Cytisus scoparius	S2	.	.	.	.	.	.	0.5	+	.	.
Pseudotsuga menziesii	S2	.	.	.	.	.	.	.	r	.	.
Thuja spec.	S1	.	.	.	2	.	.	.	.	.	.
Cytisus scoparius	S1	.	.	.	.	.	.	+	+	.	.
Herb layer											
Galeopsis tetrahit	H	.	+	.	.	+	0.5	.	.	.	.
Vaccinium myrtillus	H	.	r	.	0.5	0.5	.	.	.	.	.
Senecio ovatus	H	.	.	+	0.5	+	9	.	.	.	.
Galium saxatile	H	.	.	.	0.5	0.5	.	.	.	.	.
Senecio sylvaticus	H	.	.	.	0.5	r	.	.	.	.	.
Mycelis muralis	H	.	.	+	.	r	5	.	.	.	.
Dryopteris dilatata	H	.	.	1	.	+	0.5	.	.	.	.
Galium album	H	.	.	.	+	.	.	0.5	+	.	.
Teucrium scorodonia	H	.	.	.	.	0.5	.	2	0.5	.	.
Epilobium angustifolium	H	.	.	.	.	.	2	+	0.5	.	.
Holcus lanatus	H	.	.	.	.	.	.	+	0.5	.	.
Melica uniflora	H	.	.	.	.	.	.	+	0.5	.	.
Milium effusum	H	.	.	.	.	.	.	.	0.5	.	.
Veronica officinalis	H	.	.	.	.	.	.	0.5	.	.	.
Senecio inaequidens	H	.	.	.	.	.	.	0.5	.	.	.
Rumex acetosella	H	.	.	.	.	.	.	0.5	.	.	.
Carex pilulifera	H	.	.	+	r	0.5	.	.	+	.	.
Sorbus aucuparia	H	.	.	.	0.5	+	.	r	.	.	.
Agrostis capillaris	H	.	.	.	.	.	0.5	2	0.5	.	.
Poa nemoralis	H	.	.	.	.	.	0.5	0.5	0.5	.	.
Dryopteris carthusiana	H	.	0.5	1	0.5	1	0.5	.	0.5	.	.
Rubus idaeus	H	.	+	.	0.5	0.5	6	6	10	.	.
Digitalis purpurea	H	.	.	.	0.5	0.5	10	+	0.5	.	.
Rubus fruticosus ag.	H	.	.	.	r	0.5	1	7	15	.	.
Oxalis acetosella	H	.	0.5	1	.	.	1	.	0.5	.	.
Luzula luzuloides	H	.	.	0.5	0.5	.	0.5	+	0.5	.	.
Festuca altissima	H	.	.	0.5	.	.	1	R	+	.	.
Pseudotsuga menziesii	H	.	+	.	0.5	.	.	0.5	+	.	.
Deschampsia flexuosa	H	.	.	0.5	.	+	.	0.5	.	.	.
Moehringia trinervia	H	.	+	.	.	.	0.5	.	+	.	.
Geum urbanum	H	.	.	.	.	0.5	.	.	.	.	.
Urtica dioica	H	.	.	.	.	0.5	.	.	.	.	.
Taraxacum spec.	H	.	.	.	.	.	0.5	.	.	.	.
Dactylis glomerata	H	.	.	.	.	.	+	.	+	.	.
Quercus petraea	H	r	.	.	.	.	.	.	r	.	.
Dryopteris filix-mas	H	.	.	.	.	+	.	.	+	.	.
Cerastium holosteoides	H	.	.	.	r	.	+	.	.	.	.
Sambucus nigra	H	.	.	.	r	+	r	.	.	.	.
Cytisus scoparius	H	.	.	.	.	r	.	+	r	.	.

Other species (< 1 occurrence and ≤ 1 % cover)

T2: Pseudotsuga menziesii 502: r

S1: Thuja spec. 209: +

S2: Calystegia sepium 209: r

H: Brachypodium sylvaticum 211: r; Deschampsia cespitosa 211: r; Taraxacum spec. 1477: r; Festuca gigantea 1477: r; Hypericum maculatum ag. 1477: r; Sambucus racemosa 502: r; Athyrium filix-femina 502: r; Crataegus laevigata 502: r; Urtica dioica 793: r; Geum urbanum 793: r; Prunus avium 793: r; Hypericum pulchrum 793: r; Cirsium palustre 793: r; Carex sylvatica 793: r; Hieracium spec. 793: r; Epilobium montanum 793: r; Quercus rubra 793: r; Milium effusum 1567: r; Carpinus betulus 1567: r; Juncus effusus 1567: r; Pseudotsuga menziesii 1567: r; Senecio inaequidens 1566: r; Veronica officinalis 1566: r; Rumex acetosella 1566: r; Luzula sylvatica 1566: r; Betula pendula 1566: r

Supplement S13. Synoptic table of vegetation units of class *Molinio-Arrhenatheretea* Tx. 1937 (FesAgrC1 = *Festuca rubra-Agrostis capillaris* community; FesCyn = *Festuco-Cynosuretum* Tx. in Büker 1942 em. Meis. 1966; LolCyn = *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936; ArrElat1-3 = *Arrhenatheretum elatioris* Braun 1915) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, negatively differentiating ones in red.

Beilage S13. Übersichtstabelle der Vegetationseinheiten der Klasse *Molinio-Arrhenatheretea* Tx. 1937 (FesAgrC1 = *Festuca rubra-Agrostis capillaris* community; FesCyn = *Festuco-Cynosuretum* Tx. in Büker 1942 em. Meis. 1966; LolCyn = *Lolio-Cynosuretum* Br.-Bl. et De Leeuw 1936; ArrElat1-3 = *Arrhenatheretum elatioris* Braun 1915) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, negativ differenzierende rot hinterlegt.

