ForestBIOTA work report

Assessment of Ground Vegetation

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1. Introduction

Biodiversity has gained global attention particularly since the UNCED conference in Rio de Janeiro in 1992 and the adoption of the Convention on Biological Diversity. Ten years later the World Summit for Sustainable Development in Johannesburg reinforced the importance and formulated the overall target “to achieve by 2010 a significant reduction in the current rate of loss of biological diversity”.
For the European region the Environment for Europe Ministerial Conference in Kiew (ECE/CEP/94/Rev.1) as well as the EU in its 6th environmental action programme (Decision No 1600/2002/EC of 22 July 2002) have formulated the even more ambitious target “to halt the loss of biodiversity until 2010”. At their 4th Ministerial Conference in Vienna, April 2003, the forestry ministers of Europe and the European Community declared the aim to “further maintain, conserve, restore and, as appropriate, enhance forest biological diversity” (Vienna Resolution 4). In December 2003 Regulation (EC) No 2152/2003 (Forest Focus) entered into force aiming inter alia at the development of forest biodiversity monitoring in Europe (Art 6 (2)).

Ground vegetation information is a key parameter for biodiversity, directly expressed by the species richness and derived indices like Shannon-Wiener-Index or Simpson-Index, indirectly trough the providing of numerous ecological niches.
Furthermore ground vegetation is a bioindicator of environmental changes and can thus be used for long-term studies of vegetation dynamics and their relationship to changes in other forest ecosystem variables like deposition, climate, soil and also other key parameters for biodiversity like stand structure.

2. Methods

a. Sampling method

The ground vegetation assessments are based on a well defined methodology which is already established in all participating countries. The Ground Vegetation assessments follow the ICP-Forests Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests, chapter 8 Ground Vegetation.
In addition to this manual, the minimum requirement for the sampling design were two sampling units which differs in assessment intensity and size:

i) The ForestBIOTA plot

According to the methodology for extended stand structure and deadwood assessments the ForestBIOTA plot has a continuous area of 0,25 ha (50 x 50m recommended) and should be located in the centre of the Level II plot.
A list of all vascular plants and terricolous bryophytes and lichens should be recorded. In addition, the fencing situation is recorded.

ii) The Common Sample Area (CSA)

The CSA has a total sampling area of 400 m^2 which should be representative for the ground vegetation of the ForestBIOTA plot. The participating countries are free in the sampling design of the CSA. Number and shape of the sampling units could selected by the responsible experts.
According to the manual, a separate record, including an estimate of the global percentage cover, must be made for each species in the different vertical strata. The layers are defined as follows:

- moss layer (i.e. terricolous bryophytes and lichens),
- herb layer (all non-ligneous, and ligneous < 0.5m height),
- shrub layer (only ligneous, incl. climbers) > 0.5 m height,
- tree layer (only ligneous, incl. climbers) > 5 m height.

Also the method of the measurement of species abundance or cover is free. For data submission, the estimates were transformed into a percentage cover estimate. Fencing of the sample plot is recorded. In all cases the CSA is part of the ForestBIOTA plot.

The Nomenclature follows Flora Europaea (Tutin et al., 1968-1980; Tutin et al., 1993) for vascular plants and Frey et al. (1995) for bryophytes.

b. Participating countries

Ground Vegetation surveys were carried out by 11 countries and on 89 plots. On most of the plots both surveys were carried out, the assessment within the Common Sample Area and the species list for the ForestBIOTA plot. For Switzerland and the Slovak Republic only data from the CSA and from Greece only the species list (2500m²) were available (Figure 2.1).

Table 2.1 Overview of the number of plots with Ground Vegetation surveys.

Country	Nr of plots	Nr of plots with CSA (400m²)	thereof fenced	Nr of plots with 2500 m² species list	thereof fenced
The Netherlands	5	5	0	5	0
Germany	20	20	12	20	12
Italy	12	12	12	12	12
Denmark	3	3	2	3	2
Greece	4	0	-	4	4
Spain	12	12	0	12	0
Finland	8	8	0	8	0
Slovak Republic	3	3	0	0	0
Switzerland	16	16	0	0	0
Czech Republic	3	3	0	3	0
Ukraine	3	3	0	3	0
Total	**89**	**85**	**26**	**70**	**30**

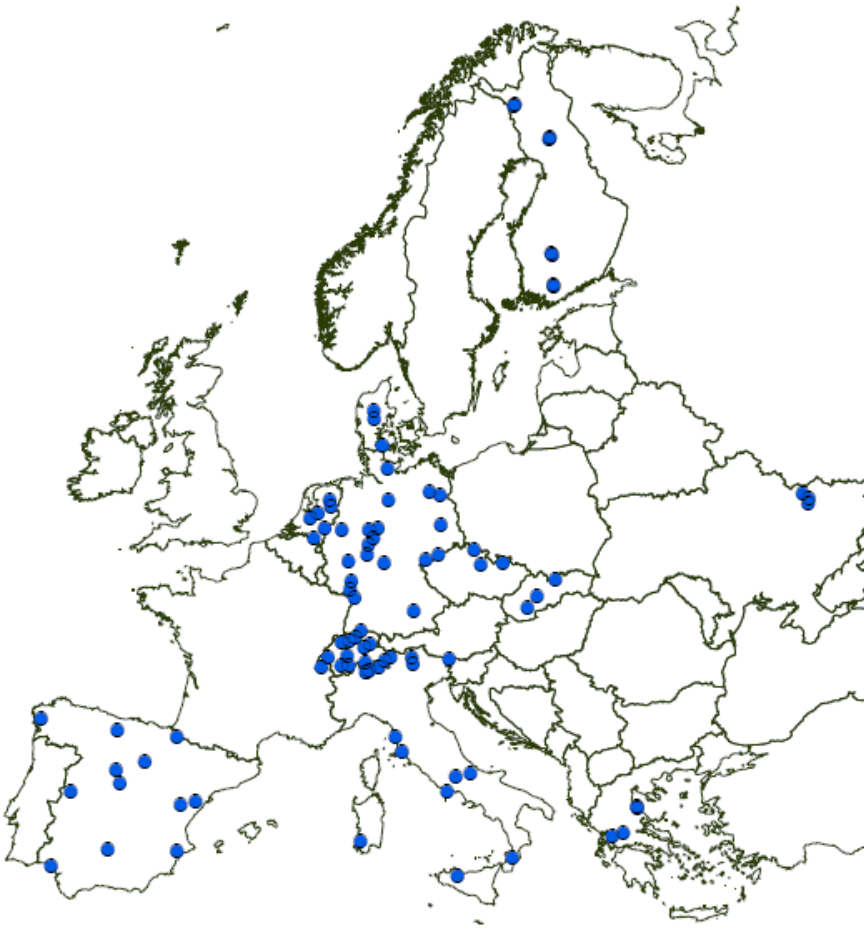

Figure 2.1: Location of the ForestBIOTA plots with ground vegetation surveys

Data management

To avoid additional costs, in some cases the existing Level II data were used, even if the plotsize was not exactly according to the requirements. So in the following cases different plotsizes were used:

- In Switzerland the CSA has a size of 500m².
- The CSA in Denmark has a total area of 462m².
- In Greece, the ForestBIOTA plot size has a size of 2800 m² at plot 4 and plot 2 has a size of 2700 m². Furthermore the species list does not include bryophytes and lichens.
- The Ukrainian ForestBIOTA plot was generated from four separately submitted 625 m² subplots. The CSA is a summation of four submitted 100 m² plots (Figure 2.1). The Coverage value for the CSA is the arithmetic mean of the single value of the Cover of a species per subplot. In cases that a species did not occur on all subplots the value of the cover was set to “0” on those subplots.

