Deliverable D01.02.02
Fragmentation and other landscape metrics at European Scales

Part I: Fragmentation and other landscape metrics at European Scales. Prepared by CR03 WSL.

Part II: Refined classifications" Modelling the actual spatial distribution for specific Natura 2000 habitat types. Prepared by CR21 ALTERRA.

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Challenges in assessing and forecasting biodiversity and ecosystem

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Document Abstract

Part I

The main objectives of deliverable 1.2.2 „Fragmentation and other landscape metrics at European Scales“ is to calculate landscape metrics across Europe using the datasets assembled in Deliverable 1.2.1. In this report we describe calculations suited for the purpose of ECOCHANGE. The calculations employ the software FRAGSTATS and yield metric data for the entire continent at 2 resolutions (100m/500m pixel resolution) and 2 extents. At the 100m-pixel resolution discrete (not moving!) windows of 50x50km have been used. At the 500-m pixel resolution the calculations were performed for the extent of the entire continent. More than 20 metrics have been calculated. The metrics fulfill the following criteria: (a) quantify landscape structure for both local and regional scales, (b) likely correlation to species occurrence, (c) sensitivity to scenario-induced changes of landscape structure.

All calculations are available as ArcGIS coverage files (center points of the 50x50km windows) for the 100-m pixel resolution and as Tables for the 500-m pixel resolution.

Part II

The major objective here was to develop a refinement of land cover information into relevant ecological classes, see page 97 of the ECOCHANGE proposal task 01.02.03 “refined classifications”. This task can be considered as part II of the deliverable report D01.02.02. The ecological refinement concerns the land cover information as produced within task T01.02.02, the pan-European Land Cover Mosaics (PLCM’s), see also deliverable report D01.02.01 and http://www.synbiosys.alterra.nl/ecochange/plcm.aspx. The methodology developped is based on the experience from the PEENHAB project (Mücher et al., 2004, 2005). Land cover information next to environmental data sets with a European coverage and a high spatial resolution have a crucial role in this methodology. Since it became clear that in-situ information is often crucial next to information derived from remotely sensed information much effort was put in the collection of vegetation relevés across Europe. The modeling of the spatial distribution focussed especially on the forest and grassland ecosystems, since they are the major focus of the ECOCHANGE project. 14 Annex I habitat types (read Natura 2000) were selected as case studies to model their spatial distribution across Europe. All resulting habitat maps have a spatial resolution of 100 m which is very high for European application, but needed since most of these habitats are quite fragmented and scattered across Europe. The developed methodology seems quite successful in the spatial identification of these habitats as is shown by the detail figures. Much effort was made on the establishment of the knowledge rules for the relationship between CORINE land cover classes (CEC, 1994; Bossard et al, 2000; Büttner et al, 2004) and the Annex 1 Habitats (European Commission, 2007), see also the website http://www.synbiosys.alterra.nl/ecochange/singleclasses.aspx. The knowledge rules were largly based on the ecological knowledge of Dr R.G.H. Bunce who was responsible for that specific part in this report. Knowledge rules can be improved in the future by more in-depth exploitation of the in-situ data and use of more European expert knowledge which will definitely improved the developed spatial models, although some habitats are so locally distributed or weakly described that their spatial identification identification at the European scale is hardly possible.

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1. Introduction

Landscape metrics have been widely used to quantify landscape or individual patch properties and are standard tools to analyze landscape composition and spatial configuration (Turner et al., 2001; McGarigal et al., 2002). There are many widely used metrics available which are easy to calculate. Limitations, however, include that some metrics may be highly correlated (Riitters et al., 1995; Gustafson, 1998) and interpretation problems may arise for some metrics if used across spatial scales (Thompson et al., 2002; Wu et al., 2002; Wu, 2004).

Previous studies showed that landscape metrics measuring either patch complexity or diversity of landscape images can be successfully correlated with species occurrence (see e.g. Hamazaki (1996)). It is yet unknown whether metric calculations can be successfully linked with genetic patterns. A search in the Web of Science with the keywords listed below yielded the following results (as of Nov. 4, 2008): Keywords: landscape metrics & species: 222 hits; Keywords: landscape metrics & species distribution: 48 hits; Keywords: landscape metrics & species dispersal: 24 hits; Keywords: landscape metrics & genetic: 9 hits.

Landscape metrics either measure composition (e.g. how much, how many?) or configuration (e.g. how arranged?) and can be grouped into the following groups: (1) Area, density, and edge metrics; (2) Shape metrics; (3) Core area metrics; (4) Isolation and proximity metrics; (5) Contagion and interspersion metrics; (6) Connectivity metrics; (7) Diversity metrics.

The goal of the presented calculations is to derive a set of landscape metrics at 2 resolutions and 2 extents to be used as predictor variables in ECOCHANGE-related SDMs (species distribution models) or in landscape-genetic analyses.

2. Methods

2.1 Selected metrics

The landscape metrics used for ECOCHANGE (Table 1) fulfill the following criteria: (a) quantify landscape structure for both local and regional scales, (b) likely correlation to species occurrence, (c) sensitivity to scenario-induced changes of landscape structure. Most of the metrics that were calculated (Table 1) fulfill the 3 criteria as reported in the literature.

Table 1. Selected landscape metrics for the ECOCHANGE land-use analysis (highlighted in grey are those metrics that are of special interest to ECOCHANGE).

Metric	Definition[1]	Examples of postulated, associated landscape function/processes
Landscape composition		
PD	Patch density	Number/density of habitat patches = surrogate of fragmentation
NP	Number of patches	Number/density of habitat patches = surrogate of fragmentation
%Area	Percentage of landscape occupied by each patch type	Habitat availability has strong influence on species populations.
mPS	Mean Patch Size (ha)	Patch size is a key feature representing suitable habitat.
LPI	Largest patch index	Measures the largest contiguous patch which might be important for interior species
PR	Patch richness	Number of land-use classes
Landscape configuration		
SHAPE_MN	Mean Shape Index: measures shape complexity of a patch compared to a standard shape (square for raster format)	The number of organisms can be a function of patch shape (Hamazaki 1996).
SHAPE_AM	Area-weighted Mean Shape Index: measures shape complexity of a patch compared to a standard shape (square for raster format)	The number of organisms can be a function of patch shape (Hamazaki 1996).
LSI	Landscape shape index	The number of organisms can be a function of patch shape (Hamazaki 1996).

[1] For details see (McGarigal and Marks 1995)

Metric	Definition[2]	Examples of postulated, associated landscape function/processes
FRAC_AM	Area-weighted mean fractal dimension	Fractal dimension is a good surrogate for the complexity of edge
FRAC_MN	Mean fractal dimension	Fractal dimension is a good surrogate for the complexity of edge
ENN_MN	Mean Nearest Neighbor: measures the distance from a patch to the nearest neighboring patch of the same type, based on edge-to-edge distance (m)	Dispersal and thus species colonization and the conservation of metapopulations are determined by the distance between suitable habitats.
ENN_AM	Area-weighted mean Nearest Neighbor: measures the distance from a patch to the nearest neighboring patch of the same type, based on edge-to-edge distance (m) weighted with patch size	Dispersal and thus species colonization and the conservation of metapopulations are determined by the distance between suitable habitats.
PROX_MN	Mean Proximity Index: measures the degree of isolation and fragmentation. MPI uses the nearest neighbor statistics.	Do.
PROX_AM	Area-weighted mean Proximity Index: measures the degree of isolation and fragmentation. MPI uses the nearest neighbor statistics and considers additionally the size of neighboring patches.	Do.
IJI	Interspersion and Juxtaposition Index: measure of patch adjacency. IJI = 100 if all patch types are equally adjacent to all other patch types	The suitability as habitat for species with multiple habitat requirements depends on interspersion and juxtaposition of different habitat types.
ED	Edge Density: standardizes total edge length to a per unit area basis (m/ha)	Some species are more related to the amount of edge than to the total amount of habitat (Browder and others 1989).
TE	Total Edge (m)	Some species are more related to the amount of edge than to the total amount of habitat (Browder and others 1989).
CLUMP	Clumpyness: Degree to which patches of the same type and adjacent	Dispersal and thus species colonization depend on adjacencies of suitable habitats.
COHESION	Physical connectedness of patches of the same patch type	Dispersal and thus species colonization depend on adjacencies of suitable habitats.
CONNECT	Connectance index is defined as the number of functional joinings between all patches of the corresponding patch type. Threshold distance is 10000m in the present study	
CONTAGION	Measures the degree patches of the same class are adjacent to each other	Dispersal and thus species colonization depend on adjacencies of suitable habitats.
SHDI, SIDI	Shannon / Simpson Diversity Index	The more diverse the more niche potential

2.2 Selected computer program

We used the metric calculation program FRAGSTATS (McGarigal et al., 2002) PC version (FRAGSTATS 3.3)[3]. FRAGSTATS is able to process grid data as well as vector data, whereas the alternative program V-late[4] processes vector data only. Since most of the land-use products elaborated within the EU-ECOCHANGE project are grid-based we used FRAGSTATS version 3.3. All calculations are partially script-based (see Appendix 1).