		1	2	3	4	5	6
		FesAgrC1	**FesCyn**	**LolCyn**	**ArrElat1**	**ArrElat2**	**ArrElat3**
Number of samples		87	38	27	38	40	41
Species richness							
Average		23.3	27	28.5	30.3	25.5	33.7
Standard deviation		5.8	7.4	8.5	8.5	7.3	9.5
Minimum		13	16	14	14	11	18
Maximum		39	47	55	48	39	66
EIV L		7	7.1	7.1	7	7	6.9
EIV M		5	4.9	5	5	5	4.9
EIV R		5.4	5.6	5.7	5.7	5.8	5.4
EIV N		4.8	4.9	5.3	5	5.2	5.3
Tree layer total		0	0	0.9	0	0.2	0.3
Shrub layer 1		0.1	0.9	0.2	1.5	1.6	27.2
Shrub layer 2		0.1	0.7	1.3	4.3	1.7	11.1
Herb layer		91.9	97	88	89.6	91.1	80.4
Moss layer		6.9	9.8	8.3	6.2	3.5	12
Shrub layer							
Crataegus monogyna	S1	*0*	*5*	*4*	*8*	15	**46**
Prunus spinosa	S2	*2*	*3*	*0*	8	8	**29**
Sorbus aucuparia	S2	*0*	*0*	*0*	*0*	3	**24**
Cytisus scoparius	S2	*13*	*16*	*15*	**58**	45	**80**
Cytisus scoparius	S1	*2*	*5*	*4*	*24*	**43**	**98**
Crataegus monogyna	S2	*3*	*0*	*7*	24	**38**	**59**
Herb layer							
D 1							
Luzula campestris	H	**33**	13	7	18	8	*0*
Rhinanthus minor	H	**31**	18	*4*	*5*	18	*0*
Leucanthemum ircutianum	H	**37**	16	*4*	13	13	20
D 1,4-6							
Rumex acetosa	H	**72**	55	*22*	**71**	**65**	**80**
D 2,4							
Trisetum flavescens	H	71	**87**	63	**74**	45	*27*
D 2							
Medicago lupulina	H	*5*	**39**	*7*	*3*	*8*	*2*
Phleum pratense	H	18	24	22	16	15	7
D 2,3							
Lolium perenne	H	*11*	**50**	**89**	*16*	*5*	*2*
Bellis perennis	H	*15*	**47**	**70**	*5*	*3*	*0*
Cynosurus cristatus	H	41	**84**	**81**	37	*10*	*12*
Trifolium repens	H	57	**92**	**96**	58	*30*	*32*
D 1-3							
Trifolium pratense	H	**62**	**95**	**89**	50	*13*	*27*
Hypochaeris radicata	H	**62**	**61**	**70**	29	*13*	*20*
Leontodon autumnalis	H	**31**	**34**	**33**	8	10	*2*
D 3							
Trifolium dubium	H	28	37	**59**	32	*5*	15
Plantago major s. major	H	*0*	*5*	**41**	*5*	*3*	*7*
Bromus hordeaceus agg.	H	*6*	*8*	**37**	13	*0*	*7*
Cirsium vulgare	H	*2*	8	**26**	11	*0*	15
Prunella vulgaris	H	2	11	**22**	3	*0*	5
DA 4							
Cirsium arvense	H	*21*	45	56	**66**	58	54
Vicia angustifolia	H	*7*	16	19	**45**	18	15
Centaurea jacea	H	15	16	*0*	**32**	10	7
Alopecurus pratensis	H	*0*	13	11	**21**	3	2
Vicia hirsuta	H	8	18	*4*	**34**	23	*7*
D (1),2-4							
Cerastium holosteoides	H	36	**61**	**85**	**55**	*10*	24
Plantago lanceolata	H	72	**89**	**89**	**79**	*30*	*29*
Taraxacum spec.	H	**69**	**76**	**81**	**53**	*13*	*15*
D 5							
Lathyrus pratensis	H	26	*13*	15	45	**48**	29
Vicia sepium	H	23	*18*	*15*	39	**60**	41
D (1),5,6							
Vicia cracca	H	**76**	34	*19*	45	**88**	**80**
Galium album	H	33	*11*	*26*	61	**90**	**90**
D 5,6							
Rubus idaeus	H	*1*	*3*	*11*	*26*	**55**	**93**
Urtica dioica	H	*0*	*5*	15	21	**30**	**59**
Galeopsis tetrahit	H	*3*	*8*	*11*	*16*	**50**	**76**
Senecio ovatus	H	*0*	*3*	*7*	*13*	**28**	**73**
Viola tricolor agg.	H	*7*	*0*	*0*	13	**25**	**44**
D 4,6							
Verbascum nigrum	H	13	*3*	*0*	**24**	15	**44**
D 6							
Rubus fruticosus agg.	H	*1*	*8*	*4*	*16*	*13*	**68**
Teucrium scorodonia	H	*1*	*3*	*4*	*0*	*8*	**46**
Digitalis purpurea	H	*1*	*3*	*4*	*5*	*8*	**41**
Euphorbia cyparissias	H	7	8	*0*	21	13	**34**
Crataegus monogyna	H	14	*3*	*4*	18	20	**44**
Cytisus scoparius	H	*13*	*18*	*15*	*18*	20	**56**
Linaria vulgaris	H	*5*	*5*	*7*	29	23	**44**
Poa trivialis	H	*3*	*3*	11	13	13	**34**
Prunus spinosa	H	*2*	*3*	7	13	15	**32**
Hypericum perforatum	H	*2*	18	7	13	10	**27**
Cirsium palustre	H	*0*	8	*0*	11	10	**24**
Holcus mollis	H	5	13	4	*0*	13	**24**
Galium aparine agg.	H	*0*	*0*	7	8	13	**22**
Orobanche rapum-genistae	H	2	*0*	*0*	*0*	5	**20**
Constant species (≥20% frequency)							
Festuca rubra agg.	H	100	100	85	100	90	85
Dactylis glomerata	H	92	87	81	100	95	100
Arrhenatherum elatius	H	44	45	59	84	100	93
Agrostis capillaris	H	99	97	93	92	83	83
Holcus lanatus	H	97	95	96	97	65	66
Veronica chamaedrys	H	86	68	93	97	95	93
Poa pratensis	H	76	68	89	92	73	68
Achillea millefolium	H	56	79	89	74	43	44
Anthoxanthum odoratum	H	85	63	48	58	33	51
Lotus corniculatus	H	70	84	59	76	55	46
Ranunculus repens	H	48	63	78	68	50	71
Galium verum	H	48	34	33	68	75	49
Hypericum maculatum agg.	H	54	45	26	68	48	51
Stellaria graminea	H	46	55	37	58	43	66
Ranunculus acris	H	52	34	26	26	38	20
Pimpinella saxifraga	H	14	21	22	39	10	27
Festuca pratensis	H	8	8	30	21	10	12
Barbarea vulgaris	H	13	13	7	21	8	15

Supplement S14. Synoptic table of vegetation units of woodland clearings (EpiDigi1-5 = *Epilobio-Digitalietum purpureae* Schwickerath 1944; RubIdae = *Rubetum idaei* Pfeiffer 1936 sensu Oberd. 1973; SarScop1-2 = *Sarothamnion scoparii* Oberd. 1957; PteAqui = *Pteridietum aquilini* Jouanne et Chouard 1929) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Frequency of taxa within each vegetation unit is given in percentages with positively differentiating taxa highlighted in green, positively-negatively differentialing ones in orange and negatively differentiating ones in red.

Beilage S14. Übersichtstabelle der Vegetationseinheiten der Schlagfluren (EpiDigi1-5 = *Epilobio-Digitalietum purpureae* Schwickerath 1944; RubIdae = *Rubetum idaei* Pfeiffer 1936 sensu Oberd. 1973; SarScop1-2 = *Sarothamnion scoparii* Oberd. 1957; PteAqui = *Pteridietum aquilini* Jouanne et Chouard 1929) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Stetigkeit der Taxa innerhalb der Vegetationseinheiten in Prozent; positiv differenzierende Arten sind grün, positiv-negativ differenzierende orange und negativ differenzierende rot hinterlegt.