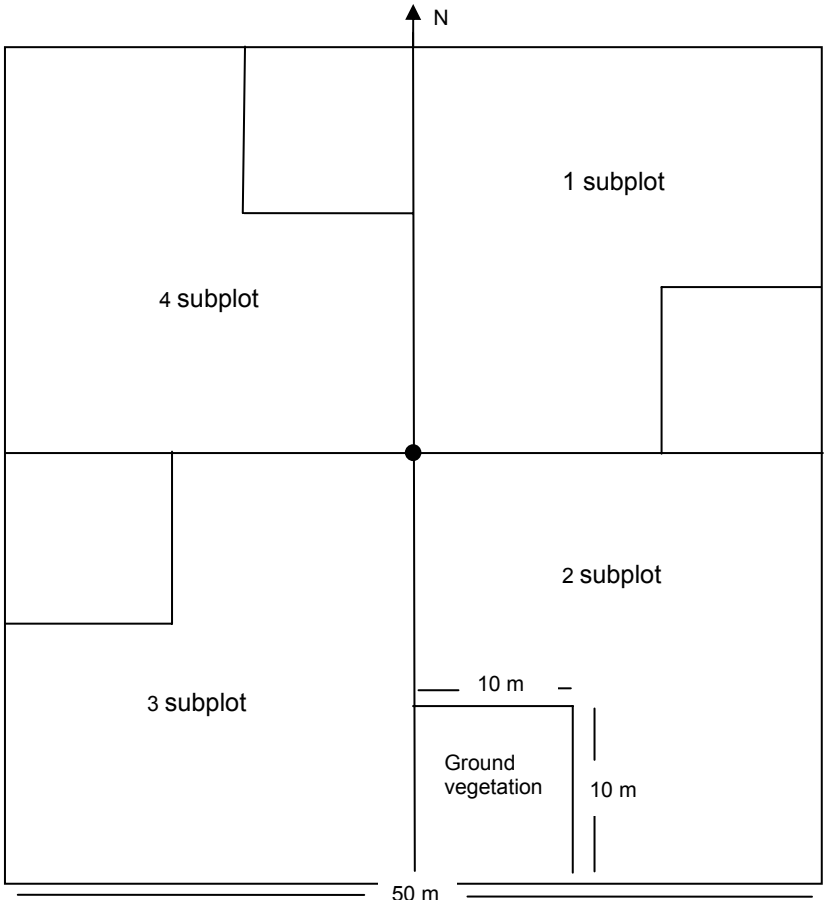

Figure 2.1 Differing plot design in Ukraine.

- For The Netherlands the CSA was generated from four subplots with an area of 75m² (=300m²). The mean Coverage value was calculated in the same way like for Ukraine
- Spain had submitted two ground vegetation surveys per year (summer and autumn). For further processing, the records were summarized. For the percentage of the coverage, the maximum value for a species was taken.

Taxonomic groups in the dataset were treated like a species in the analysis for following taxa: *Rubus fruticosus* group, *Viola sylvestris* group, *Taraxacum officinale* group, *Hieracium murorum* group, *H. argillaceum* group and *H. pictum* group.

Calculation of Diversity Indices

Besides the mere consideration of species richness, some common Diversity Indices give further information Following Indices were calculated based on the data from the CSA:

Shannon-Wiener-Index:

$H' = -\sum p_i * ld(p_i)$

where p_i is the relative abundance of the i^{th} species
and ld = dual logarithm

Evenness:

$E = H'/H'_{max}$

in which H'max is the theoretical maximum value for H' if all species in the sample were equally abundant.

Simpson index:

$D = 1 - \sum p_i^2$

3. Results

Species Richness

Forests usually comprise several horizontal vegetation layers. Therefore the data analysis was not reduced to the total number of all species; instead, also the layerwise species richness was considered.
In total 1056 different ground vegetation species were found on 89 ForestBIOTA plots. 158 species are terricolous lichens or bryophytes.
In 291 cases the determination of a species could made only at genus level.

Common Sample Area

The mean total number of different species on the 85 analysed CSA was 32 with a standard error of 1.99 and a standard deviation of 18.3. A beech forest plot in Germany had the lowest (2 species) and a mountainous *Picea* and *Abies* Woodland in Switzerland (107 species) had the highest species richness.

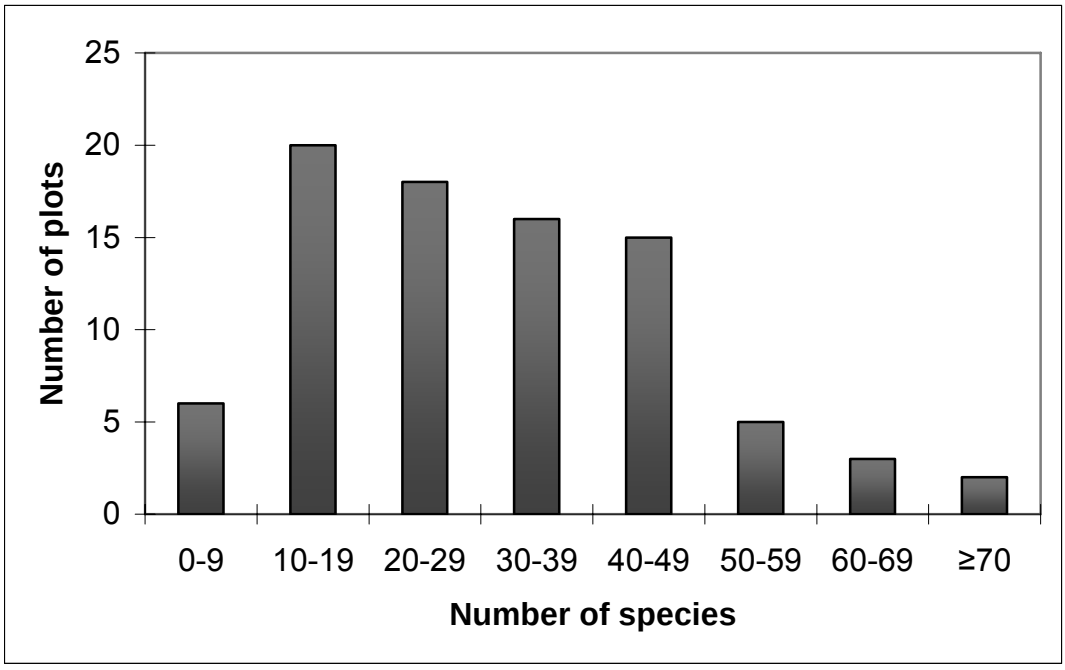

Figure 3.1 Total number of species recorded in the Common Sample Area (n=85 plots)

Plots with high species numbers were mostly located in the Alps and on the Iberian Peninsula, whereas on central European plots the species richness was mostly lower than 30 species per 400m² (Figure 3.2).