2.3 Selected land-use covers and metric calculation

Out of the many land use products elaborated in D01.02.01 we generated 6 products along the lines described in Table 2a,b. The products are available as (a) Tables for full-extent (i.e. Europe, Fig. 1) for calculations at 500m resolution or (b) as maps (coverage files) for the *discrete* window analysis (100m resolution, excerpts in *discrete* windows of 50x50km allover Europe; see below, Figure 1 & Appendix 1, 2). The calculations at the 500-m resolution are performed with the HISLU classes, i.e. urban, arable land, grassland, forest, non-agricultural land, inland water, sea. Since the 500m resolution is rather coarse, we concentrated on the 100m resolution with three thematic classes, i.e. (1) the HISLU classes, (2) detailed grassland and forests classes and (3) classes related to intensive urban and agricultural use and non-vegetated areas. The next paragraphs yield detailed information about the calculation procedures for both the 100m and 500m resolution.

[2] For details see (McGarigal and Marks 1995)

[3] downloads: http://www.umass.edu/landeco/research/fragstats/downloads/fragstats_downloads.html

[4] download: http://arcscripts.esri.com/details.asp?dbid=13898

At the 500-m pixel resolution a reduced set of metrics (see Table 8) was calculated for the entire area of Europe at both the landscape level and the level of individual classes. Appendix 3 yields detailed information about the calculations and available data.

At the 100-m resolution calculation time and memory allocation increases considerably, hence limiting the analyses to discrete window analysis. Thus we calculated tiles (windows) with a size of 50x50km all across Europe. For each tile (50x50km quadrat) all metrics described in Table 1 have been calculated for both the landscape level and the level of individual classes. The classes are as follows: (1) the HISLU classes (Table 2a), (2) classes related to grassland, forest and other vegetated areas extracted from CLC level3 (grassland classes: 231, 321; forest classes: 311, 312, 313; other „green“ classes: 141, 322, 323, 324) (Table 2b), and (3) classes related to intensive urban and agricultural use and non-vegetated areas (Table 2b). The data sets (2) & (3) are available for 1990 and 2000, dataset (1) for 1960, 1990, and 2000.

In addition to the detailed classes mentioned under (2) runs were carried out with lumped classes, i.e. a run where all grassland, forest and other vegetated areas (231, 321, 311, 312, 313, 141, 322, 323, 324) were grouped to one class and a run where all urban, all intensively used arable areas and all bare areas were grouped to one class.

Calculations for 50x50km discrete windows were applied for all covers at a 100m resolution. Depending on the class types, two (1990, 2000) or three time steps (1960, 1990, 2000) have been calculated – three time steps for the HISLU classes, and two time steps for the remaining classes. Technically all pixels of a 50x50km window are considered as an independent excerpt of the landscape and FRAGSTATS was calculated for this extent. Later the calculations were assigned to the center coordinate of each 50x50km window, yielding a point cover with points at 50km distance. In Appendix 1 a log of one calculation procedure is given. Metrics calculated for the 50x50km extents can be COMPARED over the entire continent since extent and resolution among the windows are constant. Average calculations for a subset of windows (= greater extent or subregion) is allowed but will not yield the same results as if the measure was calculated for the entire greater extent or subregion in an independent FRAGSTATS calculation. Furthermore each average from two or more 50x50km windows must be accompanied by standard deviation and number of averaged points.

Table 2a: Metric calculations with the “HISLU” classes.

Year	1960		1990		2000	
Resolution: File name: Classes:	• 100m • hislu60_100m • 7 HISLU	• 500m • hislu60_500m • 7 HISLU	• 100m • lc1990_hislu60_100m • 7 HISLU	• 500m • lc1990_hislu60_500m • 7 HISLU	• 100m • lc2000_hislu60_100m • 7 HISLU	• 500m • lc2000_hislu60_500m • 7 HISLU
Full-extent metrics m: metrics l: level		• m: see Table 8, • l: landscape & all 7 HISLU classes		• m: see Table 8 • l: landscape & all 7 HISLU classes		• m: see Table 8 • l: landscape & all 7 HISLU classes
Discrete window analysis m: metrics l: level w: window	• m: all from Table 8, • l: landscape & all 7 HISLU classes • w: 50x50km		• m: all from Table 8, • l: landscape & all 7 HISLU classes • w: 50x50km		• m: all from Table 8, • l: landscape & all 7 HISLU classes • w: 50x50km	•

Table 2b: Metric calculations with subclasses of the CLC of grassland, forest and other biodiversity-relevant CLC classes.

Year	1960		1990		2000	
Resolution: File name:			• 100m • lc_1990_level3_100m_v2	•	• 100m • lc_1990_level3_100m_v2	•
Discrete window analysis m: metrics l: level w: window			• m: all from Table 8, • l: landscape & 10 classes related to grassland, forest & other vegetated areas; 1 class out of the 10 consists of the lumped remaining classes)* • w: 50x50km	•	• m: all from Table 8, • l: landscape & 10 classes related to grassland, forest & other vegetated areas; 1 class out of the 10 consists of the lumped remaining classes)* • w: 50x50km	•
Discrete window analysis m: metrics l: level w: window			• m: all from Table 8, • l: landscape & 2 classes (lumped grassland, forest & other vegetated area classes vs lumped remaining classes)** • w: 50x50km	•	• m: all from Table 8, • l: landscape & 2 classes (lumped grassland, forest & other vegetated area classes vs lumped remaining classes)** • w: 50x50km	•
Discrete window analysis m: metrics l: level w: window			• m: all from Table 8, • l: landscape & 2 classes (lumped intensive urban, agricultural use and non-vegetated areas vs lumped remaining classes)*** • w: 50x50km	•	• m: all from Table 8, • l: landscape & 2 classes (lumped intensive urban, agricultural use and non-vegetated areas vs lumped remaining classes)*** • w: 50x50km	•

* 10 classes are: grassland (units 231, 321); forest (311, 312, 313), other vegetated (141, 322, 323, 324), lumped remaining classes
** 2 classes are: lumped unit 231, 321, 311, 312, 313, 141, 322, 323, 324 versus all other CLC classes
*** 2 classes are: lumped unit 111 through 213 and 331 through 335 versus all other CLC classes

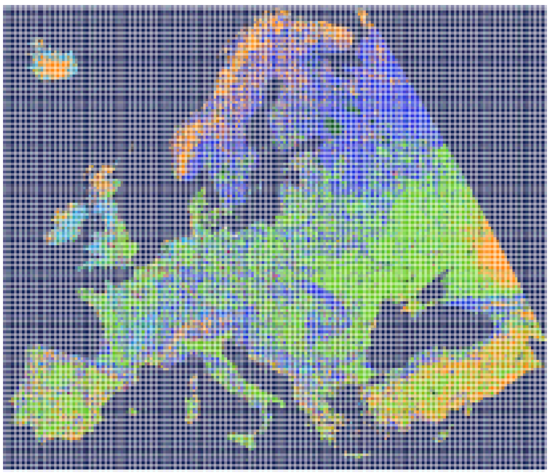


Figure 1: Tiles of 50x50km over the whole study area. Background: land cover 2000, resolution 100m. The whole area accounts for 7708 tiles (windows). 4336 tiles contain at least 1 pixel of terrestrial habitat. Coastal tiles should be eliminated for certain metrics. In the database they can be found by adding the area of the terrestrial land use classes including inland waters. If the resulting area is less than 250 km^2 the tile is a coastal or border tile.

3. Results

3.1 Metrics for full extents

We present selected metrics for the time steps 1960, 1990, and 2000 for the 500m resolution using the HISLU classes. Results are displayed in Table 3 and 4 for the three core metrics "Number of patches", "Mean shape index" and "Mean fractal dimension". The full set of metrics can be obtained both as FRAGSTATS output files or Excel files (see Appendix 3 for full file names). Note that the 1960 map has a different data source compared to the 1990 (PLCM1990) and the 2000 (PLCM2000) land cover database. Between-year comparisons of the metrics should thus be handled with caution. As highlighted in Table 4 we found an increase from 1960 to 1990 in arable area followed by a decrease from 1990 to 2000. Forested and urban area is increasing consistently, and a clear decrease in grasslands can be observed. Fractal dimension and mean shape index suggest that the perimeters of the patches were more complex in the 1960's than in the 1990's. This is most likely a bias caused by the rather coarse map resolution of the 1960 map (HISLU60). Between 1990 and 2000 we observed steady conditions in both fractal dimension and mean shape index. However, the resolution of 500m is definitely too coarse and the extent too large for the purpose of species distribution modeling. Thus we concentrated all work efforts to the 100m resolution in 50km x 50km windows (see paragraph 3.2)

Table 3: Selected metrics at the landscape level (no classes distinguished) for three time steps. Note that the 1960 map is taken from an analog map while the 1990 and 2000 maps are based on the CORINE land classification.

Cover / year	Number of patches	Mean shape index (no dimension)	Mean fractal dimension (no dimension)
hislu60_500m; 1960	76060	1.4876	1.0428
lc1990_hislu60_500m; 1990	1593391	1.1293	1.0175
lc2000_hislu60_500m; 2000	1605689	1.1294	1.0175

Table 4: Selected metrics at the class level for three time steps. Note that the 1960 map is taken from an analog map while the 1990 and 2000 maps are based on the CORINE land classification.