		1	2	3	4	5	6	7	8	9
		EpiDigi1	RubIae	EpiDigi2	SarScop1	SarScop2	EpiDigi3	PteAqui	EpiDigi4	EpiDigi5
Number of samples		15	9	11	12	24	12	7	14	2
Species richness										
Average		29.3	30.3	35.2	32.3	29.9	20.7	22.7	24.6	20
Standard deviation		13.2	8.7	7.7	11.1	11.3	5.2	14.3	4.6	4.2
Minimum		18	13	24	10	11	12	9	13	17
Maximum		70	40	47	48	53	29	50	30	23
EIV L		5.9	6.1	6.1	6.3	5.7	6	6.2	5.6	5.1
EIV M		5.4	5.2	5.7	5.2	5.2	5.5	5.2	5.3	5.6
EIV R		4.1	4.1	4.2	4.2	4.5	3.4	4.1	4	3.8
EIV N		5.1	5.1	5	5	5.4	4.4	4.9	5.2	5.1
Tree layer total		4.5	0	3.6	1.4	10	3.7	2.9	16.4	12.5
Shrub layer 1		0.6	10.6	1.4	18.5	4	5.9	6.4	9.9	35
Shrub layer 2		1.2	1.3	2.9	3.4	1.3	2.4	4.7	4.6	1.8
Herb layer		22.2	89.4	85.5	71.9	75.4	76.3	90.4	19.6	27.5
Moss layer		6.2	7.3	2.9	4.8	5.3	5.3	0.5	6.7	5.5
Tree layer										
Picea abies	T1	**20**	*0*	**27**	*0*	**42**	**33**	*0*	**93**	*0*
Fagus sylvatica	T1	*7*	*0*	*0*	*8*	*8*	*0*	*0*	*0*	**50**
Fagus sylvatica	T2	*0*	*0*	*0*	*0*	*8*	*0*	*0*	*0*	**50**
Shrub layer										
Salix caprea	S2	7	**22**	9	8	*0*	*0*	14	*0*	*0*
Sambucus racemosa	S2	*0*	**22**	*0*	17	8	8	*0*	*0*	*0*
Cytisus scoparius	S1	*7*	**78**	*18*	**67**	*17*	*8*	*14*	*0*	*0*
Sambucus nigra	S2	*0*	**22**	*0*	*0*	**21**	8	*0*	7	*0*
Sorbus aucuparia	S1	*0*	**22**	*0*	*0*	*0*	**42**	*0*	7	*0*
Betula pendula	S1	*0*	**44**	*0*	**58**	*4*	*8*	*0*	*14*	*0*
Salix aurita	S2	*0*	11	**27**	17	*0*	8	*0*	7	*0*
Cytisus scoparius	S2	*13*	**56**	**45**	**75**	33	33	*14*	*14*	*0*
Betula pendula	S2	*7*	**44**	**36**	**67**	29	17	29	29	*0*
Pseudotsuga menziesii	S2	*7*	*11*	*0*	**42**	17	*0*	*0*	*7*	*0*
Populus tremula	S2	*0*	*0*	18	**25**	*0*	*0*	*0*	7	*0*
Corylus avellana	S2	7	*0*	9	8	**21**	8	14	14	*0*
Sorbus aucuparia	S2	*0*	33	27	25	*13*	**92**	*0*	29	*0*
Prunus spinosa	S2	*0*	*0*	*0*	*0*	*4*	*0*	**29**	*0*	*0*
Crataegus monogyna	S2	*0*	*0*	*0*	8	8	*0*	**29**	*0*	*0*
Corylus avellana	S1	*0*	*0*	*0*	8	17	*0*	**29**	14	*0*
Carpinus betulus	S2	*0*	*0*	9	8	17	*0*	*0*	**21**	*0*
Acer pseudoplatanus	S2	7	*0*	*0*	8	4	*0*	*0*	**21**	*0*
Fagus sylvatica	S1	*0*	*11*	27	*8*	*17*	33	*0*	36	**100**
Picea abies	S1	*0*	*11*	*9*	*0*	*0*	33	*0*	29	**100**
Fagus sylvatica	S2	27	*0*	*9*	33	29	33	*0*	29	**100**
Picea abies	S2	*20*	33	36	42	*21*	50	*14*	29	**100**
Herb layer										
D 1										
Hypochaeris radicata	H	**27**	0	9	8	0	0	0	14	0
Viola riviniana	H	**20**	11	0	17	13	0	14	14	0
Betula pubescens s. pubescens	H	**20**	11	9	0	0	0	14	7	0
Prunus spinosa	H	**20**	0	0	0	0	0	14	0	0
Prunus avium	H	**20**	11	0	0	13	0	0	14	0
D 1,5,8										
Sambucus nigra	H	**27**	11	9	0	**38**	8	14	**36**	0
Melica uniflora	H	**20**	11	0	0	**21**	0	0	**21**	0
Quercus petraea	H	**20**	11	18	17	**21**	17	0	**29**	0
D 1,2,5,8										
Mycelis muralis	H	**27**	**33**	18	8	**21**	0	0	**21**	0
Poa nemoralis	H	**33**	**33**	9	25	**50**	0	14	**36**	0
D 1,3,6										
Vaccinium myrtillus	H	**33**	11	**45**	25	4	**92**	29	29	0
D 1,2,3,4										
Hypericum perforatum	H	**20**	**33**	9	**25**	17	8	14	7	0
Lapsana communis	H	**20**	**22**	9	8	**29**	0	0	0	0
Hypericum pulchrum	H	**47**	**44**	18	**58**	**38**	8	0	14	0
D 1,2,8-9										
Festuca altissima	H	**27**	**44**	0	8	17	0	0	**21**	**50**
D 2,(4),(6),(9)										
Carex sylvatica	H	13	**22**	0	0	13	0	0	0	0
Senecio inaequidens	H	7	**22**	9	**50**	13	0	0	0	0
Calluna vulgaris	H	27	**44**	18	**42**	4	**33**	14	7	0
Pseudotsuga menziesii	H	20	**33**	18	**33**	13	0	0	7	**50**
D 2,3,6,7										
Cirsium palustre	H	13	**33**	**36**	17	13	**25**	**29**	14	0
D 2,3,(7,9)										
Arrhenatherum elatius	H	0	22	**27**	17	4	8	**29**	14	0
Deschampsia cespitosa	H	20	22	**82**	8	17	33	29	14	**50**
D 1-3,(7),(9)										
Rumex acetosa	H	**20**	**33**	**45**	17	0	0	**29**	0	0
Epilobium angustifolium	H	**80**	**78**	**82**	75	58	42	29	57	**100**
D 1-4,9										
Juncus effusus	H	**53**	**56**	**91**	**50**	25	17	0	7	**100**
D 1-5,(7-9)										
Epilobium montanum	H	**40**	**44**	**64**	**58**	**42**	0	14	14	0
Ranunculus repens	H	**27**	**44**	**36**	**33**	**21**	0	0	0	0
Moehringia trinervia	H	**33**	**56**	**45**	**42**	**38**	0	**29**	**29**	**50**
D 2-5,8										
Rumex acetosella	H	13	**22**	**36**	**33**	**25**	8	0	**29**	0
Teucrium scorodonia	H	33	**56**	**45**	**83**	**71**	17	29	**57**	0
Dactylis glomerata	H	20	**67**	**36**	**42**	**46**	8	14	**43**	0
D 2-4,(6),(8-9)										
Holcus lanatus	H	20	**67**	**91**	**58**	38	42	14	36	0
Salix caprea	H	13	**33**	**36**	**33**	8	**33**	14	7	0
Sorbus aucuparia	H	47	**89**	**55**	**50**	42	**100**	14	**50**	**50**
D 2,3,(6,7)										
Molinia caerulea	H	0	**22**	**27**	0	0	**33**	14	7	0
Senecio ovatus	H	40	**78**	**82**	50	50	25	**71**	57	50
D 2,3,5-8										
Holcus mollis	H	13	**33**	**73**	25	**42**	**33**	**43**	**50**	0
D 2,3,5,8,9										
Dryopteris filix-mas	H	27	**44**	**45**	25	**75**	0	14	**36**	**50**
D 3,4										
Cirsium arvense	H	7	0	**27**	**25**	8	0	14	7	0
D 3,(5,7,8)										
Stellaria graminea	H	13	11	**27**	8	13	0	**29**	7	0
Oxalis acetosella	H	27	22	**55**	17	**38**	17	14	**50**	0
Galium aparine agg.	H	7	22	**36**	17	**33**	0	**43**	21	0
Poa trivialis	H	20	11	**27**	25	**38**	8	14	7	0
D 3										
Ranunculus acris	H	0	0	**27**	0	0	0	14	0	0
Salix aurita	H	0	0	**27**	8	0	17	14	7	0
D 1,3-5,9										
Agrostis stolonifera	H	**27**	22	**45**	**42**	**29**	0	14	7	**50**
D (3),4,5,(8,9)										
Urtica dioica	H	33	33	**73**	**42**	**63**	8	14	**43**	0
Fagus sylvatica	H	13	0	9	**42**	**38**	8	0	7	**50**
D 1,4										
Taraxacum spec.	H	**60**	33	27	**42**	25	8	14	14	0
Pinus sylvestris	H	**20**	11	9	**50**	8	17	0	0	0
Senecio sylvaticus	H	**53**	11	27	**33**	25	8	14	7	0
Carex pilulifera	H	**67**	44	45	**58**	17	42	14	36	50
D 4										
Sambucus racemosa	H	13	11	9	**42**	4	17	0	7	0
Quercus robur	H	0	0	9	**33**	4	0	14	0	0
Stellaria alsine	H	0	0	18	**25**	4	0	0	14	0
D 4,9										
Calamagrostis epigejos	H	0	11	0	**25**	0	0	0	7	**50**
D 5										
Carpinus betulus	H	13	11	0	8	**29**	0	0	14	0
Veronica officinalis	H	13	11	9	17	**29**	8	0	7	0
Geranium robertianum	H	7	11	0	0	**25**	8	0	14	0
D 6										
Deschampsia flexuosa	H	40	56	55	33	29	**100**	43	57	50
Galium saxatile	H	67	33	64	42	29	**92**	43	71	50
Hieracium laevigatum	H	0	11	9	0	0	**33**	14	0	0
Festuca rubra agg.	H	0	11	9	8	13	**25**	14	7	0
Carex ovalis	H	7	0	9	8	0	**25**	0	0	0
D 7										
Pteridium aquilinum	H	0	0	0	0	0	0	**100**	7	0
Lolium perenne	H	0	0	0	0	0	0	**29**	0	0
Vicia cracca	H	0	11	0	0	0	8	**29**	0	0
Glechoma hederacea	H	0	0	9	0	8	0	**29**	0	0
Potentilla erecta	H	0	0	18	8	4	8	**29**	7	0
D 8										
Acer pseudoplatanus	H	13	11	9	0	17	8	14	**36**	0
Quercus spec.	H	13	0	0	0	4	0	0	**21**	0
Luzula pilosa	H	13	11	0	8	4	0	14	**21**	0
D (2,3,5),9										
Dryopteris dilatata	H	40	33	36	42	50	58	29	64	**100**
Galium album	H	13	22	45	33	25	17	29	14	**50**
Luzula luzuloides	H	73	56	**82**	33	42	75	29	36	**100**
Carex remota	H	13	**33**	0	8	4	0	0	0	**50**
Blechnum spicant	H	0	**22**	0	0	0	0	0	0	**50**
Milium effusum	H	7	**33**	0	8	**54**	0	0	**29**	**50**
D 1-8										
Galeopsis tetrahit	H	**53**	**89**	**55**	**50**	**71**	**42**	**43**	**57**	0
Cytisus scoparius	H	**67**	**67**	**27**	**75**	**50**	**33**	**29**	**36**	0
D 9										
Athyrium filix-femina	H	27	56	55	58	54	17	14	29	**100**
Constant species (frequency ≥ 20 %)										
Digitalis purpurea	H	87	89	91	83	79	92	57	86	50
Rubus idaeus	H	93	100	100	100	92	75	100	100	100
Agrostis capillaris	H	73	100	100	92	67	67	43	57	100
Rubus fruticosus agg.	H	93	78	82	100	100	50	100	93	100
Dryopteris carthusiana	H	60	78	100	75	79	100	43	93	100
Picea abies	H	67	56	55	58	42	83	43	79	100
Betula pendula	H	73	33	27	67	29	50	29	43	50