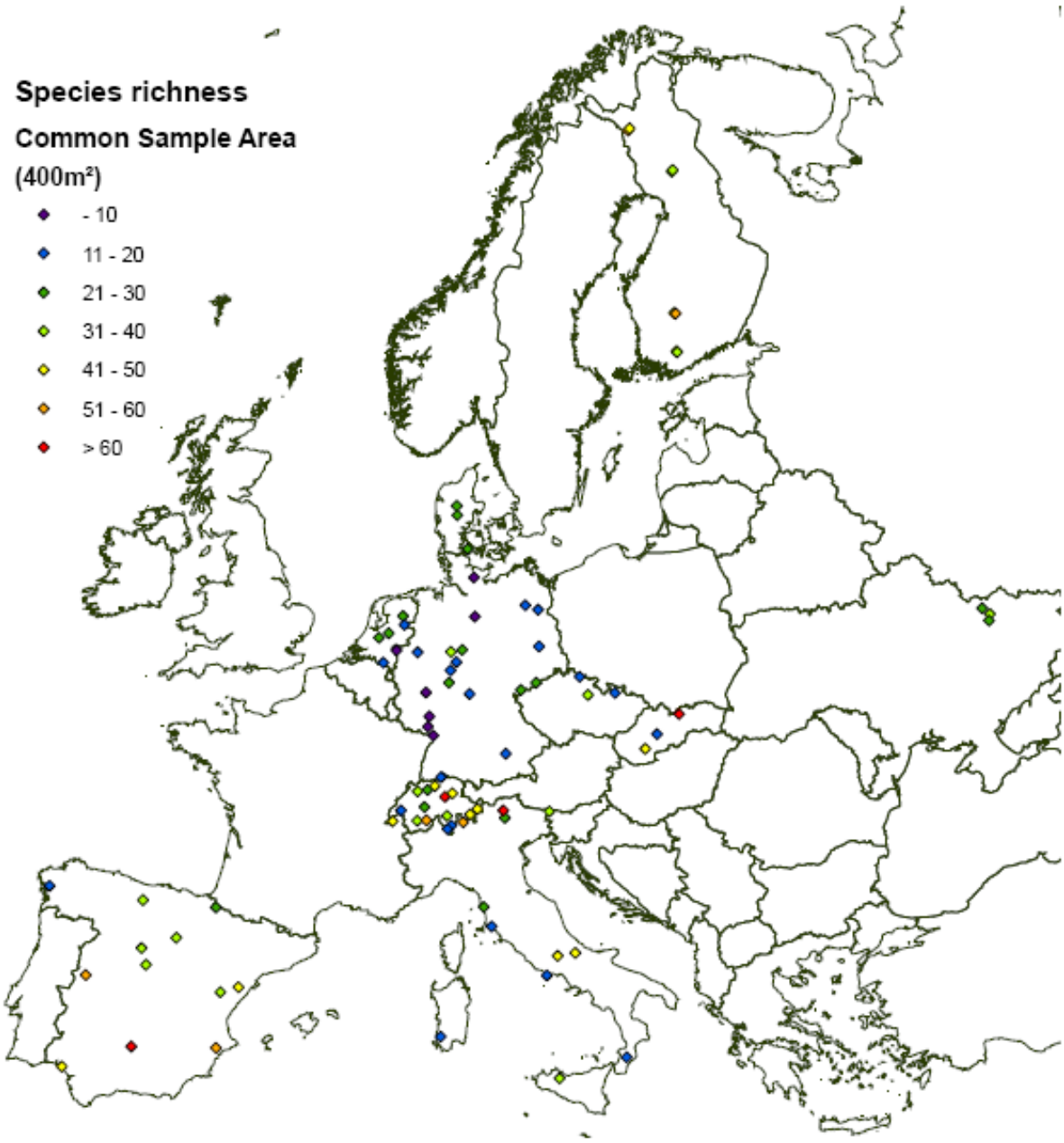

Figure 3.2 Number of plant species recorded in the common sample area (400m²) of the ForestBIOTA plots.

The mean number of plant species differed between the forest types (Figure 3.3). The lowland beech forests were the less species rich forest types, but with a high standard deviation mainly due to different soil and light conditions. On plots in coniferous plantations the number of different species was only a little higher (21) than in the lowland beech forests (18), but the ratio of vascular plants is lower than 50%.

Only in Taiga woodlands the ratio of terricolous lichen and bryophytes on the plant diversity has a higher value (62%) than in coniferous plantations, which indicates the importance of cryptogam species with respect to total plant diversity. The mean total species number on plots in the Taiga was even higher than on plots in the Mediterranean regions.

As expected, the species richness the later forest types are still high (mean of 35-40 species per plot) and the ratio of vascular plants is in most cases lower than 10 %.

Also high mean species number (mean 41 species) was detected on plots in fir and spruce woodlands, located mainly in the Alps and other mountainous areas.

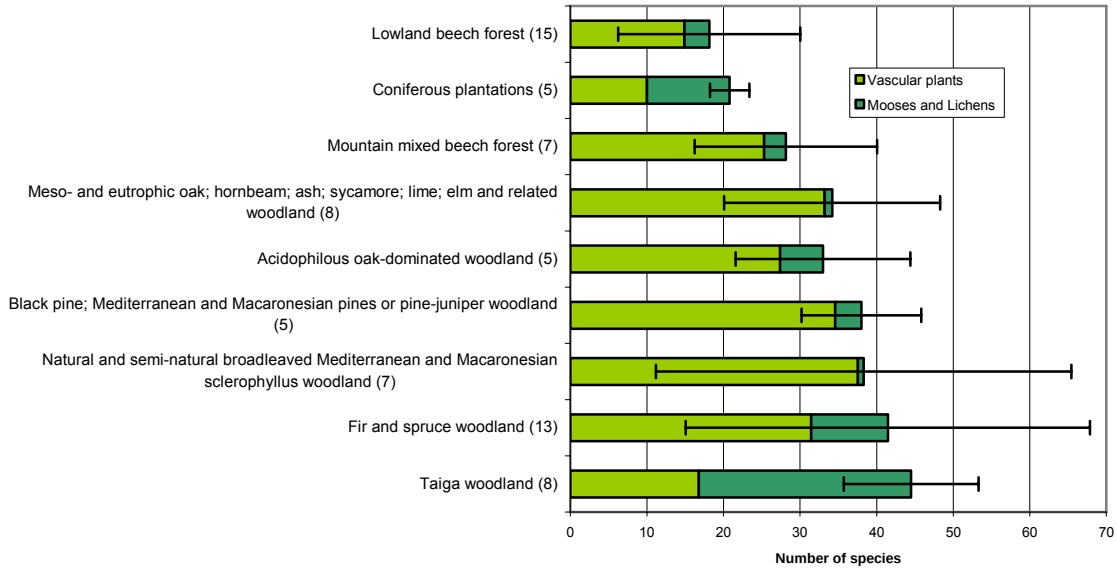

Figure 3.3 Mean number of vascular plant species and number of terricolous mosses and lichens species recorded at the Common Sample Area (400m²) classified in forest types. Only forest types with more than four occurrences were taken into account (in brackets the number of plots). Error bars indicate standard deviation.

ForestBIOTA plot
The total plant species richness and also the species richness for trees, all vascular plants (including trees) and cryptogams are provided in Annex 4.

Species Diversity and Evenness

The Shannon-Wiener Index (=Shannon Index) was calculated as an indicator for the diversity of the plant communities. The higher the values of the Shannon Index are the smaller is the probability to predict the species of a given individual picked at random. Thus high Shannon indices indicate a high diversity in a plant community. For a given number of species, the Shannon Index has thus the largest value when every individual belongs to a different species.