Cover&Class type & year	Area (km^2)	Number of patches	Mean shape index (no dimension)	Mean fractal dimension (no dimension)
hislu60_500m; arable-1960	3463368.75	8212	1.6545	1.0512
lc1990_hislu60_500m; arable-1990	3504935.50	305961	1.1663	1.0202
lc2000_hislu60_500m; arable-2000	3497342.75	307401	1.1669	1.0202
hislu60_500m; forest-1960	2277674.00	16061	1.6848	1.0548
lc1990_hislu60_500m; forest-1990	2876751.00	327721	1.1563	1.0189
lc2000_hislu60_500m; forest-2000	2877165.75	329292	1.1564	1.0189
hislu60_500m; grass-1960	1722380.00	10352	1.7332	1.0569
lc1990_hislu60_500m; grass-1990	698470.25	366644	1.1147	1.0175
lc2000_hislu60_500m; grass-2000	694959.25	367268	1.1149	1.0175
hislu60_500m; inlandwaters-1960	196018.75	4174	1.5556	1.0512
lc1990_hislu60_500m; inlandwaters-1990	232788.75	75422	1.1049	1.0153
lc2000_hislu60_500m; inlandwaters-2000	233703.75	76237	1.1047	1.0153
hislu60_500m; non-agricultural-1960	1213102.25	12801	1.4774	1.0436
lc1990_hislu60_500m; non-agricultural-1990	1470658.75	362244	1.1197	1.0166
lc2000_hislu60_500m; non-agricultural-2000	1471359.50	365387	1.1194	1.0166
hislu60_500m; urban-1960	21165.25	4748	1.1547	1.0236
lc1990_hislu60_500m; urban-1990	180827.25	153889	1.0677	1.0122
lc2000_hislu60_500m; urban-2000	189816.75	158587	1.0692	1.0123

3.2 Metrics for discrete windows

3.2.1 Overview of all calculations

A total of 57 class or landscape metric calculations have been performed for the 50x50km discrete windows covering all Europe. Table 5 through 7 yield detailed information about the calculations and the metrics used. Appendix 1 gives a log of the calculation procedure.

Table 5: Complete list of metric calculations for the 7 HISLU classes (CLC<year-100> = Corine land cover 100m resolution). Each metric calculation for the class and the landscape-level involved the metrics displayed in Table 8. „Class level“ means that the metrics were calculated for one and only this class vs. a matrix of all other remaining classes. „Landscape level“ means that all classes mentioned under „class-level“ were merged in a composite land cover for which metrics were calculated.

HISLU classes	
Year	**Class description**
1960 (HISLU 60, digitized analog map)	Class-level metrics: grassland,arable,Non-agricultural land,urban,forest,Inland water, sea
	Landscape-level metrics: all hislu classes (7)
1990 (PLCM1990, CLC 1990-100)	Class-level metrics: grassland,arable,Non-agricultural land,urban,forest,Inland water, sea
	Landscape-level metrics: all hislu classes (7)
2000 (PLCM, 2000, CLC 2000-100)	Class-level metrics: grassland,arable,Non-agricultural land,urban,forest,Inland water, sea
	Landscape-level metrics: all hislu classes (7)

Table 6: Complete list of metric calculations for 10 grassland, forest and other vegetated classes (CLC<year-100> = Corine land cover 100m resolution). Each metric calculation for the class and the landscape-level involved the metrics displayed in Table 8. „Class level“ means that the metrics were calculated for one and only this class vs. a matrix of all other remaining classes. „Landscape level“ means that all classes mentioned under „class-level“ were merged in a composite land cover for which metrics were calculated.

Grassland, forest, other vegetated	
Year	**Class description**
1990 (CLC 1990-100)	Class-level metrics: Green urban areas (231),Pastures (321),Broad leaved forest (311),Coniferous forest (312),Mixed forest (313),Natural grasslands (141),Moors and heathland (322),Sclerophyllous vegetation (323),Transitional woodland-shrub (324),lumped remaining classes
	Landscape-level metrics: all grassland, forest & other vegetated area classes (231, 321, 311, 312, 313, 141, 322, 323, 324) + the lumped remaining classes (=10 classes)
2000 (CLC 2000-100)	Class-level metrics: Green urban areas (231),Pastures (321),Broad leaved forest (311),Coniferous forest (312),Mixed forest (313),Natural grasslands (141),Moors and heathland (322),Sclerophyllous vegetation (323),Transitional woodland-shrub (324),lumped remaining classes
	Landscape-level metrics: all grassland, forest & other vegetated area classes (231, 321, 311, 312, 313, 141, 322, 323, 324) + the lumped remaining classes (=10 classes)
2 classes lumped Grassland, forest, other vegetated vs. matrix	
Year	**Class description**
1990 (CLC 1990-100)	Class-level metrics: lumped class consisting of units 231, 321, 311, 312, 313, 141, 322, 323, 324 (grassland, forest and other vegetated areas)
	Class-level metrics: lumped class consisting of all classes not consisting units 231, 321, 311, 312, 313, 141, 322, 323, 324
	Landscape-level metrics: 2 above classes
2000 (CLC 2000-100)	Class-level metrics: lumped class consisting of units 231, 321, 311, 312, 313, 141, 322, 323, 324 (grassland, forest and other vegetated areas)
	Class-level metrics: lumped class consisting of all classes not consisting units 231, 321, 311, 312, 313, 141, 322, 323, 324
	Landscape-level metrics: 2 above classes

Table 7: Complete list of metric calculations for 2 lumped classes consisting of intensive, urban, agricultural use and non-vegetated classes (CLC<year-100> = Corine land cover 100m resolution). Each metric calculation for the class and the landscape-level involved the metrics displayed in Table 8. „Class level" means that the metrics were calculated for one and only this class vs. a matrix of all other remaining classes. „Landscape level" means that all classes mentioned under „class-level" were merged in a composite land cover for which metrics were calculated.

Lumped intensive urban, agricultural use and non-vegetated areas vs matrix	
Year	**Class description**
1990 (CLC 1990-100)	Class-level metrics: lumped class consisting of units 111 through 213 and 331 through 335
	Class-level metrics: lumped class consisting of all classes **not** consisting units 111 through 213 and 331 through 335
	Landscape-level metrics: 2 above classes
2000 (CLC 2000-100)	Class-level metrics: lumped class consisting of units 111 through 213 and 331 through 335
	Class-level metrics: lumped class consisting of all classes **not** consisting units 111 through 213 and 331 through 335
	Landscape-level metrics: 2 above classes

Table 8: Complete list of metric calculated for each class selection and landscape composite mentioned in Tables 5 through 7. Note that some metrics (*) were not calculated for the 500-m resolution. Further some metrics (e.g. patch richness, PR) were calculated at the landscape-level only, and some metrics (e.g. Percentage of the class on the total landscape excerpt, PLAND) were calculated at the class-level only. The header „Class level Metrics" means that the metrics were calculated for one and only this class vs. a matrix of all other remaining classes. The header „Landscape-level Metrics" means that all classes were merged in a composite land cover for which metrics were calculated.

Landscape-level Metrics	**Class-level Metrics**	**Description**
	TYPE	Class
TA	CA	Total Area
	PLAND	Percentage of the class on the total landscape excerpt
NP	NP	Number of patches
PD	PD	Patch density
LPI	LPI	Largest patch index
TE	TE	Total edge
ED	ED	Edge density
LSI	LSI	Landscape Shape Index
SHAPE_MN	SHAPE_MN	Mean Shape Index
SHAPE_AM	SHAPE_AM	Area Weighted Mean Shape Index
FRAC_MN	FRAC_MN	Mean Fractal Dimension
FRAC_AM	FRAC_AM	Area Weighted Mean Fractal Dimension
PROX_MN*	PROX_MN*	Mean Proximity Index (with search radius 10000m)
PROX_AM*	PROX_AM*	Area Weighted Mean Proximity Index (with search radius 10000m)
ENN_MN*	ENN_MN*	Mean Euclidian Nearest Neighbor
ENN_AM*	ENN_AM*	Area Weighted Mean Euclidian Nearest Neighbor
CONTAG		Contagion
	CLUMPY	Clumpiness
IJI	IJI	Interspersion Juxtaposition Index
CONNECT*	CONNECT*	Connectance Index (threshold: 10000m)
COHESION	COHESION	Patch Cohesion Index (threshold: 10000m)
PR		Patch Richness
SHDI		Shannon's Diversity Index
SIDI		Simpson's Diversity Index