Supplement S15. Vegetation table of relevés of *Senecioni ovati-Coryletum* Passarge 1979 (SenCory) and *Senecio fuchsii-Sambucetum racemosae* Oberd. 1957 (SenSamb) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S15. Vegetationstabelle von Aufnahmen des *Senecioni ovati-Coryletum* Passarge 1979 (SenCory) und des *Senecio fuchsii-Sambucetum racemosae* Oberd. 1957 (SenSamb) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1										2
		SenCory										SenSamb
Number of samples		10										1
Species richness												
Average		29.7										16
Standard deviation		7.6										-
Minimum		14										16
Maximum		44										16
EIV L		5.4										4.5
EIV M		5.4										5.1
EIV R		5.6										5.3
EIV N		5.8										6.1
Tree layer total		32.2										90
Shrub layer 1		53.1										1
Shrub layer 2		1.6										1
Herb layer		30.3										15
Moss layer		2.4										5
PSI- No.	Layer	519	709	253	579	856	982	954	746	422	769	1546
Tree layer												
Prunus avium	T1	.	.	.	.	.	35	40	45	.	.	35
Sorbus aucuparia	T1	.	.	4	.	.	.	15	.	.	.	.
Carpinus betulus	T1	.	.	.	.	.	.	30	.	.	5	.
Corylus avellana	T2	95	.	.	.	.	.	.	.	.	.	.
Populus tremula	T1	5	.	.	.	.	.	.	.	.	.	.
Alnus glutinosa	T1	.	.	.	3	.	.	.	.	.	.	.
Quercus robur	T2	.	.	.	.	.	10	.	.	.	.	.
Quercus robur	T1	.	.	.	.	.	.	20	.	.	.	.
Carpinus betulus	T2	.	.	.	.	.	.	15	.	.	.	.
Betula x aurata	T1	.	.	.	.	.	.	.	40	.	.	.
Acer pseudoplatanus	T1	.	.	.	.	.	.	.	.	50	.	.
Corylus avellana	T1	.	.	.	.	.	.	.	.	.	55	.
Fagus sylvatica	T1	.	.	.	.	.	.	.	.	.	.	40
Quercus petraea	T1	.	.	.	.	.	.	.	.	.	.	10
Picea abies	T1	.	.	.	.	.	.	.	.	.	.	10
Shrub layer												
Corylus avellana	S1	.	65	80	90	80	70	15	6	55	15	.
Crataegus monogyna	S2	.	1	.	+	r	r	.	0.5	.	.	.
Crataegus monogyna	S1	.	15	.	1	10	.	.	+	.	.	.
Prunus spinosa	S2	.	5	.	+	+	.	.	.	.	1	.
Fagus sylvatica	S2	.	+	r	.	.	.	.	+	.	.	.
Sorbus aucuparia	S2	.	r	.	.	.	.	r	+	.	.	.
Prunus spinosa	S1	.	.	.	2	1	.	.	.	.	15	.
Acer pseudoplatanus	S1	.	.	5	r	.	.	.	.	.	.	.
Acer pseudoplatanus	S2	.	.	0.5	+	.	.	.	.	.	.	.
Carpinus betulus	S1	.	.	.	5	.	.	.	.	.	.	.
Sambucus nigra	S1	.	.	.	.	.	.	.	.	.	10	.
Sambucus nigra	S2	.	.	.	.	.	.	.	.	.	4	.
Herb layer												
Senecio ovatus	H	0.5	3	0.5	0.5	7	0.5	0.5	+	2	.	.
Dryopteris filix-mas	H	0.5	.	+	.	r	6	1	r	+	1	+
Galeopsis tetrahit	H	+	5	0.5	+	0.5	.	0.5	0.5	0.5	0.5	.
Rubus fruticosus agg.	H	15	25	.	r	2	+	1	15	.	.	10
Rubus idaeus	H	0.5	.	0.5	.	+	+	.	0.5	.	0.5	2
Poa nemoralis	H	.	1	.	.	0.5	0.5	0.5	0.5	0.5	.	+
Dryopteris carthusiana	H	.	.	+	r	.	0.5	.	+	r	0.5	+
Acer pseudoplatanus	H	10	0.5	0.5	0.5	.	1	.	.	0.5	.	.
Sorbus aucuparia	H	0.5	+	+	.	+	r	.	0.5	.	.	.
Geum urbanum	H	.	+	.	0.5	0.5	0.5	0.5	.	.	0.5	.
Prunus avium	H	.	.	.	+	+	0.5	r	.	r	.	0.5
Geranium robertianum	H	.	.	.	.	0.5	r	0.5	0.5	.	0.5	+
Impatiens noli-tangere	H	30	.	.	0.5	.	15	.	.	8	0.5	.
Oxalis acetosella	H	15	.	0.5	.	.	2	.	.	.	0.5	0.5
Agrostis capillaris	H	0.5	5	+	.	.	.	.	0.5	1	.	.
Dactylis glomerata	H	.	2	.	r	.	+	.	2	+	.	.
Poa trivialis	H	.	0.5	.	0.5	0.5	.	.	+	1	.	.
Crataegus monogyna	H	.	0.5	.	+	1	r	.	+	.	.	.
Urtica dioica	H	.	0.5	.	.	.	+	.	0.5	.	20	0.5
Stellaria holostea	H	.	.	0.5	0.5	+	.	0.5	1	.	.	.
Athyrium filix-femina	H	3	.	0.5	.	.	+	.	.	.	0.5	.
Prunus spinosa	H	.	3	.	0.5	1	.	.	.	.	0.5	.
Deschampsia cespitosa	H	.	.	1	r	.	+	.	.	+	.	.
Carpinus betulus	H	.	.	.	r	.	r	.	.	.	0.5	r
Mycelis muralis	H	.	.	.	.	+	.	+	+	.	+	.
Deschampsia flexuosa	H	.	1	0.5	.	.	.	+	.	.	.	.
Galium album	H	.	0.5	.	.	r	.	.	0.5	.	.	.
Quercus robur	H	.	+	r	.	.	r	.	.	.	.	.
Stellaria media agg.	H	.	+	.	.	1	0.5	.	.	.	.	.
Ranunculus repens	H	.	+	.	.	1	.	.	.	0.5	.	.
Sambucus nigra	H	.	+	.	.	+	.	.	.	.	1	.
Bistorta officinalis	H	.	.	2	2	.	.	.	.	+	.	.
Stellaria nemorum	H	.	.	.	2	.	.	.	.	0.5	30	.
Lamium galeobdolon agg.	H	.	.	.	1	.	.	0.5	.	.	25	.
Galium aparine agg.	H	.	.	.	0.5	+	0.5	.	.	.	.	.
Silene dioica	H	.	.	.	0.5	.	.	.	.	+	0.5	.
Alliaria petiolata	H	.	.	.	.	0.5	0.5	0.5	.	.	.	.
Milium effusum	H	.	.	.	.	.	+	0.5	+	.	.	.
Moehringia trinervia	H	.	.	.	.	.	.	0.5	.	0.5	0.5	.
Dryopteris dilatata	H	0.5	r	.	.	.	.	.	.	.	.	.
Teucrium scorodonia	H	.	3	.	.	.	.	.	0.5	.	.	.
Digitalis purpurea	H	.	1	r	.	.	.	.	.	.	.	.
Cytisus scoparius	H	.	+	.	.	.	.	.	r	.	.	.
Festuca rubra agg.	H	.	+	.	.	.	.	.	.	+	.	.
Juncus effusus	H	.	r	.	.	.	.	.	.	+	.	.
Anemone nemorosa	H	.	.	0.5	1	.	.	.	.	.	.	.
Crepis paludosa	H	.	.	r	+	.	.	.	.	.	.	.
Salix caprea	H	.	.	r	.	.	.	.	+	.	.	.
Carex pallescens	H	.	.	r	.	.	.	.	.	r	.	.
Glechoma hederacea	H	.	.	.	0.5	.	.	.	.	.	20	.
Filipendula ulmaria	H	.	.	.	+	.	.	.	.	0.5	.	.
Viola reichenbachiana	H	.	.	.	r	.	0.5	.	.	.	.	.
Brachypodium sylvaticum	H	.	.	.	.	1	1	.	.	.	.	.
Cardamine hirsuta	H	.	.	.	.	0.5	.	.	0.5	.	.	.
Stachys sylvatica	H	.	.	.	.	+	.	+	.	.	.	.
Fraxinus excelsior	H	.	.	.	.	.	0.5	.	.	r	.	.
Fagus sylvatica	H	.	.	.	.	.	+	.	.	.	.	r
Mercurialis perennis	H	.	.	.	.	.	.	2	.	.	1	.
Viola riviniana	H	.	.	.	.	.	.	0.5	.	0.5	.	.
Cardamine flexuosa	H	.	.	.	.	.	.	.	.	+	+	.
Holcus lanatus	H	.	10	.	.	.	.	.	.	.	.	.
Senecio hercynicus	H	.	.	.	.	.	.	.	.	.	2	.