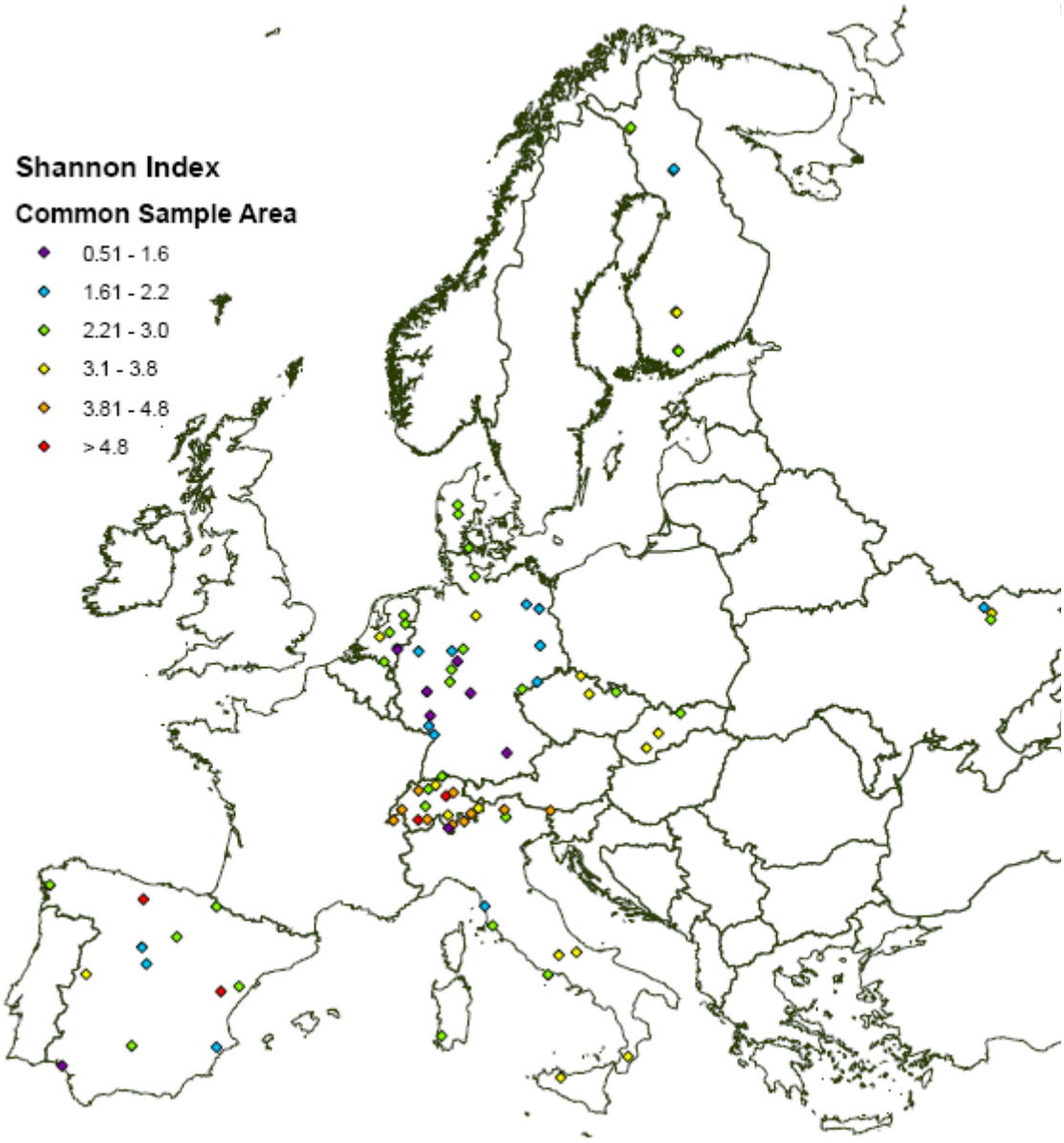

Figure 3.4 Shannon-Wiener-Index of the ground vegetation (herb and moss layer) calculated for the Common Sample Area (400m²).

The Shannon index for the ForestBIOTA plots (Annex 5 and Figure 3.4) shows a similar distribution as the species richness. This may partly be partly explained by the high influence of the species richness to the calculation of the Shannon Index. Especially the plots in the Alps have in most cases values higher than 3.5 whereas in the central European plots in Germany and the Netherlands the values are often lower than 3.

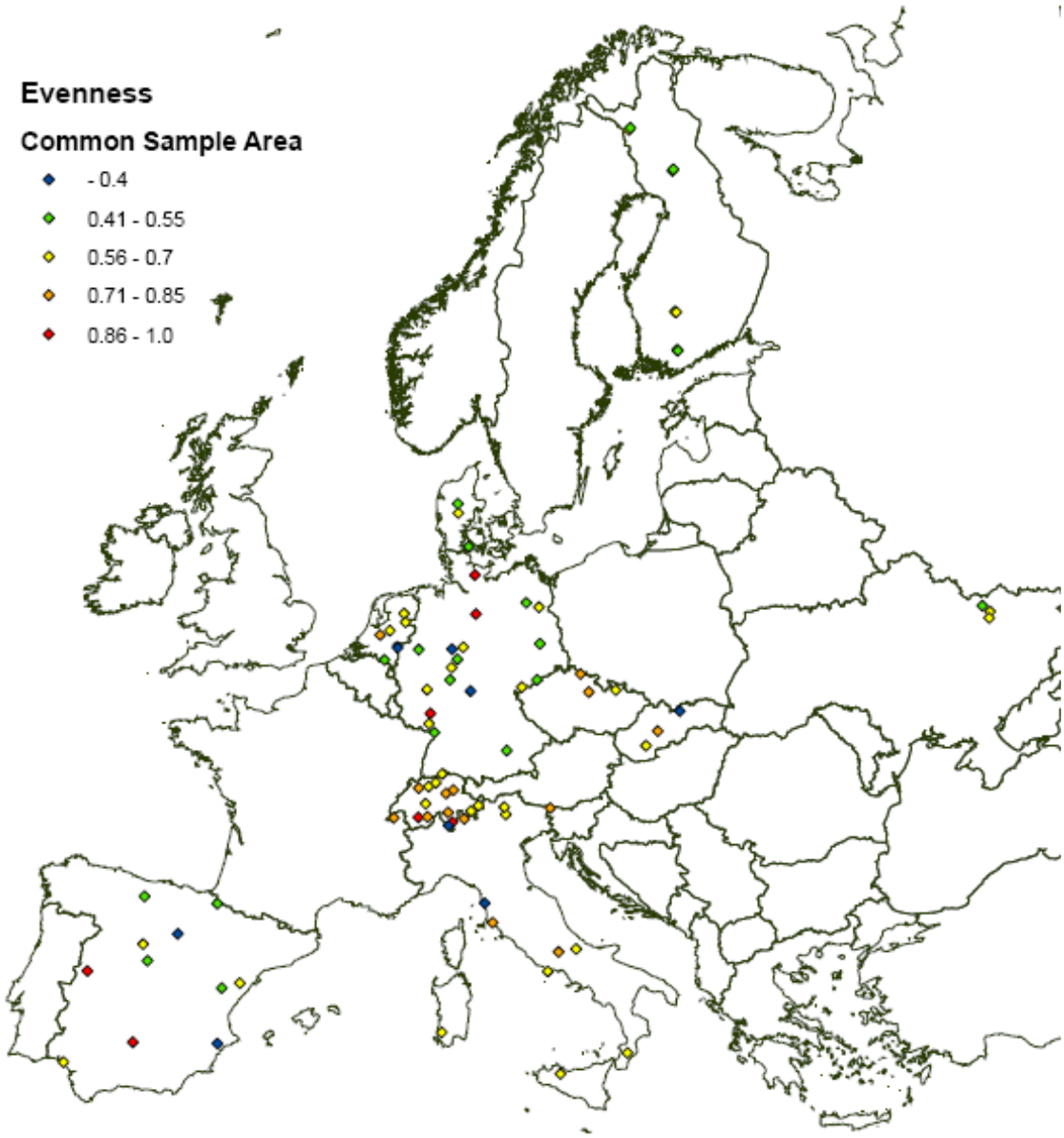

Figure 3.5 Evenness calculated for the ground vegetation (herb and moss layer) on the Common Sample Area (400m²).