* not calculated for the 500-m resolution

3.2.2 Examples

a) Landscape metrics of one state

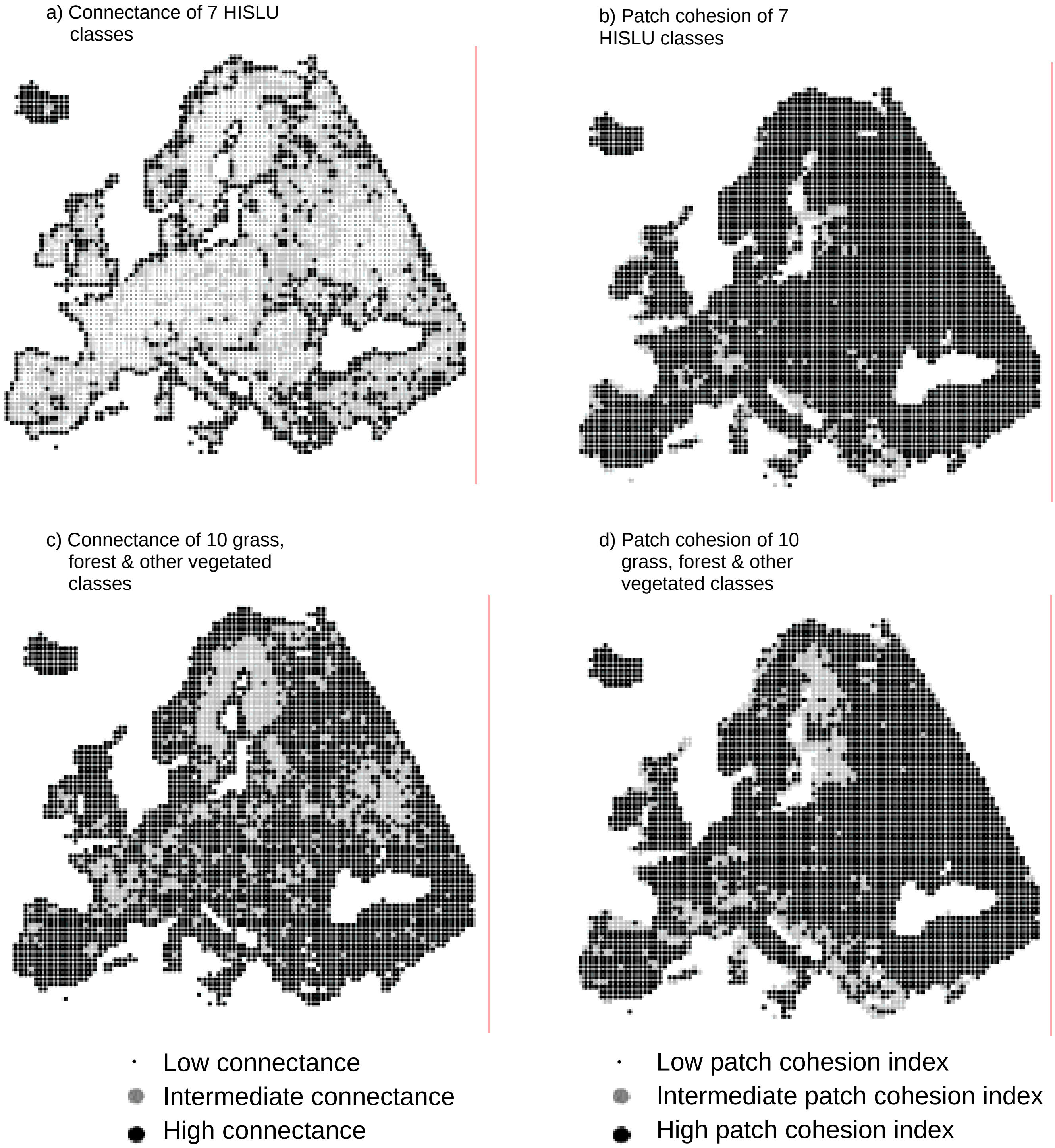
We present metrics for the year 2000 calculated on the basis of a variety of land-use classifications. Since metrics related to connectivity are of primary interest to ECOCHANGE, the connectance index and the patch cohesion index have been selected as examples (for a description of the metrics, see Tables 1&8). Both metrics are indicators for connectivity (fragmentation), e.g., high values in connectance and patch cohesion may be interpreted as low fragmentation, whereas low values may be viewed as high fragmentation. Although the visual analysis of metrics was restricted to a few metrics, the full set of metrics (Table 8) is available as ArcGIS coverage files. Appendix 2 yields detailed information about the nomenclature of these files. The maps do not contain country borders to avoid graphical blurring. The classifications "Low", "intermediate" and "High" are not identical throughout all metrics. Symbols for the value ranges are individually selected to highlight spatial patterns in each map. Be aware that the values are dependent on the number of classes involved and should be compared with care

At the landscape level[5] we present connectance and patch cohesion of the 7 HISLU classes (grassland, arable, non-agricultural land, urban, forest, inland water, sea, Fig. 2a,b), as well as for the 10 grasslands, forests and other vegetated area classes (Fig. 2c,d). For individual land use classes (class level metrics)[6] results were mapped for the lumped HISLU class „arable" (Fig. 3a, b), the lumped HISLU class „grassland" (Fig. 3c, d), the level-3 CORINE class „pastures (231)" (Fig. 3e, f) and the level-3 CORINE class „natural grasslands (321)" (Fig. 3g, h).

For the state calculations at the landscape level (Fig. 2) we observe low connectance and very high patch cohesion for the HISLU classification. There is a strong boundary effect. Connectance of the 10-class cover containing grassland, forests and vegetated areas has a very even distribution throughout Europe at a medium to high level.

[5] „Landscape level" means that all classes were merged in a composite land cover for which metrics were calculated.

[6] „Class level" means that the the metrics were calculated for one and only this class vs. a matrix of all other lumped remaining classes.



FFigure 2: Connectance and patch cohesion at the <u>*landscape level*</u> *for* <u>*year 2000*</u> *and two sets of land-use classes (a, b: 7 HISLU classes, landscape level, cover „r00_50_01l"; c, d: 10 grassland, forests and other vegetated area classes, landscape level, cover "r00_50_gfl"). "Low", "intermediate" and "High" is not identical throughout all metrics. Symbols for the value ranges are individually selected to highlight spatial patterns in each map. Be aware that the values are dependent on the number of classes involved and should be compared with care (e.g. Fig. 2a has the following classes: Low: 0.0-15.0; Intermediate: 15.1-19.0; High: 19.1-100.0, Fig. 2b has the following classes: Low: 0.0-30.0; Intermediate: 30.1-97.0; High: 97.1-100.0, Fig. 2c has the following classes: Low: 0.0-6.0; Intermediate: 6.1-14.0; High: 14.1-19.0 and Fig. 2d has the following classes: Low: 0.0-30.0; Intermediate: 30.1-97.0; High: 97.1-100.0).*

As for individual land-use classes (Fig. 3a-h), the HISLU class „arable“ (Fig. 3a, b) exhibits a very low connectance, which is contrasted by high patch cohesion. For the HISLU class „grassland“ (Fig. 3c, d) connectance is low throughout Europe, whereas patch cohesion is particularly low in Northern Europe. Both connectance maps exhibit strong boundary effects. A more pronounced pattern is observed for the level-3 CORINE class „pastures (231)“ (Fig. 3e, f) and „natural grasslands (321)“ (Fig. 3g, h). First, pastures are not reported in the lower Mediterranean area. Consequently no metrics can be generated. In those 50x50km tiles, where pastures are reported, we observe high connectance in the Northern Mediterranean area, Iceland and Northern Europe. Patch cohesion is high throughout Western and Central Europe. For those regions where natural grasslands are reported, connectance values are low across Europe except for a belt ranging from Great Britain to South-Eastern Europe. The pattern of patch cohesion is quite heterogeneous. Low values are observed in Western and Central Europe. For the remaining regions, patch cohesion is generally higher.