Other species (< 1 occurrence and ≤ 1 % cover)

T2: Fagus sylvatica 1546: r

S1: Sambucus racemosa 1546: r; Cytisus scoparius 709: r; Fagus sylvatica 746: r; Betula x aurata 746: r; Crataegus laevigata 422: r; Quercus robur 253: r; Betula pubescens s. pubescens 746: r

S2: Sambucus racemosa 1546: r; Cytisus scoparius 709: r; Corylus avellana 746: r; Rosa canina 856: r; Carpinus betulus 579: r

H: Sambucus racemosa 1546: r; Quercus petraea 1546: r; Epilobium montanum 1546: r; Luzula sylvatica 1546: r; Veronica chamaedrys 746: r; Vicia angustifolia 709: r; Anthoxanthum odoratum 709: r; Hypericum perforatum 422: r; Cerastium holosteoides 422: r; Rosa canina 856: r; Chaerophyllum temulum 856: r; Stellaria alsine 422: r; Fragaria vesca 746: r; Lapsana communis 422: r; Rumex obtusifolius 856: r; Taraxacum spec. 709: r; Corylus avellana 856: r; Vaccinium myrtillus 253: r; Quercus rubra 579: r; Arrhenatherum elatius 709: r; Carex remota 982: r; Glyceria fluitans agg. 422: r; Holcus mollis 253: r; Ranunculus acris 422: r; Luzula pilosa 856: r; Festuca altissima 856: r; Pteridium aquilinum 856: r; Rosa tomentosa agg. 954: r; Senecio hercynicus 769: +; Melica uniflora 954: r; Poa chaixii 253: r; Acer platanoides 422: r; Actaea spicata 769: r; Phyteuma nigrum 422: r; Rosa arvensis 422: r; Arum maculatum 769: r; Festuca gigantea 253: r; Polygonatum verticillatum 253: r; Acer campestre 746: r; Hedera helix 954: r; Phyteuma spicatum 579: r; Corydalis solida 982: r; Stellaria aquatica 579: r; Ranunculus ficaria 422: r; Euonymus europaea 746: r; Quercus spec. 746: r; Equisetum arvense 422: r; Vicia sepium 856: r; Myosotis scorpioides 422: r; Valeriana procurrens 422: r; Anthriscus sylvestris 709: r; Malus sylvestris agg. 746: r; Colchicum autumnale 422: r; Geranium sylvaticum 579: r; Epilobium roseum 769: r; Persicaria hydropiper 422: r; Betonica officinalis 422: r; Lathyrus linifolius 253: r; Lysimachia nemorum 422: r; Pimpinella major 422: r

Supplement S16. Vegetation table of relevés of *Galium saxatile-Agrostis capillaris* community (GalAgrC) and *Agrostis capillaris-Luzula luzuloides* community (AgrLuzC) in Eifel National Park with information on number of relevés, average, minimum and maximum number of species, mean Ellenberg Indicator Values (EIV) for light (L), moisture (M), soil reaction (R) and nutrients (N) as well as the cover of the tree layer, higher und lower shrub, herb and moss layer per vegetation unit. Abundance of taxa is given in percentages (+ = 0.3 %, r = 0.1 %).

Beilage S16. Vegetationstabelle von Aufnahmen der *Galium saxatile-Agrostis capillaris* - (GalAgrC) und der *Agrostis capillaris-Luzula luzuloides* -Gesellschaft (AgrLuzC) im Nationalpark Eifel mit Angaben zur Anzahl der Aufnahmen, dem mittleren, minimalen und maximalen Artenreichtum, mittleren Ellenberg-Zeigerwerten für Licht (L), Feuchte (M), Bodenreaktion (R) und Nährstoffe (N) sowie der Deckung von Baum-, hoher und niedriger Strauch-, Kraut- und Moosschicht je Vegetationseinheit. Angaben zur Abundanz der Taxa innerhalb der Aufnahmen in Prozent (+ = 0,3 %, r = 0,1 %).

		1				**2**											
		GalAgrC				**AgrLuzC**											
Number of samples		4				12											
Species richness																	
Average		36.3				36.8											
Standard deviation		8.8				10.5											
Minimum		25				17											
Maximum		45				52											
EIV L		6.8				6											
EIV M		5.3				5.4											
EIV R		3.7				4.1											
EIV N		4.1				4.8											
Tree layer total		0				5.7											
Shrub layer 1		0.4				4.9											
Shrub layer 2		0.4				1.9											
Herb layer		91.3				71.3											
Moss layer		0.9				5.8											
PSI-No.		95	180	116	146	700	1401	1222	1225	794	288	304	154	291	144	52	97
Tree layer																	
Picea abies	T1	.	.	.	.	.	.	.	.	.	.	10	8	10	10	10	.
Fagus sylvatica	T1	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.
Shrub layer																	
Cytisus scoparius	S2	.	+	.	+	r	1	+	5	+	.	.	.	+	.	.	1
Cytisus scoparius	S1	.	+	1	.	.	.	.	30	.	.	.	r	+	.	.	.
Picea abies	S1	.	.	.	.	.	.	.	.	.	.	.	1	.	20	5	.
Sorbus aucuparia	S2	.	.	.	.	r	.	.	.	.	.	.	.	+	+	.	.
Picea abies	S2	.	.	.	.	.	.	.	.	.	.	.	r	.	8	3	.
Fagus sylvatica	S2	.	.	.	.	.	.	.	.	.	r	2	.	.	.	.	.
Herb layer																	
Rumex acetosa	H	+	0.5	+	0.5	+	.	.	+	.	.	.	+	.	.	.	.
Festuca rubra agg.	H	0.5	0.5	0.5	5	2	3	.	r	.	.	.	.	.	.	.	.
Lotus corniculatus	H	.	1	1	0.5	+	.	.	.	.	.	.	r	1	.	.	.
Rhinanthus minor	H	0.5	.	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.
Anthoxanthum odoratum	H	2	2	+	.	4	.	.	.	+	.	.	.	.	.	.	.
Campanula rotundifolia	H	0.5	0.5	.	.	.	.	.	.	.	.	0.5	.	.	.	.	.
Lathyrus linifolius	H	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Meum athamanticum	H	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ranunculus acris	H	0.5	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Luzula campestris	H	0.5	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypericum maculatum agg.	H	.	0.5	0.5	.	+	0.5	.	.	.	.	.	.	.	.	.	.
Sambucus racemosa	H	.	r	r	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex obtusifolius	H	.	.	+	r	.	.	.	.	.	.	.	.	.	r	.	.
Hypochaeris radicata	H	.	.	+	0.5	.	.	.	.	r	.	.	.	.	.	.	.
Poa chaixii	H	.	15	.	+	.	.	.	.	.	.	.	+	.	.	.	.
Polypodium vulgare agg.	H	0.5	.	.	r	.	.	.	.	.	.	.	r	.	.	.	.
Juncus squarrosus	H	+	.	r	.	.	.	.	.	.	.	.	.	.	.	.	.
Anemone nemorosa	H	.	0.5	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Plantago lanceolata	H	.	.	r	.	+	.	.	.	.	.	.	.	.	.	.	.
Linaria vulgaris	H	.	.	.	r	+	+	.	.	.	.	.	.	.	.	.	.
Euphrasia stricta agg.	H	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Achillea millefolium	H	.	0.5	.	.	.	.	.	.	.	.	.	0.5	.	.	.	.
Leucanthemum ircutianum	H	.	.	0.5	.	+	.	.	.	.	.	.	.	.	.	.	.
Carex echinata	H	r	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.
Stellaria holostea	H	.	0.5	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Epilobium spec.	H	.	.	+	.	.	+	0.5	.	.	.	.	.	.	.	.	.
Veronica chamaedrys	H	.	0.5	0.5	0.5	0.5	0.5	.	.	.	+	+	+	.	.	.	+
Hypericum perforatum	H	.	0.5	+	.	+	.	.	+	r	.	.	.	.	.	.	.
Viola riviniana	H	.	0.5	.	0.5	.	.	0.5	.	+	+	.	.	.	.	.	.
Rubus idaeus	H	.	5	+	0.5	0.5	1	0.5	0.5	1	10	0.5	2	15	4	.	0.5
Cytisus scoparius	H	.	+	+	10	0.5	.	0.5	0.5	0.5	r	r	.	.	.	.	+
Rumex acetosella	H	0.5	.	.	0.5	0.5	+	0.5	5	.	+	.	.	.	.	.	0.5
Deschampsia cespitosa	H	1	0.5	+	0.5	.	.	.	.	.	+	0.5	1	10	+	45	+
Holcus mollis	H	1	5	0.5	8	10	.	.	.	0.5	.	.	15	35	0.5	0.5	7
Galeopsis tetrahit	H	.	0.5	0.5	3	0.5	.	.	0.5	+	0.5	.	0.5	0.5	.	.	.
Holcus lanatus	H	0.5	0.5	2	.	0.5	+	.	0.5	.	+	0.5	0.5	0.5	.	.	+
Senecio ovatus	H	.	0.5	0.5	0.5	.	.	.	.	0.5	0.5	.	15	1	r	.	.
Stellaria graminea	H	+	.	+	0.5	0.5	1	.	.	.	.	.	0.5	0.5	.	.	.
Ranunculus repens	H	.	+	0.5	0.5	0.5	.	.	.	+	.	.	0.5	0.5	+	.	.
Dryopteris carthusiana	H	+	.	.	+	.	+	0.5	.	0.5	0.5	1	0.5	1	0.5	0.5	+
Rubus fruticosus agg.	H	.	.	+	r	2	10	3	0.5	+	0.5	.	0.5	+	3	.	.
Digitalis purpurea	H	.	.	+	+	0.5	1	0.5	0.5	50	0.5	0.5	0.5	0.5	0.5	r	0.5
Dactylis glomerata	H	.	.	+	+	0.5	1	+	.	+	+	.	0.5	+	+	.	.
Cirsium palustre	H	.	.	r	0.5	+	+	.	.	r	.	.	0.5	+	.	.	.
Juncus effusus	H	0.5	.	.	0.5	.	0.5	.	.	.	.	.	0.5	0.5	7	.	0.5
Galium album	H	.	.	+	+	0.5	.	+	0.5	.	+	.	0.5	.	.	.	.
Urtica dioica	H	.	.	0.5	+	.	0.5	0.5	+	.	.	+	0.5	.	.	.	.
Poa trivialis	H	.	.	.	0.5	.	2	.	.	.	.	.	0.5	1	0.5	.	.
Quercus petraea	H	.	+	.	.	0.5	.	0.5	.	.	r	.	.	.	.	.	.
Poa pratensis	H	.	.	0.5	.	0.5	1	.	.	.	.	.	.	.	0.5	.	+
Salix caprea	H	.	.	+	.	r	0.5	r	.	+	.	+	.	r	+	.	.
Teucrium scorodonia	H	.	10	.	.	0.5	+	+	0.5	5	0.5	0.5	.	.	.	.	.
Betula pendula	H	.	.	r	.	+	4	0.5	0.5	0.5	.	.	.	.	.	+	.
Veronica officinalis	H	.	.	.	.	.	r	0.5	0.5	.	+	+	0.5	.	.	.	+
Picea abies	H	.	.	.	.	.	0.5	0.5	0.5	.	0.5	0.5	.	+	.	2	.
Epilobium angustifolium	H	.	.	.	.	.	0.5	+	0.5	1	0.5	.	0.5	.	0.5	.	.
Athyrium filix-femina	H	.	.	.	.	.	+	.	.	+	+	0.5	.	1	1	0.5	.
Epilobium montanum	H	.	.	.	.	.	+	0.5	r	r	.	0.5	.	+	+	.	.
Cerastium holosteoides	H	.	.	.	.	+	+	+	.	.	.	.	+	+	.	.	+
Dryopteris dilatata	H	.	.	.	.	.	+	.	.	.	0.5	1	0.5	.	2	0.5	.
Dryopteris filix-mas	H	.	.	.	.	.	.	+	.	r	+	+	.	+	.	.	.
Moehringia trinervia	H	.	.	.	.	+	.	.	.	.	0.5	.	0.5	0.5	0.5	.	.
Taraxacum spec.	H	.	.	.	.	.	0.5	+	.	+	.	+	.	.	.	.	.
Senecio inaequidens	H	.	.	.	.	.	+	+	0.5	+	.	.	.	.	.	.	.
Oxalis acetosella	H	.	.	.	.	.	.	0.5	.	.	0.5	.	0.5	.	0.5	.	.
Mycelis muralis	H	.	.	.	.	.	.	0.5	.	+	0.5	0.5	.	.	.	.	.
Trifolium repens	H	.	.	.	.	0.5	.	.	+	.	.	.	+	.	.	.	.
Lapsana communis	H	.	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.
Fagus sylvatica	H	.	.	.	.	.	.	0.5	.	.	.	r	.	.	.	+	.
Poa nemoralis	H	.	.	.	.	.	2	.	.	0.5	.	0.5	.	.	.	.	.
Milium effusum	H	.	.	.	.	.	0.5	+	.	.	.	.	.	+	.	.	.
Fragaria vesca	H	.	.	.	.	.	.	5	.	.	+	.	.	0.5	.	.	.
Carex ovalis	H	.	.	.	.	.	.	.	.	.	+	.	.	r	.	.	1
Agrostis stolonifera	H	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	0.5
Luzula luzuloides	H	.	.	.	.	.	2	1	+	0.5	20	5	0.5	1	3	0.5	+
Sorbus aucuparia	H	.	.	.	.	+	.	.	+	.	+	0.5	+	0.5	0.5	+	+
Vaccinium myrtillus	H	.	.	.	.	.	.	.	.	+	0.5	0.5	0.5	.	2	1	1
Molinia caerulea	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5	4
Calluna vulgaris	H	0.5	.	.	+	.	.	.	.	0.5	.	.	.	.	.	.	0.5
Potentilla erecta	H	0.5	0.5	.	.	0.5	.	.	.	.	.	.	.	.	.	.	0.5
Senecio sylvaticus	H	.	.	.	.	.	.	.	0.5	+	+	0.5	.	.	.	.	.
Luzula multiflora	H	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	r
Carex pilulifera	H	+	.	+	.	.	+	0.5	.	3	0.5	.	.	.	.	.	.
Arrhenatherum elatius	H	.	.	.	.	4	0.5	.	.	.	.	.	.	.	.	.	.
Sambucus nigra	H	.	.	.	.	r	0.5	.	.	.	.	.	.	.	.	.	.
Cirsium arvense	H	.	.	.	.	.	0.5	.	.	.	.	.	0.5	.	.	.	.
Stachys sylvatica	H	.	.	.	.	.	0.5	+	.	.	.	.	.	.	.	.	.
Pseudotsuga menziesii	H	.	.	.	.	.	r	.	r	.	.	.	.	.	.	.	.
Luzula sylvatica	H	.	.	.	.	.	.	.	.	1	.	.	.	.	.	0.5	.
Prunella vulgaris	H	.	.	.	.	.	.	.	.	r	.	.	.	+	.	.	.
Hypericum pulchrum	H	.	.	.	.	.	.	0.5	.	1	.	.	.	.	.	.	.
Crataegus monogyna	H	.	.	.	.	r	.	.	.	r	.	.	.	.	.	.	.
Festuca altissima	H	.	.	.	.	.	.	.	.	.	+	.	.	r	.	.	.
Hieracium laevigatum	H	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+
Crepis biennis	H	.	.	.	.	r	.	.	.	.	r	.	.	.	.	.	.
Carex sylvatica	H	.	.	.	.	.	.	+	.	.	r	.	.	.	.	.	.
Constant species																	
Agrostis capillaris	H	85	30	85	70	70	60	40	30	15	20	15	45	15	45	10	15
Galium saxatile	H	1	2	0.5	4	0.5	.	0.5	1	1	0.5	1	1	0.5	0.5	0.5	55
Deschampsia flexuosa	H	2	3	.	.	.	.	+	.	1	15	0.5	0.5	0.5	0.5	5	5