The Evenness (Figure 3.5) provides information of the relative distribution of individuals among the species present in a community. That means that the evenness is greatest when species are equally abundant, independent of the species richness of a plant community.
The comparison of Evenness and species richness and/or the Shannon index on plot level shows different situations:
Low species richness and high evenness..occurs on some beech plots in Northern Germany, where only some species with very low abundances occur.
On the other hand, plot 919 in Germany is an example for a low species diversity and richness and also a low Evenness due to the dominance of *Impatiens parviflora* and *Fagus sylvatica* in the herb layer.
Plot 26 in Spain is representing a typical species rich (88 species) plot where the coverage of most of the species does not attain more than 0.1%. In conclusion also the evenness has a high value (0.99).

But also species rich communities can have a low Evenness. On the CSA of the plot 207 in the Slovak Republic 61 different species occur in the ground vegetation (herb and moss layer), but the evenness has a value of 0.4. Most species do not reach a coverage of more than 0.2 % but the herb layer is dominated by *Oxalis* acetosella (10%) and even more important the moos *Dicranum scoparium* has a coverage of nearly 70%.

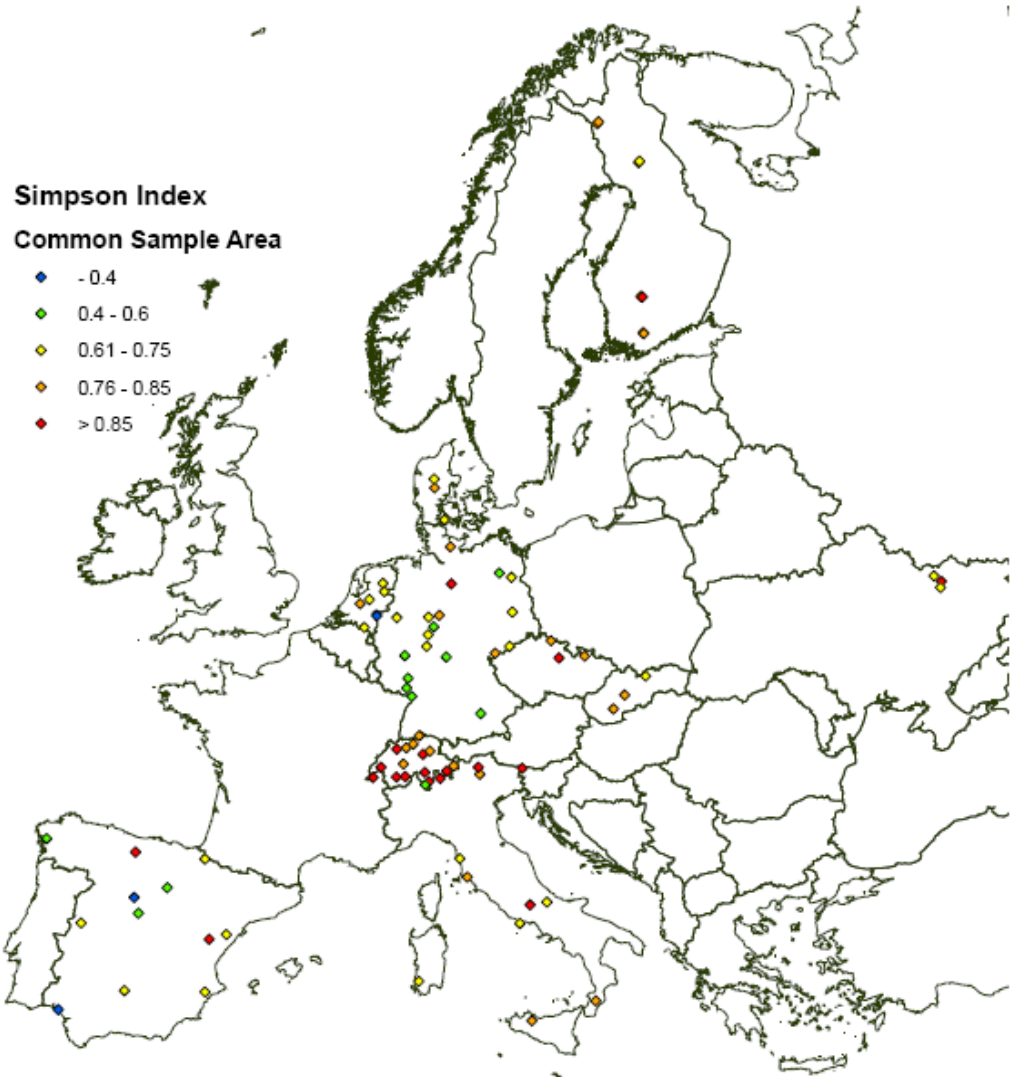

Figure 3.6 Simpson Index calculated for the ground vegetation (herb and moss layer) on the Common Sample Area (400m²).

The Simpson Index takes into account the number of the occurring species, as well as the abundance of each species. The Index measures the probability that two individuals randomly selected from a sample will belong to the same species. The value of the Simpson Index could range between 0 and 1, where values near to one are indicating the greater sample diversity. In this case, the index represents the probability that two individuals randomly selected from a sample will belong to different species.
High values of the Simpson Index could found again in the Alps. Also the plots in Italy, the Czech Republic and the Slovak Republic have relatively high values.