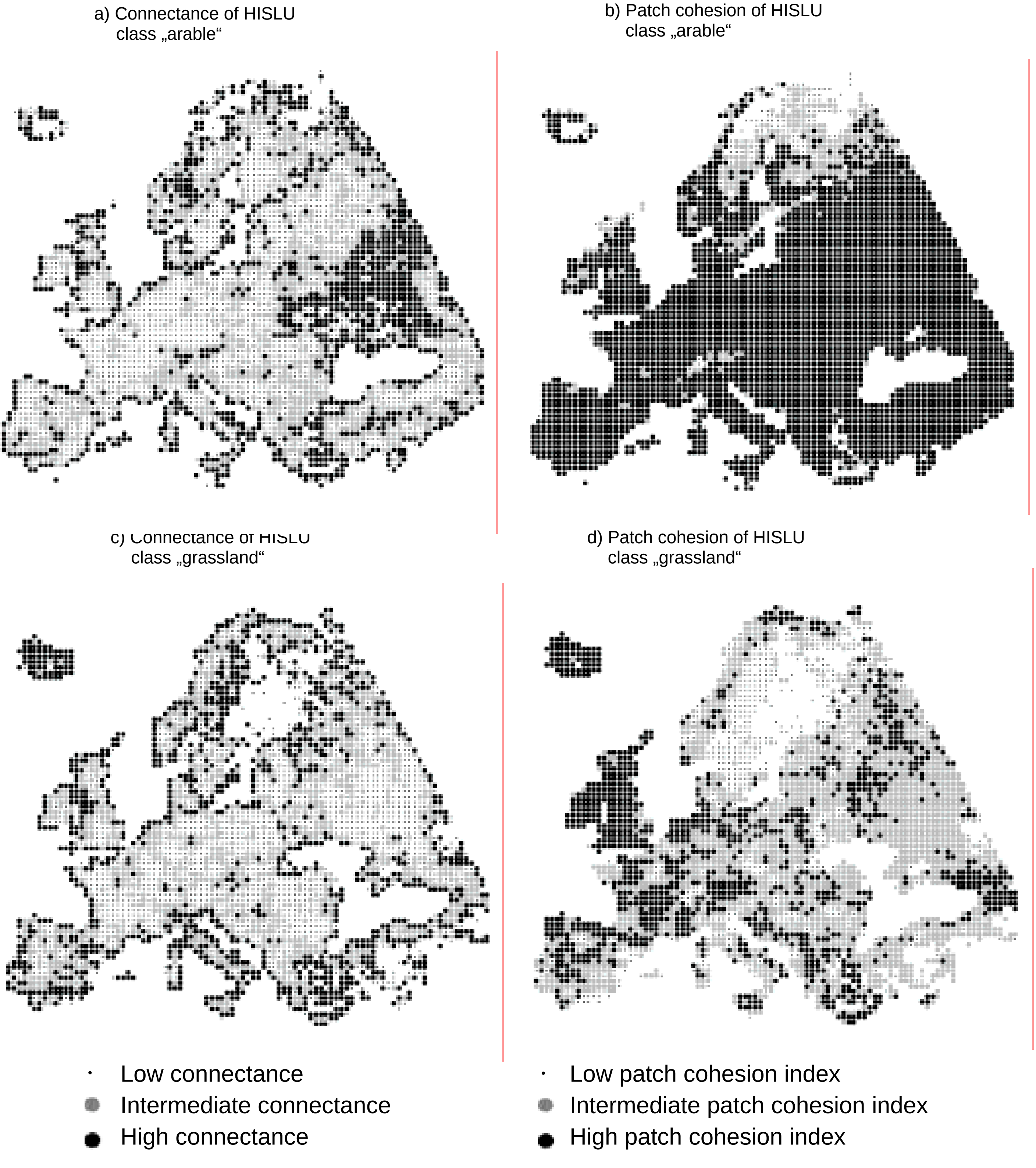


Figure 3a-d: Connectance and patch cohesion at the *<u>class level</u>* *for* *<u>year 2000</u>* *and individual HISLU classes (a, b: HISLU class „arable“, class level, cover „r00_50_01ca”; c, d: HISLU class „grassland“, class level, cover “r00_50_01cg”). “Low”, “intermediate” and “High” is not identical throughout all metrics. Symbols for the value ranges are individually selected to highlight spatial patterns in each map. Be aware that the values are dependent on the number of classes involved and should be compared with care (e.g. Fig. 3a has the following classes: Low: 0.0-16.0; Intermediate: 16.1-24.0; High: 24.1-100.0, Fig. 3b has the following classes: Low: 0.0-86.0; Intermediate: 86.1-92.0; High: 92.1-100.0 or Fig. 3c has the following classes: Low: 0.0-14.0; Intermediate: 14.1-21.0; High: 21.1-100.0).*

e) Connectance of level-3 CORINE class „pastures

f) Patch cohesion of level-3 CORINE class „pastures (231)“

g) Connectance of level-3 CORINE class „natural grasslands (321)“

h) Patch cohesion of level-3 CORINE class „natural grasslands (321)“

- Low connectance
- Intermediate connectance
- High connectance

- Low patch cohesion index
- Intermediate patch cohesion index
- High patch cohesion index

Figure 3e-h: Connectance and patch cohesion at the <u>class level</u> for <u>year 2000</u> and the level-3 CORINE class „pastures“ and the level-3 CORINE class „natural grasslands“ (e, f: level-3 CORINE class „pastures“, class level, cover „r00_50_gf231”; g, h: level-3 CORINE class „natural grasslands“, class level, cover r00_50_gf321). “Low”, “intermediate” and “High” is not identical throughout all metrics. Symbols for the value ranges are individually selected to highlight spatial patterns in each map. Be aware that the values are dependent on the number of classes involved and should be compared with care (e.g. Fig. 3e has the following classes: Low: 0.0-14.0; Intermediate: 14.1-22.0; High: 22.1-100.0, Fig. 3g has the following classes: Low: 0.0-15.0; Intermediate: 15.1-28.0; High: 28.1-100.0 or Fig. 3h has the following classes: Low: 0.0-90.0; Intermediate: 90.1-93.0; High: 93.1-100.0).

b) Comparison of landscape metrics between two states

In order to characterize the temporal development of fragmentation, we calculated differences between the metric calculations for two consecutive time steps, i.e. 1990 and 2000. Technically this can be done in ArcGIS by joining the attribute files of two consecutive time steps. We restricted the graphical analysis in this report to a few connectivity measures relevant for the ECOCHANGE project. Data are, however, available for all metrics listed in Table 1&8. The following metrics were selected: connectance index, mean number of patches, Euclidian distance, patch cohesion index and mean shape index (for a description of the metrics, see Table 8). Appendix 2 yields detailed information about the nomenclature of the files.

Available maps in this report: For the metric „number of patches“ we present difference maps at the landscape level[7] for (1) the 10 grasslands, forests and other vegetated areas (Fig. 4a), (2) the lumped grasslands, forests, and other vegetated area classes versus the matrix (2 classes) (Fig. 4b), (3) the lumped intensive urban, agricultural use, and non-vegetated areas versus the matrix (2 classes) (Fig. 4c), and (4) the 7 HISLU classes (grassland, arable, non-agricultural land, urban, forest, inland water, sea) (Fig. 4d). In addition we present difference maps at the class-level[8] for the metric „number of patches“ for (1) the lumped 10 grasslands, forests and other vegetated areas vs. the matrix (Fig. 5a), (2) the lumped agricultural classes vs. the matrix (Fig. 5b), (3) the lumped HISLU class „arable“ (Fig. 6a), (4) the HISLU class „grassland“ (Fig. 6b), (5) the level-3 CORINE class „pastures (231)“ (Fig. 6c) and (6) the level-3 CORINE class „natural grasslands (321)“ (Fig. 6d).

For the metrics „connectance“ and „patch cohesion“ we present difference maps at the landscape level for (1) the 7 HISLU classes (grassland, arable, non-agricultural land, urban, forest, inland water, sea) (Fig. 7a, b), (2) the 10 grasslands, forests and other vegetated area classes (Fig. 7c, d). In addition we present for the metrics „connectance“ and „patch cohesion“ difference maps at the class-level for (1) the lumped HISLU class „arable“ (Fig. 8a, b), (2) the HISLU class „grassland“ (Fig. 8c, d), (3) the level-3 CORINE class „pastures (231)“ (Fig. 9a, b) and (4) the level-3 CORINE class „natural grasslands (321)“ (Fig. 9c, d).

Finally we present (Fig. 10) a difference map (1990 vs. 2000) for Euclidian distance for the HISLU class forest (class-level metric) and a map (Fig. 11) exhibiting the differences between the shape index for all HISLU classes in year 1990 and in 2000. This is a landscape-level metric).

The Nordic countries Sweden, Finland, Norway and Iceland as well as Serbia, Montenegro, Croatia, Albania, and Bosnia-Herzegovina were not displayed (but included in the dataset), since they do not have a CLC 1990 cover. Thus no difference maps could be generated for these areas.

In the following sections, we discuss selected results for the metric number of patches, connectance, patch cohesion, mean Euclidean distance and shape index. All metrics are indicators for connectivity (fragmentation). An increase in number of patches may be interpreted as increasing fragmentation, whereas a decrease may be viewed as decreasing fragmentation between 1990 and 2000. Contrary, an increase in connectance and patch cohesion may be interpreted as de-fragmentation, whereas a decrease may be viewed as increasing fragmentation.

Visual interpretation of the maps representing the number of patches: At the landscape level distinct changes in the number of patches are visible for many land-use classifications (Fig. 4a-d). For grasslands and forests (lumped or 10 classes, Fig. 4a,b) or the 7 HISLU classes

[7] „Landscape level“ means that all classes are merged in a composite land cover for which metrics are calculated.

[8] „Class level“ means that the the metrics are calculated for one and only this class vs. a matrix of all other lumped remaining classes.

(Fig. 4d), we observe a consistent increase in number of patches for e.g. Western Spain and Portugal, Ireland, Southern Greece, and several Eastern European regions.

Figure 4a-d: Changes in the number of patches at the landscape level between 1990 and 2000. (a: 10 grasslands, forests and other vegetated area classes, landscape level, covers „r00_50_gfl“ minus „r90_50_gfl“; b: lumped grasslands, forests, and other vegetated areas versus the matrix (2 classes), landscape level, covers „r00_50_ynl“ minus „r90_50_ynl“; c: lumped intensive urban, agricultural use, and non-vegetated areas versus the matrix (2 classes), landscape level, covers „r00_50_iel“ minus „r90_50_iel“; d: 7 HISLU classes (grassland, arable, non-agricultural land, urban, forest, inland water, sea), landscape level, covers „r00_50_01l“ minus „r90_50_01l“). “Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.

An overall decrease in number of patches is consistently observed for grasslands and forests (lumped or 10 classes, Fig. 4a,b) in Western Central Europe (Germany), parts of Eastern

Europe, and Eastern Great Britain, as well as Eastern Spain. The 7 HISLU classes (Fig. 4d) generally support these trends, although much less pronounced. The difference map of intensive, urban, agricultural use and non-vegetated (Fig. 4c) is rather insensitive.