Other species (< 1 occurrence and ≤ 1 % cover)

S1: Crataegus monogyna 700: r

S2: Lonicera periclymenum 180: r; Sambucus racemosa 146: r; Salix caprea 291: r; Sambucus nigra 700: r; Acer pseudoplatanus 288: r; Betula pendula 794: r; Quercus petraea 700: r

H: Pimpinella saxifraga 180: r; Carex pallescens 146: r; Betonica officinalis 180: 1401; Lonicera periclymenum 180: r; Briza media 180: r; Carex canescens 180: r; Galium aparine agg. 146: r; Cynosurus cristatus 146: r; Trifolium pratense 146: r; Vicia cracca 116: r; Knautia arvensis 180: r; Centaurea jacea 180: r; Trisetum flavescens 146: r; Bistorta officinalis 180: r; Vicia sepium 116: r; Convallaria majalis 180: r; Ajuga reptans 180: r; Angelica sylvestris 146: r; Danthonia decumbens 700: r; Agrostis canina 154: r; Larix spec. 1401: r; Festuca gigantea 1401: r; Rumex sanguineus 1222: r; Festuca pratensis 700: r; Salix aurita 154: r; Prunus avium 1225: r; Acer pseudoplatanus 154: r; Leontodon autumnalis 700: r; Stellaria alsine 144: r; Agrostis gigantea 144: r; Ranunculus flammula 794: r; Viola tricolor agg. 700: r; Calamagrostis canescens 291: r; Hypericum humifusum 144: r; Prunus spinosa 700: r; Picea sitchensis 288: r; Frangula alnus 1401: r; Lysimachia nummularia 291: r; Geum urbanum 1401: r; Lysimachia nemorum 288: r; Cirsium vulgare 1401: r; Torilis japonica 154: r; Cardamine flexuosa 304: r; Carex flava agg. 1401: r; Eupatorium cannabinum 794: +; Viola reichenbachiana 1401: r; Calamagrostis epigejos 1401: r; Populus tremula 1401: r; Juncus tenuis 700: r; Hieracium murorum 288: r; Geranium robertianum 1222: r; Carex remota 291: r; Quercus rubra 1401: r; Barbarea vulgaris 700: r

Supplement E1. Abbreviation and full species name of species in PSI records.

Anhang E1. Abkürzung und ausgeschriebener Name der Arten in den PSI-Stichproben.