Annex

Annex 1: General plot information

country	*plotnr*	*Foresttype (2nd level)*	*Main-treespecies*	*Altitude*	*Mean age*
The Netherlands	106	FT3A	Pseudotsuga menziesii	<= 50 m	61 - 80
	175	FT3A	Pinus sylvestris	<= 50 m	41 - 60
	1040	FT1N.5	Quercus robur	<= 50 m	61 - 80
	2084	FT3A	Pseudotsuga menziesii	51 - 100 m	41 - 60
	2085	FT3A	Pinus sylvestris	<= 50 m	41 - 60
Germany	101	FT1N.3a	Fagus sylvatica	<= 50 m	101 - 120
	301	FT1N.3a	Fagus sylvatica	101 - 150 m	101 - 120
	305	FT3N.1	Picea abies	501 - 550 m	101 - 120
	502	FT1N.7	Quercus robur	<= 50 m	101 - 120
	503	FT1N.3a	Fagus sylvatica	51 - 100 m	101 - 120
	508	FT1N.3a	Fagus sylvatica	351 - 400 m	101 - 120
	603	FT1N.3a	Fagus sylvatica	301 - 350 m	101 - 120
	606	FT1N.3a	Fagus sylvatica	401 - 450 m	> 120
	608	FT1N.3a	Fagus sylvatica	401 - 450 m	> 120
	703	FT1N.3a	Fagus sylvatica	551 - 600 m	61 - 80
	704	FT1N.3a	Fagus sylvatica	351 - 400 m	101 - 120
	706	FT1N.1	Quercus robur	101 - 150 m	81 - 100
	707	FT4N.2	Pinus sylvestris	501 - 550 m	> 120
	903	FT1N.3a	Fagus sylvatica	801 - 850 m	> 120
	919	FT1N.3a	Fagus sylvatica	501 - 550 m	> 120
	1202	FT3N.3	Pinus sylvestris	<= 50 m	61 - 80
	1203	FT3N.3	Pinus sylvestris	<= 50 m	61 - 80
	1205	FT3N.3	Pinus sylvestris	<= 50 m	61 - 80
	1401	FT3N.1	Picea abies	801 - 850 m	61 - 80
	1402	FT3N.1	Picea abies	701 - 750 m	101 - 120
Italy	1	FT1N.3b	Ostrya carpinifolia	1451 - 1500 m	101 - 120
	3	FT1N.3b	Fagus sylvatica	901 - 950 m	101 - 120
	8	FT3N.1	Picea abies	801 - 850 m	61 - 80
	10	FT3N.1	Picea abies	1151 - 1200 m	41 - 60
	14	FT2N	Quercus ilex	651 - 700 m	101 - 120
	15	FT1N.7	Quercus cerris	901 - 950 m	21 - 40
	16	FT2N	Quercus ilex	101 - 150 m	21 - 40
	17	FT3N.1	Picea abies	1751 - 1800 m	101 - 120
	21	FT1N.7	Fraxinus angustifolia	951 - 1000 m	21 - 40
	22	FT2N	Quercus ilex	151 - 200 m	21 - 40
	25	FT2N	Quercus ilex	<= 50 m	Irregular stands
	27	FT3N.1	Picea abies	1701 - 1750 m	101 - 120
Denmark	51	FT3A	Picea abies	<= 50 m	41 - 60
	64	FT1N.3a	Fagus sylvatica	<= 50 m	81 - 100
	95	FT1N.5	Quercus robur	<= 50 m	> 120
Greece	1	FT2N	Quercus ilex	351 - 400 m	41 - 60
	2	FT1N.4	Quercus frainetto	701 - 750 m	61 - 80
	3	FT1N.3b	Fagus moesiaca	851 - 900 m	81 - 100

	4	FT3N.1	Abies borisii-regis	1151 - 1200 m	81 - 100
Spain	5	FT3N.4	Pinus sylvestris	1501 - 1550 m	101 - 120
	6	FT2N	Quercus ilex	701 - 750 m	41 - 60
	10	999	Pinus pinea	51 - 100 m	41 - 60
	11	FT2N	Quercus suber	451 - 500 m	101 - 120
	15	FT1N.3b	Fagus sylvatica	851 - 900 m	81 - 100
	22	FT3N.4	Pinus nigra	1401 - 1450 m	101 - 120
	25	FT3N.4	Pinus halepensis	751 - 800 m	41 - 60
	26	FT2N	Quercus ilex	601 - 650 m	41 - 60
	30	FT3N.4	Pinus sylvestris	1101 - 1150 m	61 - 80
	33	FT1N.5	Quercus petraea	1101 - 1150 m	41 - 60
	37	FT3N.4	Pinus pinaster	751 - 800 m	41 - 60
	102	999	Pinus pinaster	251 - 300 m	41 - 60
Finland	2	FT3N.6	Pinus sylvestris	301 - 350 m	41 - 60
	3	FT3N.6	Picea abies	251 - 300 m	61 - 80
	5	FT3N.6	Picea abies	251 - 300 m	61 - 80
	6	FT3N.6	Pinus sylvestris	101 - 150 m	21 - 40
	10	FT3N.6	Pinus sylvestris	151 - 200 m	61 - 80
	11	FT3N.6	Picea abies	151 - 200 m	41 - 60
	12	FT3N.6	Picea abies	101 - 150 m	41 - 60
	13	FT3N.6	Pinus sylvestris	101 - 150 m	41 - 60
Slovak Republic	201	FT1N.7	Quercus cerris	201 - 250 m	61 - 80
	206	FT1N.3a	Fagus sylvatica	551 - 600 m	61 - 80
	207	FT3N.1	Picea abies	1101 - 1150 m	> 120
Switzerland	1	FT3N.1	Picea abies	1151 - 1200 m	Irregular stands
	2	FT3N.1	Picea abies	1551 - 1600 m	Irregular stands
	3	FT1N.3b	Fagus sylvatica	1101 - 1150 m	Irregular stands
	4	FT3N.2	Pinus cembra	1851 - 1900 m	Irregular stands
	5	FT3N.1	Picea abies	1351 - 1400 m	Irregular stands
	6	FT1N.3b	Fagus sylvatica	1201 - 1250 m	Irregular stands
	7	FT1N.5	Quercus petraea	501 - 550 m	Irregular stands
	8	FT1N.3b	Fagus sylvatica	801 - 850 m	Irregular stands
	9	FT3N.2	Pinus sylvestris	1051 - 1100 m	Irregular stands
	10	FT3N.2	Pinus mugo	1851 - 1900 m	Irregular stands
	11	FT1N.3a	Fagus sylvatica	551 - 600 m	Irregular stands
	12	FT1N.5	Quercus cerris	951 - 1000 m	Irregular stands
	13	FT1N.3a	Fagus sylvatica	451 - 500 m	Irregular stands
	14	FT3N.3	Pinus sylvestris	651 - 700 m	Irregular stands
	15	FT3N.1	Abies alba	451 - 500 m	Irregular stands
	16	FT1N.3b	Fagus sylvatica	751 - 800 m	Irregular stands
Czech Republic	541	FT3N.1	Picea abies	1251 - 1300 m	101 - 120
	2015	FT4N.5	Fagus sylvatica	901 - 950 m	> 120
	2171	FT1N.7	Carpinus betulus	251 - 300 m	81 - 100
Ukraine	1	FT1N.7	Quercus robur	151 - 200 m	81 - 100
	2	FT1N.7	Quercus robur	not known	81 - 100
	3	FT1N.7	Quercus robur	not known	81 - 100

Annex 2: Code list for the forest types (2nd level) on ForestBIOTA plots

code	***description***
FT1N.1	Fluvial and riparian woodland
FT1N.3a	Lowland beech forest
FT1N.3b	Mountain mixed beech forest
FT1N.4	Thermophilous deciduous woodland
FT1N.5	Acidophilous oak-dominated woodland
FT1N.7	Meso- and eutrophic oak; hornbeam; ash; sycamore; lime; elm and related woodland
FT2N	Natural and semi-natural broadleaved Mediterranean and Macaronesian sclerophyllus woodland
FT3A	Coniferous plantations
FT3N.1	Fir and spruce woodland
FT3N.2	Alpine larch-Arolla and mountain pine woodland
FT3N.3	Scots pine woodland
FT3N.4	Black pine; Mediterranean and Macaronesian pines or pine-juniper woodland
FT3N.6	Taiga woodland
FT4N.2	Hemiboreal forest
FT4N.5	Mixed fir-spruce-beech woodland
999	not defined