At the class level the aggregated classifications exhibiting vegetated classes versus the matrix (Fig. 5a, b) indicate, that an increase in patch numbers is observed in Northern and Eastern Europe (Germany, Poland), and southern Spain. The trend is more pronounced for the lumped agricultural classes (Fig. 5b). Decreases in patch numbers are consistently found for both classifications in Southern and Western Spain and Ireland.

a) Development (1990 to 2000) of the number of patches for lumped grasslands, forests and other vegetated areas versus the matrix

b) Development (1990 to 2000) of the number of patches for lumped agricultural classes vs. the matrix

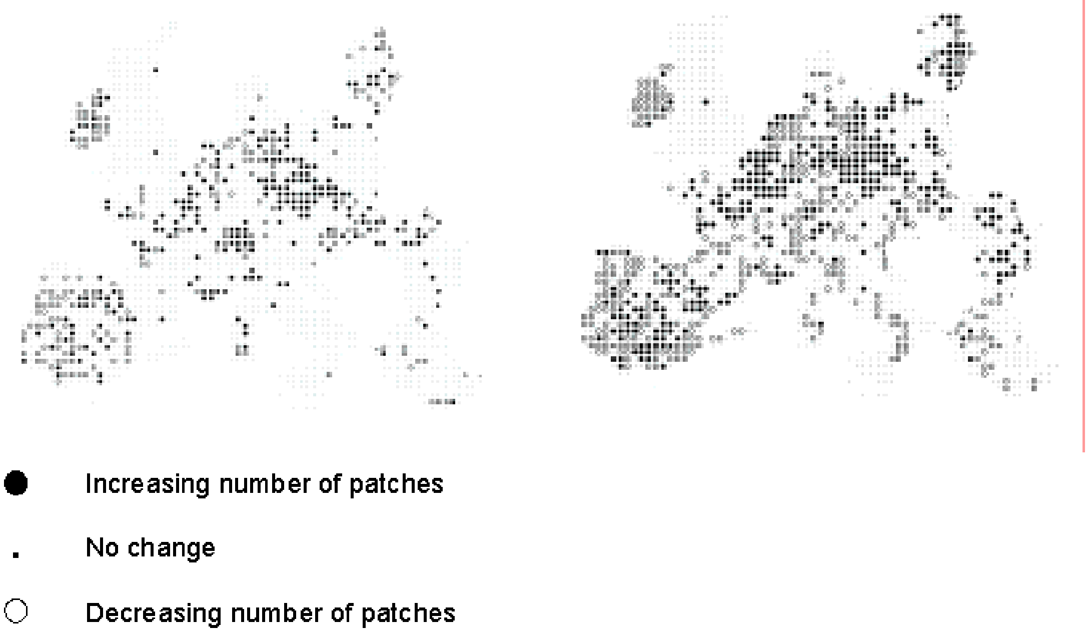


Figure 5a-b: Changes in the number of patches at the class level between 1990 and 2000. (a: lumped grasslands, forests and other vegetated areas versus the matrix, class level, covers „r00_50_yngre“ minus „r90_50_yngre“; b: lumped agricultural classes vs. the matrix, class level, covers „r00_50_iemat“ minus „r90_50_iemat“).“Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.

Changes in patch numbers between 1990 and 2000 for individual classes are shown in Fig. 6a-d. The HISLU grasslands (Fig. 6b) show strong increases in the number of patches in Ireland and in Eastern Europe and decreases in Spain, Western Germany, and Lithuania/Latvia. CORINE level-3 natural grasslands (Fig. 6d) exhibit decreases in the number of patches all-across Europe, particularly across Spain, Southern France, and parts of Eastern Europe. Increases in the number of natural grassland patches are observed in Central Europe, across the Alps and in northern Germany. Increasing number of patches is reported for CORINE level-3 pastures (Fig. 6c) in Ireland and parts of Eastern Europe with strong increases across northern Germany. For the HISLU class arable land (Fig. 6a), increases in patch numbers are observed for Eastern Europe, whereas losses are observed for Germany. Spain shows a mix between losses and gains between 1990 and 2000.

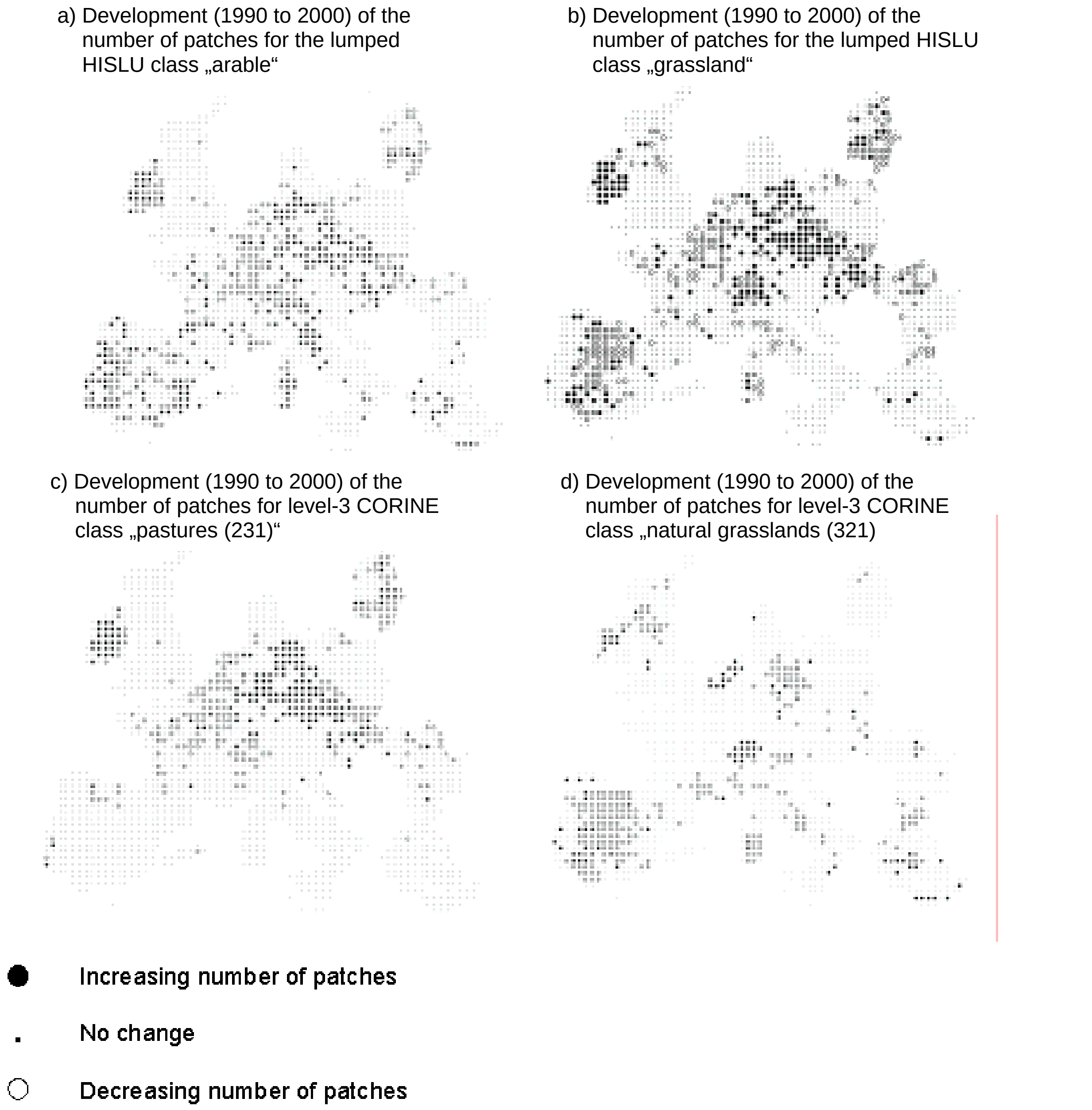


Figure 6a-d: Changes in the number of patches at the class level between <u>*1990 and 2000*</u>*. (a: lumped HISLU class „arable“, class level, covers „r00_50_01ca“ minus „r90_50_01ca“; b: lumped HISLU class „grassland“, class level, covers „r00_50_01cg“ minus „r90_50_01cg“; c: level-3 CORINE class „pastures (231)“, class level, covers „r00_50_gf231“ minus „r90_50_gf231“; d: level-3 CORINE class „natural grasslands (321)“, class level, covers „r00_50_gf321“ minus „r90_50_gf321“).“Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.*

Visual interpretation of the maps representing Connectance and patch cohesion index: As for connectance and cohesion, the landscape-level metrics of the HISLU and the grassland & forest classes (Fig. 7) do not show clear distinct patterns between 1990 and 2000.

a) Development (1990 to 2000) of the connectance for 7 HISLU classes

b) Development (1990 to 2000) of the patch cohesion for 7 HISLU classes

c) Development (1990 to 2000) of the connectance for 10 grasslands, forests and other vegetated area classes

d) Development (1990 to 2000) of the patch cohesion for 10 grasslands, forests and other vegetated area classes

● Increasing connectance
▪ No change
○ Decreasing connectance

● Increasing patch cohesion
▪ No change
○ Decreasing patch cohesion

Figure 7a-d: Changes in connectance and patch cohesion at the <u>*landscape level*</u> *between* <u>*1990 and 2000*</u>*. (a, b: 7 HISLU classes (grassland, arable, non-agricultural land, urban, forest, inland water, sea), landscape level, covers „r00_50_01l" minus „r90_50_01l"; c, d: 10 grasslands, forests and other vegetated area classes, landscape level, covers „r00_50_gfl" minus „r90_50_gfl").“Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.*