Abbreviation	Species name
AbiAlba	Abies alba
AbiNord	Abies nordmanniana
AbiSpec	Abies spec.
AceCamp	Acer campestre
AcePlat	Acer platanoides
AcePseu	Acer pseudoplatanus
AchMill	Achillea millefolium
AchPtar	Achillea ptarmica
AcoNape	Aconitum napellus
ActSpic	Actaea spicata
AdoMosc	Adoxa moschatellina
AegPoda	Aegopodium podagraria
AesHipp	Aesculus hippocastanum
AgrCani	Agrostis canina
AgrCapi	Agrostis capillaris
AgrEupa	Agrimonia eupatoria
AgrGiga	Agrostis gigantea
AgrStol	Agrostis stolonifera
AjuRept	Ajuga reptans
AlcVulg	Alchemilla vulgaris agg.
AllPeti	Alliaria petiolata
AlnGlut	Alnus glutinosa
AlnInca	Alnus incana
AloGeni	Alopecurus geniculatus
AloPrat	Alopecurus pratensis
AneNemo	Anemone nemorosa
AngSylv	Angelica sylvestris
AntArve	Anthemis arvensis
AntOdor	Anthoxanthum odoratum
AntSylv	Anthriscus sylvestris
AraThal	Arabidopsis thaliana
ArcMinu	Arctium minus
ArrElat	Arrhenatherum elatius
ArtVulg	Artemisia vulgaris
AruMacu	Arum maculatum
AspSept	Asplenium septentrionale
AspTric	Asplenium trichomanes
AthFili	Athyrium filix-femina
AtrBell	Atropa bella-donna
BarVulg	Barbarea vulgaris
BelPere	Bellis perennis
BetOffi	Betonica officinalis
BetPend	Betula pendula
BetPubP	Betula pubescens s. pubescens
BetPubC	Betula pubescens s. carpatica
BetSpec	Betula spec.
BetXAur	Betula x aurata
BidTrip	Bidens tripartita
BisOffi	Bistorta officinalis
BleSpic	Blechnum spicant
BraSylv	Brachypodium sylvaticum
BriMedi	Briza media
BroErec	Bromus erectus
BroHord	Bromus hordeaceus agg.
BroSter	Bromus sterilis
BryDioi	Bryonia dioica
CalArun	Calamagrostis arundinacea
CalCane	Calamagrostis canescens
CalEpig	Calamagrostis epigejos
CalPalu	Caltha palustris
CalSepi	Calystegia sepium
CalSpec	Callitriche spec.
CalVulg	Calluna vulgaris
CamRapu	Campanula rapunculoides
CamRotu	Campanula rotundifolia
CamTrac	Campanula trachelium
CapBurs	Capsella bursa-pastoris
CarAcut	Carex acutiformis
CarAmar	Cardamine amara
CarBetu	Carpinus betulus
CarBriz	Carex brizoides
CarBulb	Cardamine bulbifera
CarCane	Carex canescens
CarCris	Carduus crispus
CarDemi	Carex demissa
CarEchi	Carex echinata
CarexSp	Carex spec.
CarFlac	Carex flacca
CarFlav	Carex flava agg.
CarFlex	Cardamine flexuosa
CarHirs	Cardamine hirsuta
CarHirt	Carex hirta
CarImpa	Cardamine impatiens
CarMuri	Carex muricata agg.
CarNigr	Carex nigra
CarOval	Carex ovalis
CarPall	Carex pallescens
CarPani	Carex panicea
CarPilu	Carex pilulifera
CarPrat	Cardamine pratensis
CarRemo	Carex remota
CarSpec	Carduus spec.
CarSylv	Carex sylvatica
CenEryt	Centaurium erythraea
CenJace	Centaurea jacea
CenNigr	Centaurea nigra
CerArve	Cerastium arvense
CerHolo	Cerastium holosteoides
ChaSpec	Chaerophyllum spec.
ChaTemu	Chaerophyllum temulum
ChePoly	Chenopodium polyspermum
ChrOppo	Chrysosplenium oppositifolium
CirArve	Cirsium arvense
CirLute	Circaea lutetiana
CirOler	Cirsium oleraceum
CirPalu	Cirsium palustre
CirSpec	Circaea spec.
CirVulg	Cirsium vulgare
CliVulg	Clinopodium vulgare
ColAutu	Colchicum autumnale
ConArve	Convolvulus arvensis
ConCana	Conyza canadensis
ConMaja	Convallaria majalis
CorAvel	Corylus avellana
CorSang	Cornus sanguinea
CorSoli	Corydalis solida
CraLaev	Crataegus laevigata
CraMono	Crataegus monogyna
CraSpec	Crataegus spec.
CreBien	Crepis biennis
CreCapi	Crepis capillaris
CrePalu	Crepis paludosa
CreTect	Crepis tectorum
CruLaev	Cruciata laevipes
CusEuro	Cuscuta europaea
CynCris	Cynosurus cristatus
CynGerm	Cynoglossum germanicum
CytScop	Cytisus scoparius
DacGlom	Dactylis glomerata
DacSpec	Dactylis spec.
DanDecu	Danthonia decumbens
DapMeze	Daphne mezereum
DauCaro	Daucus carota
DesCesp	Deschampsia cespitosa
DesFlex	Deschampsia flexuosa
DigGran	Digitalis grandiflora
DigPurp	Digitalis purpurea
DryCart	Dryopteris carthusiana
DryDila	Dryopteris dilatata
DryFili	Dryopteris filix-mas
EchVulg	Echium vulgare
ElyCani	Elymus caninus
ElyRepe	Elymus repens
EpiAngu	Epilobium angustifolium
EpiCili	Epilobium ciliatum
EpiHell	Epipactis helleborine
EpiHirs	Epilobium hirsutum
EpiLanc	Epilobium lanceolatum
EpiMont	Epilobium montanum
EpiObsc	Epilobium obscurum
EpiPalu	Epilobium palustre
EpiParv	Epilobium parviflorum
EpiRose	Epilobium roseum
EpiSpec	Epilobium spec.
EpiTetr	Epilobium tetragonum
EquArve	Equisetum arvense
EquFluv	Equisetum fluviatile
EquPalu	Equisetum palustre
EriAngu	Eriophorum angustifolium
EriTetr	Erica tetralix
EroVern	Erophila verna
EuoEuro	Euonymus europaea
EupAmyg	Euphorbia amygdaloides
EupCann	Eupatorium cannabinum
EupCypa	Euphorbia cyparissias
EupHeli	Euphorbia helioscopia
EuphrSp	Euphrasia spec.
EupSpec	Euphorbia spec.
EupStri	Euphrasia stricta agg.
FagSylv	Fagus sylvatica
FalConv	Fallopia convolvulus
FesAlti	Festuca altissima
FesArun	Festuca arundinacea
FesFili	Festuca filiformis
FesGiga	Festuca gigantea
FesNigr	Festuca nigrescens
FesOvin	Festuca ovina agg.
FesPrat	Festuca pratensis
FesRubr	Festuca rubra agg.
FesSpec	Festuca spec.
FilUlma	Filipendula ulmaria
FraAlnu	Frangula alnus
FraExce	Fraxinus excelsior
FraVesc	Fragaria vesca
GalAlbu	Galium album
GalApar	Galium aparine agg.
GalBifi	Galeopsis bifida
GalOdor	Galium odoratum
GalPalu	Galium palustre
GalSaxa	Galium saxatile
GalSege	Galeopsis segetum
GalSylv	Galium sylvaticum
GalTetr	Galeopsis tetrahit
GalUlig	Galium uliginosum
GalVeru	Galium verum
GerDiss	Geranium dissectum
GerMoll	Geranium molle
GerPusi	Geranium pusillum
GerPyre	Geranium pyrenaicum
GerRobe	Geranium robertianum
GerSylv	Geranium sylvaticum
GeuRiva	Geum rivale
GeuUrba	Geum urbanum
GleHede	Glechoma hederacea
GlyDecl	Glyceria declinata
GlyFlui	Glyceria fluitans agg.
GnaSylv	Gnaphalium sylvaticum
GnaUlig	Gnaphalium uliginosum
GymDryo	Gymnocarpium dryopteris
HedHeli	Hedera helix
HelPube	Helictotrichon pubescens
HelSpec	Helictotrichon spec.
HerSpho	Heracleum sphondylium
HieAura	Hieracium aurantiacum
HieLach	Hieracium lachenalii
HieLaev	Hieracium laevigatum
HieMuro	Hieracium murorum
HiePilo	Hieracium pilosella
HieSaba	Hieracium sabaudum
HieSpec	Hieracium spec.
HieUmbe	Hieracium umbellatum
HolLana	Holcus lanatus
HolMoll	Holcus mollis
HorEuro	Hordelymus europaeus
HumLupu	Humulus lupulus
HypHumi	Hypericum humifusum
HypMacu	Hypericum maculatum agg.
HypPerf	Hypericum perforatum
HypPulc	Hypericum pulchrum
HypRadi	Hypochaeris radicata
HypSpec	Hypericum spec.
IleAqui	Ilex aquifolium
ImpNoli	Impatiens noli-tangere
ImpParv	Impatiens parviflora
IriPseu	Iris pseudacorus
IsoSeta	Isolepis setacea
JunAcut	Juncus acutiflorus
JunArti	Juncus articulatus