Annex 3: Species richness (number of species) in the Common Sample Area

Country	*plotnr*	*Number of species in*					*Percentage of Cryptogames*
		all layers	*Tree layer*	*Shrub layer*	*Herb layer*	*Moss layer*	
The Netherlands	106	20	2	2	7	12	60.0
	175	17	1	2	11	6	35.3
	1040	28	4	4	14	11	39.3
	2084	21	1	0	6	15	71.4
	2085	24	2	6	16	6	25.0
Germany	101	6	1	0	3	3	50.0
	301	9	2	0	2	7	77.8
	305	21	1	3	12	9	42.9
	502	4	2	0	2	1	25.0
	503	17	1	3	10	7	41.2
	508	34	2	3	27	6	17.6
	603	26	1	2	23	3	11.5
	606	15	4	3	11	0	0.0
	608	18	1	0	15	3	16.7
	703	2	1	0	2	0	0.0
	704	5	1	0	4	1	20.0
	706	9	3	0	6	3	33.3
	707	10	2	2	6	3	30.0
	903	20	1	2	19	0	0.0
	919	12	2	3	10	0	0.0
	1202	15	3	6	9	3	20.0
	1203	13	1	2	8	3	23.1
	1205	16	2	4	9	6	37.5
	1401	21	1	2	15	6	28.6
	1402	26	1	4	20	4	15.4
Italy	1	19	1	1	18	1	5.3
	3	33	2	1	31	2	6.1
	8	57	2	5	47	10	17.5
	10	45	4	5	38	6	13.3
	14	18	6	7	17	0	0.0
	15	33	1	9	27	0	0.0
	16	29	9	12	24	2	6.9
	17	30	1	3	14	14	46.7
	21	49	10	11	44	0	0.0
	22	15	6	12	15	0	0.0
	25	16	4	6	13	1	6.3
	27	64	4	6	49	13	20.3
Denmark	51	22	1	0	6	15	68.2
	64	26	1	1	13	11	42.3
	95	30	2	0	23	5	16.7
Greece	1	n.d.					
	2	n.d.					
	3	n.d.					
	4	n.d.					

Spain	5	33	1	3	30	2	6.1
	6	48	2	10	44	2	4.2
	10	42	1	6	35	3	7.1
	11	53	1	0	53	0	0.0
	15	25	1	9	19	2	8.0
	22	37	1	4	32	4	10.8
	25	51	1	7	48	2	3.9
	26	89	1	1	88	0	0
	30	31	1	0	26	5	16.1
	33	39	1	2	37	2	5.1
	37	38	1	2	33	4	10.5
	102	19	5	5	15	1	5.3
Finland	2	55	n.d.	2	13	42	76.4
	3	35	n.d.	1	12	23	65.7
	5	47	n.d.	2	8	38	80.9
	6	40	n.d.	1	13	27	67.5
	10	40	n.d.	5	16	23	57.5
	11	60	n.d.	3	28	32	53.3
	12	41	n.d.	1	20	21	51.2
	13	38	n.d.	5	21	16	42.1
Slovak Republic	201	45	2	10	35	1	2.2
	206	17	4	0	14	0	0
	207	69	4	6	43	18	26.1
Switzerland	1	107	2	6	87	17	19.5
	2	24	1	1	13	11	84.6
	3	36	5	6	33	3	9.1
	4	47	2	2	41	6	14.6
	5	37	3	1	28	8	28.6
	6	15	2	2	11	3	27.3
	7	49	6	11	41	6	14.6
	8	20	2	4	19	1	5.3
	9	39	3	6	31	6	19.4
	10	44	1	1	40	4	10.0
	11	17	2	2	14	3	21.4
	12	19	3	9	15	4	26.7
	13	48	2	4	42	5	11.9
	14	57	2	16	52	3	5.8
	15	21	6	2	11	8	72.7
	16	49	7	4	40	8	19.5
Czech Republic	541	17	n.d.	0	11	6	35.3
	2015	18	n.d.	1	14	4	22.2
	2171	40	n.d.	1	37	3	7.5
Ukraine	1	26	3	13	19	0	0
	2	36	5	11	29	0	0
	3	26	6	11	21	0	0

n.d.: no data

Annex 4: Species richness (number of species) at the ForestBIOTA plots (2500m²). The number of tree species is derived from the Species list of the Stand structure data.

Country	*plotnr*	*Number of species of*				*Percentage of Cryptogames*
		all Layers	*Trees*	*Vascular plants*	*Cryptogames*	
The Netherlands	106	21	n.d.	9	12	57.1
	175	18	n.d.	12	6	33.3
	1040	30	n.d.	19	11	36.7
	2084	23	n.d.	8	15	65.2
	2085	26	n.d.	20	6	23.1
Germany	101	15	1	8	7	46.7
	301	9	2	2	7	77.8
	305	25	1	14	11	44.0
	502	8	3	5	3	37.5
	503	26	2	19	7	26.9
	508	40	4	34	6	15.0
	603	41	2	35	6	14.6
	606	20	4	19	1	5.0
	608	32	1	28	4	12.5
	703	8	1	6	2	25.0
	704	15	1	12	3	20.0
	706	14	5	10	4	28.6
	707	17	5	11	6	35.3
	903	32	1	30	2	6.3
	919	22	2	20	2	9.1
	1202	18	7	14	4	22.2
	1203	16	1	13	3	18.8
	1205	18	1	12	6	33.3
	1401	25	1	18	7	28.0
	1402	28	1	24	4	14.3
Italy	1	26	1	25	1	3.8
	3	39	2	37	2	5.1
	8	64	3	53	11	17.2
	10	63	9	56	7	11.1
	14	25	5	25	0	0.0
	15	46	3	45	1	2.2
	16	35	13	33	2	5.7
	17	34	2	17	17	50.0
	21	68	13	66	2	2.9
	22	19	10	19	0	0.0
	25	21	8	19	2	9.5
	27	85	4	69	16	18.8
Denmark	51	27	4	10	17	63.0
	64	31	4	19	12	38.7
	95	36	4	28	8	22.2
Greece	1	50	6	50	n.d.	n.d.
	2	31	6	31	n.d.	n.d.
	3	6	1	6	n.d.	n.d.
	4	38	3	38	n.d.	n.d.
Spain	5	36	1	34	2	5.6