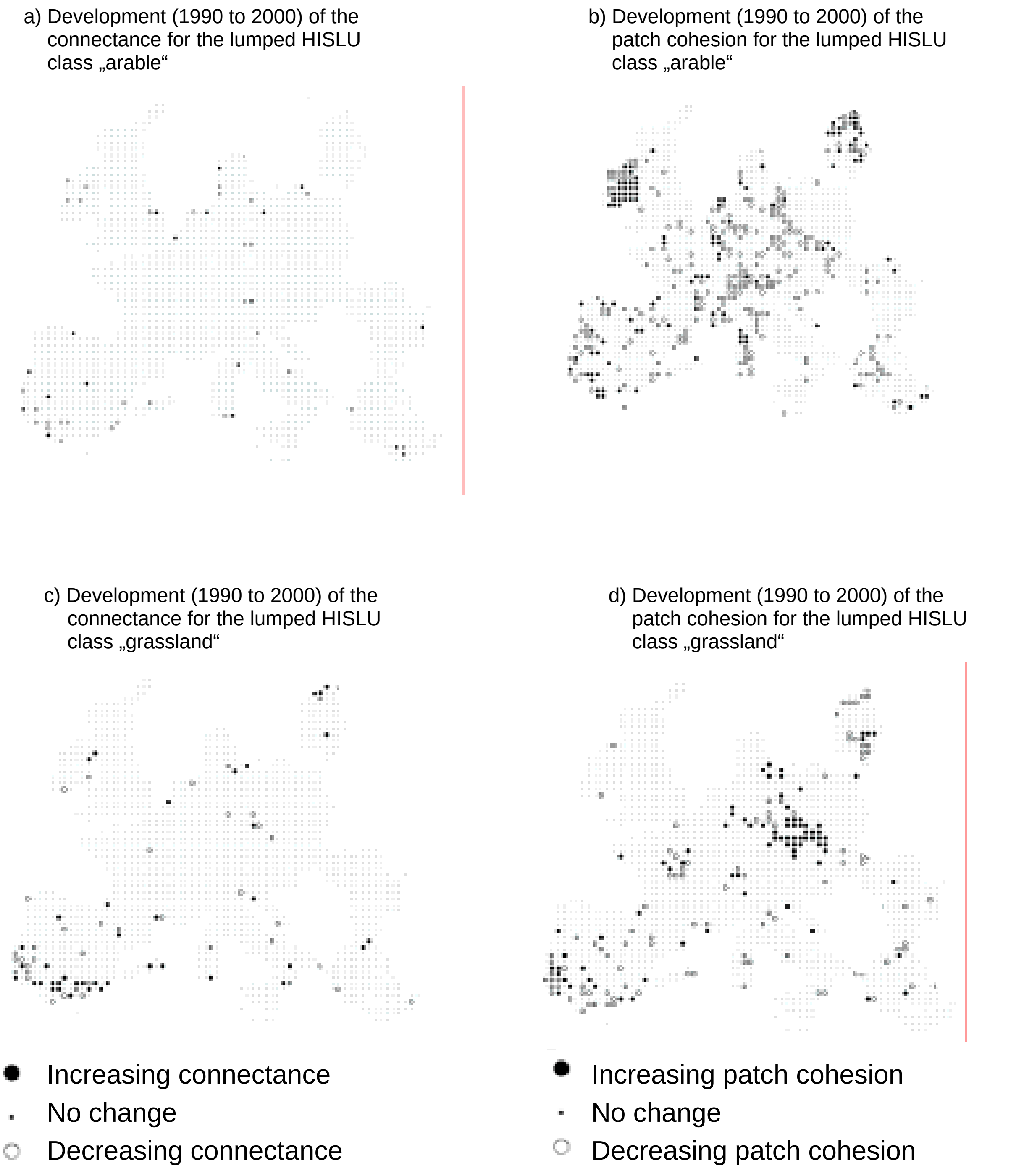


Figure 8a-d: Changes in connectance and patch cohesion at the class level between 1990 and 2000. (a, b: lumped HISLU class „arable“, class level, covers „r00_50_01ca“ minus „r90_50_01ca“; c, d: HISLU class „grassland“, class level, covers „r00_50_01cg“ minus „r90_50_01cg“).“Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.

Change of connectance and patch cohesion for individual land-use classes between 1990 and 2000 are shown in Figs. 8 and 9. Changes for arable land (Fig. 8a, b) and grasslands (Fig. 8c, d) are relatively marginal for the connectance index. The changes are more pronounced, however, for the patch cohesion index, which suggests increases for Ireland for arable land, and increases in parts of Eastern Europe for grasslands. Scattered decreases for grasslands are observed throughout western Spain, whereas patch cohesion for arable land appears to decrease throughout most of Europe.

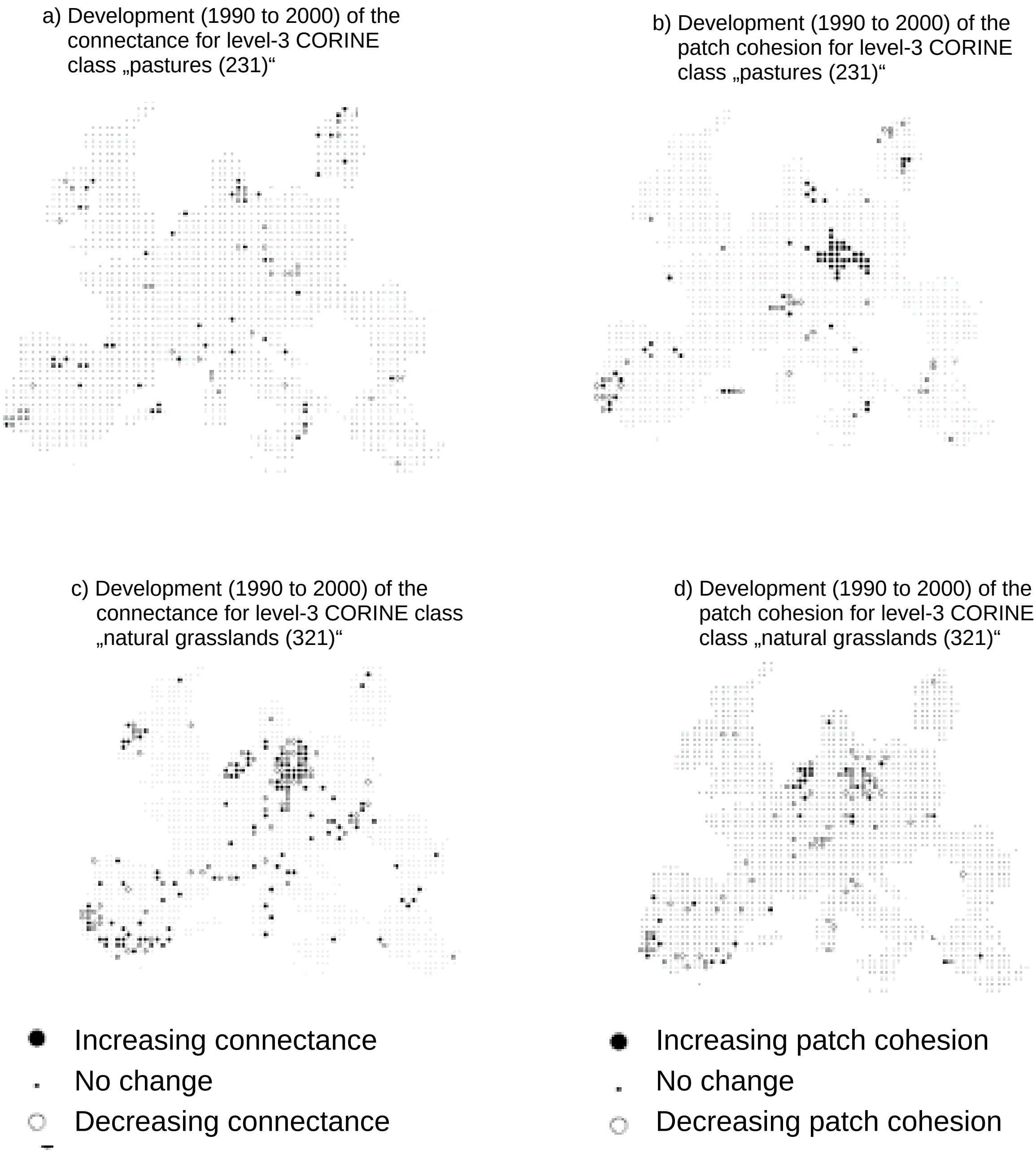
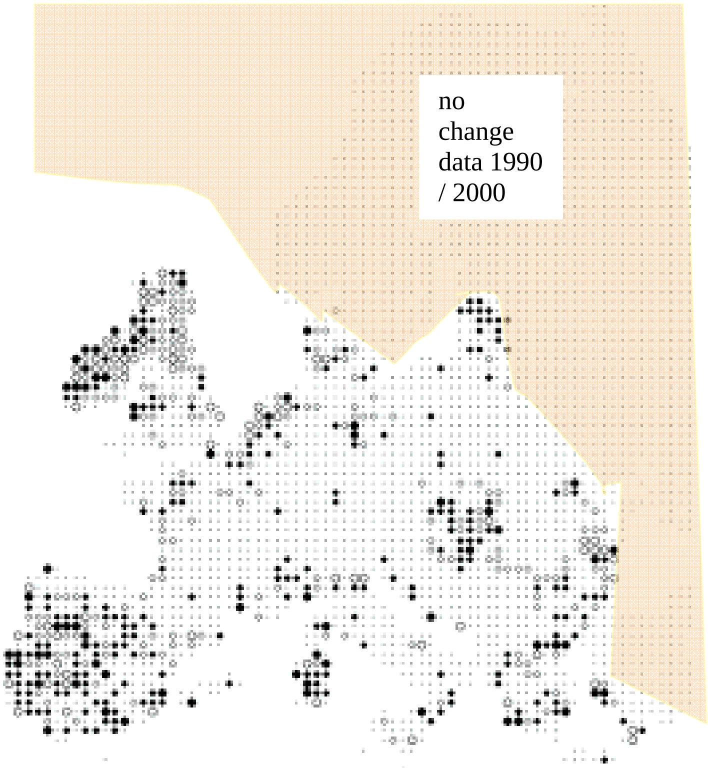


Figure 9a-d: Changes in connectance and patch cohesion at the <u>class level</u> between <u>1990 and 2000</u>. (a, b: level-3 CORINE class „pastures (231)“, class level, covers „r00_50_gf231“ minus „r90_50_gf231“; c, d: level-3 CORINE class „natural grasslands (321)“, class level, covers „r00_50_gf321“ minus „r90_50_gf321“).“Increasing” means value 2000 minus 1990 >0; “No change” means value 2000 minus 1990 = 0; “Decreasing” means value 2000 minus 1990 <0.