JunBulb	Juncus bulbosus
JunCong	Juncus conglomeratus
JunEffu	Juncus effusus
JunSqua	Juncus squarrosus
JunTenu	Juncus tenuis
KnaArve	Knautia arvensis
KnaSpec	Knautia spec.
LamAlbu	Lamium album
LamGale	Lamium galeobdolon agg.
LamMacu	Lamium maculatum
LamPurp	Lamium purpureum
LapComm	Lapsana communis
LarDeci	Larix decidua
LarKaem	Larix kaempferi
LarSpec	Larix spec.
LatLini	Lathyrus linifolius
LatPrat	Lathyrus pratensis
LatSpec	Lathyrus spec.
LeoAutu	Leontodon autumnalis
LeoHisp	Leontodon hispidus
LeuIrcu	Leucanthemum ircutianum
LinVulg	Linaria vulgaris
LolPere	Lolium perenne
LonPeri	Lonicera periclymenum
LotCorn	Lotus corniculatus
LotPedu	Lotus pedunculatus
LupPoly	Lupinus polyphyllus
LuzCamp	Luzula campestris
LuzLuzu	Luzula luzuloides
LuzMult	Luzula multiflora
LuzPilo	Luzula pilosa
LuzSylv	Luzula sylvatica
LycEuro	Lycopus europaeus
LysNemo	Lysimachia nemorum
LysNumm	Lysimachia nummularia
LysVulg	Lysimachia vulgaris
MaiBifo	Maianthemum bifolium
MalDome	Malus domestica
MalMosc	Malva moschata
MalSpec	Malus spec.
MalSylv	Malus sylvestris agg.
MedLupu	Medicago lupulina
MelPrat	Melampyrum pratense
MelUnif	Melica uniflora
MenArve	Mentha arvensis
MenX	Mentha x villosa
MerPere	Mercurialis perennis
MeuAtha	Meum athamanticum
MilEffu	Milium effusum
MoeTrin	Moehringia trinervia
MolCaer	Molinia caerulea
MonHypo	Monotropa hypopitys agg.
MycMura	Mycelis muralis
MyoArve	Myosotis arvensis
MyoNemo	Myosotis nemorosa
MyoScor	Myosotis scorpioides
OdoSpec	Odontites spec.
OdoVulg	Odontites vulgaris
OnoRepe	Ononis repens
OreLimb	Oreopteris limbosperma
OriVulg	Origanum vulgare
OroRapu	Orobanche rapum-genistae
OxaAcel	Oxalis acetosella
PapRhoe	Papaver rhoeas
ParQuad	Paris quadrifolia
PerDubi	Persicaria dubia
PerHydr	Persicaria hydropiper
PerLapa	Persicaria lapathifolia
PerSpec	Persicaria spec.
PetHybr	Petasites hybridus
PhaArun	Phalaris arundinacea
PheConn	Phegopteris connectilis
PhlBert	Phleum bertolonii
PhlPrat	Phleum pratense
PhyNigr	Phyteuma nigrum
PhySpic	Phyteuma spicatum
PicAbie	Picea abies
PicSitc	Picea sitchensis
PicSpec	Picea spec.
PimMajo	Pimpinella major
PimSaxi	Pimpinella saxifraga
PinSylv	Pinus sylvestris
PlaLanc	Plantago lanceolata
PlaMajI	Plantago major s. intermedia
PlaMajM	Plantago major s. major
PlantSp	Plantago spec.
PlaSpec	Platanthera spec.
PoaAnnu	Poa annua
PoaChai	Poa chaixii
PoaNemo	Poa nemoralis
PoaPalu	Poa palustris
PoaPraA	Poa pratensis agg.
PoaPrat	Poa pratensis
PoaTriv	Poa trivialis
PolAcul	Polystichum aculeatum
PolAvic	Polygonum aviculare agg.
PolMult	Polygonatum multiflorum
PolSeti	Polystichum setiferum
PolVert	Polygonatum verticillatum
PolVulA	Polypodium vulgare agg.
PolVulg	Polygala vulgaris
PopTrem	Populus tremula
PopXCan	Populus x canadensis
PotAnse	Potentilla anserina
PotErec	Potentilla erecta
PotPalu	Potentilla palustris
PotRept	Potentilla reptans
PotSter	Potentilla sterilis
PriVeri	Primula veris
PruAviu	Prunus avium
PruSero	Prunus serotina
PruSpin	Prunus spinosa
PruVulg	Prunella vulgaris
PseMenz	Pseudotsuga menziesii
PteAqui	Pteridium aquilinum
PyrComm	Pyrus communis agg.
PyrSpec	Pyrus spec.
QuePetr	Quercus petraea
QueRobu	Quercus robur
QueRubr	Quercus rubra
QueSpec	Quercus spec.
QueXRos	Quercus x rosacea
RanAcri	Ranunculus acris
RanAuri	Ranunculus auricomus agg.
RanBulb	Ranunculus bulbosus
RanFica	Ranunculus ficaria
RanFlam	Ranunculus flammula
RanPoly	Ranunculus polyanthemos s. nemorosum
RanRepe	Ranunculus repens
RanSpec	Ranunculus spec.
RhiMino	Rhinanthus minor
RibRubr	Ribes rubrum
RibUva-	Ribes uva-crispa
RobPseu	Robinia pseudoacacia
RosArve	Rosa arvensis
RosCani	Rosa canina
RosSpec	Rosa spec.
RosTome	Rosa tomentosa agg.
RubCaes	Rubus caesius
RubFrut	Rubus fruticosus agg.
RubIdae	Rubus idaeus
RubLaci	Rubus laciniatus
RumAcel	Rumex acetosella
RumAcet	Rumex acetosa
RumCris	Rumex crispus
RumObtu	Rumex obtusifolius
RumSang	Rumex sanguineus
RumSpec	Rumex spec.
SagProc	Sagina procumbens
SalAuri	Salix aurita
SalCapr	Salix caprea
SalCine	Salix cinerea
SalFrag	Salix fragilis
SalSpec	Salix spec.
SamNigr	Sambucus nigra
SamRace	Sambucus racemosa
SamSpec	Sambucus spec.
SanMino	Sanguisorba minor
SanOffi	Sanguisorba officinalis
SaxGran	Saxifraga granulata
SciSylv	Scirpus sylvaticus
ScrNodo	Scrophularia nodosa
ScrUmbr	Scrophularia umbrosa
ScuMino	Scutellaria minor
SedRupe	Sedum rupestre agg.
SedTele	Sedum telephium
SenHerc	Senecio hercynicus
SenInae	Senecio inaequidens
SenJaco	Senecio jacobaea
SenOvat	Senecio ovatus
SenSpec	Senecio spec.
SenSylv	Senecio sylvaticus
SenVisc	Senecio viscosus
SenVulg	Senecio vulgaris
SilDioi	Silene dioica
SilFlos	Silene flos-cuculi
SilLati	Silene latifolia
SilVulg	Silene vulgaris
SisOffi	Sisymbrium officinale
SolDulc	Solanum dulcamara
SolNigr	Solanum nigrum
SolVirg	Solidago virgaurea
SonArve	Sonchus arvensis
SonAspe	Sonchus asper
SonOler	Sonchus oleraceus
SorAria	Sorbus aria
SorAucu	Sorbus aucuparia
SorSpec	Sorbus spec.
SorTorm	Sorbus torminalis
SpeRubr	Spergularia rubra
StaPalu	Stachys palustris
StaSylv	Stachys sylvatica
SteAlsi	Stellaria alsine
SteAqua	Stellaria aquatica
SteGram	Stellaria graminea
SteHolo	Stellaria holostea
SteMedi	Stellaria media agg.
SteNemo	Stellaria nemorum
SucPrat	Succisa pratensis
SymOffi	Symphytum officinale
TanPart	Tanacetum parthenium
TanVulg	Tanacetum vulgare
TarSpec	Taraxacum spec.
TeuScor	Teucrium scorodonia
ThuSpec	Thuja spec.
ThyPule	Thymus pulegioides
TilCord	Tilia cordata
TorJapo	Torilis japonica
TraPrat	Tragopogon pratensis
TriArve	Trifolium arvense
TriCamp	Trifolium campestre
TriDubi	Trifolium dubium
TriEuro	Trientalis europaea
TriFlav	Trisetum flavescens
TriPerf	Tripleurospermum perforatum
TriPrat	Trifolium pratense
TriRepe	Trifolium repens
TsuSpec	Tsuga spec.
TusFarf	Tussilago farfara
UlmGlab	Ulmus glabra
UrtDioi	Urtica dioica
VacMyrt	Vaccinium myrtillus
VacViti	Vaccinium vitis-idaea
ValProc	Valeriana procurrens
VerArve	Veronica arvensis
VerBecc	Veronica beccabunga
VerCham	Veronica chamaedrys
VerHede	Veronica hederifolia
VerMont	Veronica montana
VerNigr	Verbascum nigrum
VerOffi	Veronica officinalis
VerSerp	Veronica serpyllifolia
VerSpec	Veronica spec.
VibOpul	Viburnum opulus
VicAngu	Vicia angustifolia
VicCrac	Vicia cracca
VicHirs	Vicia hirsuta
VicSati	Vicia sativa agg.
VicSepi	Vicia sepium
VicSpec	Vicia spec.
VinMino	Vinca minor
VioPalu	Viola palustris
VioReic	Viola reichenbachiana
VioRivi	Viola riviniana
VioSpec	Viola spec.
VioTric	Viola tricolor agg.