	6	65	n.d.	63	2	3.1
	10	47	1	44	3	6.4
	11	57	1	57	0	0
	15	33	1	31	2	6.1
	22	51	1	47	4	7.8
	25	61	1	59	2	3.3
	26	121	1	121	0	0
	30	47	1	42	5	10.6
	33	39	2	37	2	5.1
	37	50	1	46	4	8.0
	102	19	2	18	1	5.3
Finland	2	77	3	16	61	79.2
	3	77	2	23	54	70.1
	5	61	4	15	46	75.4
	6	67	1	21	46	68.7
	10	54	3	24	30	55.6
	11	76	4	37	39	51.3
	12	72	3	40	32	44.4
	13	59	3	31	28	47.5
Slovak Republic	201	n.d.	1	n.d.	n.d.	n.d.
	206	n.d.	1	n.d.	n.d.	n.d.
	207	n.d.	2	n.d.	n.d.	n.d.
Switzerland	1	n.d.	3	n.d.	n.d.	n.d.
	2	n.d.	1	n.d.	n.d.	n.d.
	3	n.d.	5	n.d.	n.d.	n.d.
	4	n.d.	2	n.d.	n.d.	n.d.
	5	n.d.	2	n.d.	n.d.	n.d.
	6	n.d.	2	n.d.	n.d.	n.d.
	7	n.d.	2	n.d.	n.d.	n.d.
	8	n.d.	3	n.d.	n.d.	n.d.
	9	n.d.	2	n.d.	n.d.	n.d.
	10	n.d.	1	n.d.	n.d.	n.d.
	11	n.d.	2	n.d.	n.d.	n.d.
	12	n.d.	3	n.d.	n.d.	n.d.
	13	n.d.	1	n.d.	n.d.	n.d.
	14	n.d.	4	n.d.	n.d.	n.d.
	15	n.d.	4	n.d.	n.d.	n.d.
	16	n.d.	4	n.d.	n.d.	n.d.
Czech Republic	541	25	2	19	6	24.0
	2015	35	2	29	6	17.1
	2171	55	3	52	3	5.5
Ukraine	1	27	n.d.	27	0	0
	2	38	n.d.	38	0	0
	3	26	n.d.	26	0	0

n.d.: no data

Annex 5: Diversity Indices (Shannon, Evenness and Simpson-Index) calculated for the Common Sample Area

country	*plotnr*	*groundvegetation (herb and moss layer)*			*only herb layer*		
		Shannon	*Evenness*	*Simpson*	*Shannon*	*Evenness*	*Simpson*
The Netherlands	106	2.815	0.663	0.700	1.275	0.454	0.717
	175	2.244	0.549	0.661	1.251	0.362	0.939
	1040	3.339	0.719	0.834	2.277	0.598	0.840
	2084	2.836	0.646	0.746	0.384	0.149	0.998
	2085	2.466	0.553	0.738	1.466	0.366	0.911
Germany	101	2.585	1.000	0.833	1.292	0.815	0.917
	301	3.170	1.000	0.889	0.704	0.704	0.975
	305	2.468	0.562	0.784	1.243	0.347	0.920
	502	0.510	0.322	0.180	0.448	0.448	0.180
	503	2.136	0.523	0.652	1.859	0.560	0.653
	508	1.917	0.380	0.635	1.864	0.392	0.635
	603	2.392	0.509	0.705	2.376	0.525	0.705
	606	1.471	0.425	0.574	1.471	0.425	0.574
	608	2.522	0.605	0.703	2.406	0.616	0.703
	703	1.000	1.000	0.500	1.000	1.000	0.500
	704	1.573	0.678	0.559	1.417	0.708	0.560
	706	1.656	0.523	0.488	1.127	0.436	0.984
	707	1.829	0.577	0.551	1.687	0.653	0.551
	903	1.463	0.344	0.405	1.463	0.344	0.405
	919	1.367	0.411	0.503	1.367	0.411	0.503
	1202	1.756	0.490	0.567	1.019	0.322	0.965
	1203	2.162	0.625	0.742	1.360	0.453	0.791
	1205	2.052	0.525	0.706	1.183	0.373	0.735
	1401	2.618	0.596	0.765	2.322	0.594	0.766
	1402	2.022	0.441	0.638	1.738	0.402	0.643
Italy	1	3.449	0.812	0.872	3.239	0.777	0.874
	3	3.252	0.645	0.836	3.181	0.642	0.836
	8	4.524	0.776	0.885	3.756	0.676	0.889
	10	4.295	0.787	0.882	3.476	0.662	0.888
	14	2.523	0.617	0.699	2.523	0.617	0.699
	15	3.084	0.649	0.818	3.084	0.649	0.818
	16	1.859	0.395	0.611	1.806	0.394	0.611
	17	2.931	0.610	0.750	1.421	0.373	0.777
	21	3.297	0.604	0.701	3.297	0.604	0.701
	22	2.656	0.680	0.741	2.656	0.680	0.741
	25	2.743	0.721	0.826	2.637	0.713	0.826
	27	4.106	0.690	0.870	3.275	0.583	0.884
Denmark	51	2.515	0.573	0.774	0.433	0.168	0.998
	64	2.418	0.527	0.664	1.725	0.466	0.665
	95	2.432	0.506	0.726	2.262	0.500	0.726
Spain	5	2.077	0.415	0.534	2.019	0.411	0.534
	6	3.599	0.652	0.718	3.461	0.634	0.718
	10	2.946	0.561	0.613	2.742	0.535	0.614
	11	5.728	1.000	0.981	5.728	1.000	0.981

	15	2.002	0.456	0.616	1.900	0.447	0.616
	22	2.674	0.517	0.643	2.531	0.506	0.644
	25	2.219	0.393	0.499	1.849	0.331	0.510
	26	6.397	0.990	0.987	6.397	0.990	0.987
	30	1.751	0.353	0.377	1.420	0.302	0.378
	33	2.454	0.464	0.531	2.356	0.452	0.531
	37	2.969	0.570	0.677	1.894	0.376	0.991
	102	0.983	0.246	0.298	0.972	0.249	0.298
Finland	2	3.191	0.552	0.805	1.336	0.361	0.963
	3	2.469	0.481	0.754	1.210	0.338	0.935
	5	2.735	0.495	0.793	0.717	0.239	0.945
	6	2.166	0.407	0.627	0.919	0.248	0.966
	10	2.411	0.456	0.724	1.117	0.279	0.952
	11	3.680	0.623	0.888	1.799	0.374	0.964
	12	2.827	0.528	0.783	1.325	0.307	0.863
	13	2.641	0.507	0.788	1.519	0.346	0.915
Slovak Republic	201	3.322	0.643	0.817	3.322	0.648	0.817
	206	3.001	0.788	0.785	3.001	0.788	0.785
	207	2.344	0.395	0.619	1.471	0.271	0.958
Switzerland	1	5.343	0.797	0.962	3.915	0.608	0.978
	2	2.719	0.593	0.767	1.121	0.303	0.853
	3	4.048	0.783	0.895	3.616	0.717	0.898
	4	3.832	0.690	0.866	3.116	0.582	0.877
	5	3.638	0.704	0.860	3.095	0.644	0.862
	6	3.807	1.000	0.929	2.991	0.865	0.944
	7	4.685	0.843	0.932	4.136	0.772	0.936
	8	4.490	1.039	0.941	4.405	1.037	0.941
	9	4.806	0.922	0.947	4.148	0.837	0.950
	10	3.297	0.604	0.796	2.507	0.471	0.816
	11	2.818	0.689	0.783	2.428	0.638	0.788
	12	1.596	0.376	0.548	1.453	0.372	0.548
	13	3.706	0.667	0.845	3.594	0.666	0.845
	14	4.365	0.755	0.923	3.774	0.662	0.936
	15	2.562	0.603	0.758	1.150	0.332	0.919
	16	4.027	0.721	0.846	3.718	0.699	0.846
Czech Republic	541	2.671	0.653	0.797	1.978	0.572	0.825
	2015	3.061	0.734	0.817	2.350	0.617	0.898
	2171	3.776	0.709	0.890	3.644	0.699	0.891
Ukraine	1	2.058	0.485	0.649	2.058	0.485	0.649
	2	3.256	0.670	0.855	3.256	0.670	0.855
	3	2.760	0.628	0.700	2.760	0.628	0.700