Changes for pastures and natural grasslands are shown in Fig. 9a-d. No major changes are observed for connectance between 1990 and 2000 for pastures (Fig. 9a), whereas patch cohesion indicates a strong increase in patch cohesion for parts of Eastern Europe (Fig. 9b). For natural grasslands, a heterogeneous mix of increases and decreases of connectance is observed for parts of Eastern Europe and Southwestern Spain (Fig. 9c). It appears that decreasing connectance prevails in these regions. The trend observed for natural grasslands in some East European regions and Southwestern Spain is supported by patch cohesion, which decreases in these areas (Fig. 9d).

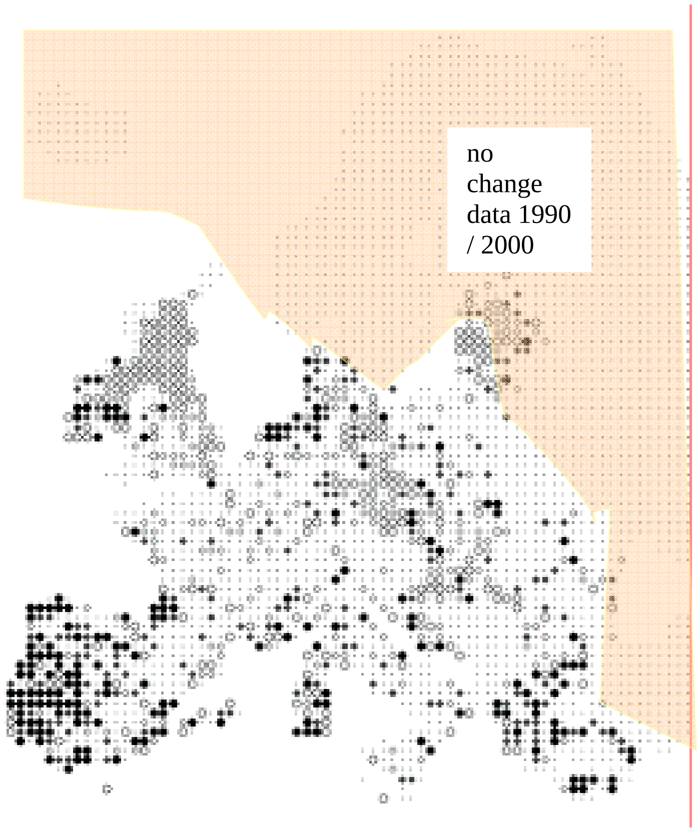
We restrict the graphical representation of changes in the Euclidean distance to one map exhibiting the changes in the HISLU class forest between 1990 and 2000 (Fig. 10). Decreasing distances mean higher connectivity and lower fragmentation. We conclude from the map that Ireland and the Iberian Peninsula as well as some regions in Eastern and Southern Europe are clearly identified as areas where in growth of forest into a mosaic of open land/forest patches may eventually increase connectivity and finally lead to more homogeneous forest landscapes.



○	-6330.569824 - -75.00000	Strongly increasing distance between forest patches between 1990 and 2000
○	-74.999999 - -10.000000	Increasing distance between forest patches between 1990 and 2000
·	-9.999999 - 10.000000	No significant change
●	10.000001 - 75.000000	Decreasing distance between forest patches between 1990 and 2000
●	75.000001 - 4194.399902	Strongly decreasing distance between forest patches between 1990 and 2000

Figure 10: Average change of the Euclidean distance between forest patches (class level metric), 1990 versus 2000 in 50x50km windows.

Finally we show the changes of the landscape-level metric “mean shape index” for all HISLU classes (Fig. 11). As a matter of fact, this map has close affinities with the map exhibited in Fig. 10. It seems that Ireland and the Iberian Peninsula as well as some regions in Eastern and Southern Europe experience a simplification of landscape structures, whereas vast parts of Central Europe remain stable.



-0.170400 - -0.010000	Strongly increasing complexity of all land use patches between 1990 and 2000
-0.009999 - -0.005000	Increasing complexity of all land use patches between 1990 and 2000
-0.004999 - 0.005000	No significant change
0.005001 - 0.010000	Decreasing complexity of all land use patches between 1990 and 2000
0.010001 - 0.138700	Strongly decreasing complexity of all land use patches between 1990 and 2000

Figure 11: Average change of the mean shape index of all land use classes (<u>landscape scale</u>), <u>1990 versus 2000</u> in 50x50km windows. The shape index measures to what degree the perimeter of a patch deviates from the minimum perimeter required accommodating the area of the patch. A value of 1 is reached when the patch is maximally compact (i.e., square or almost square) and the value increases without limit as patch shape becomes more irregular.

4. Conclusions

We have shown that fragmentation and other landscape metrics can be calculated over 2 resolutions (100m/500m) and 2 extents over the whole European continent. In this report we describe calculations suited for the purpose of ECOCHANGE. The calculations employ the software FRAGSTATS and yield metric data for the entire continent. At the 100m-pixel resolution discrete (not moving!) windows of 50x50km have been used. The values of the tiles are directly comparable since they use the same extents. At the 500m resolution the calculations are performed for the extent of the entire continent. More than 20 metrics have been calculated for both resolutions. The metrics fulfill the following criteria: (a) quantify landscape structure for both local and regional scales, (b) likely correlation to species occurrence, (c) sensitive to scenario-induced changes of landscape structure. Visual judgment of the patterns yields plausible results over Europe. We detected more sensitive and less sensitive metrics. E.g. Euclidean distance and number of patches is very sensitive to randomly placed new patches in a landscape whereas patch cohesion is rather insensitive to such alterations. All calculations are available as ArcGIS coverage files (center points of the 50x50km windows) for the 100-m pixel resolution and as Tables for the 500-m pixel resolution.

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Appendix 1: GIS and FRAGSTATS procedures to generate 50x50 km window calculations of landscape metrics

1. Create 50x50km fishnet for the extent of l1990_hl0_1km

```
Arc: kill fish50
Killed fish50 with the ARC option
Arc: generate fish50
Copyright (C) 1982-2006 Environmental Systems Research Institute, Inc.
All rights reserved.
GENERATE 9.2 (Sun Sep 17 16:05:34 PDT 2006)

Generate: fishnet
Fishnet Origin Coordinate (X,Y): 2575600, 1350900
Y-Axis Coordinate (X,Y): 2575600,4000000
Cell Size (Width,Height): 50000,50000
Number of Rows, Columns: 100,100
Generate:
Generate: q

Externalling BND and TIC...

Arc: clean fish50 fish50c 0.001 0.001 poly
Cleaning D:\ARC_GIS_PROJECTS\ECOCHANGE_LAND_USE_COVERS\FISH50
 Sorting...
 Intersecting...
The specified tolerance 0.00100000 is below the minimum resolution for this
data - intersections will be detected with a tolerance of 1.51153092 instead.
 Assembling polygons...
Arc: kill fish50 all
Killed fish50 with the ALL option
Arc:
```

in fish50c:
additems: ns_transec, ew_transec
calculate: ew_transec = Int (([FISH50C-ID] -1)/100.)+1
calculate ns_transec [FISH50C-ID] -([EW_TRANSEC]-1)*100

2. Reclassify land-use grid
grid
axt = reclass (hislu60_100m,recl_1960.txt,NODATA)
L1960_HL0_1rc = con (isnull (axt),8, axt)
Quit
Kill axt all

grid
axt = reclass (L1990_HL0_1KM,recl.txt,NODATA)
L1990_HL0_1rc = con (isnull (axt),8, axt)
Quit
Kill axt all

grid
axt = reclass (L2000_HL0_1KM,recl.txt,NODATA)
L2000_HL0_1rc = con (isnull (axt),8, axt)
Quit
Kill axt all

Recl.txt:
0 : 8
1 : 1
2 : 2
3 : 3
4 : 4
5 : 5
6 : 6
7 : 7

```
Recl_1960.txt:
0 : 8
1 : 2
2 : 3
3 : 4
4 : 5
5 : 6
6 : 1
7 : 7
99 : 8
```

3. Clip 50x50 window from L1990_HL0_1rc and store

```
&do ax = 1 &to 82
  &sv ax = %ax% * 1

&do ay = 1 &to 94
 &sv ay = %ay% * 1

Reselect fish50c axt polys
Resel ew_transec = %ax% and ns_transec = %ay%
;N
;N

grid
gridclip L1990_HL0_1rc F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew%ax%\L90HL0_1%ax%%ay% cover axt
quit
kill axt all

&end

&end
```

4. Clip 50x50 window from L2000_HL0_1rc and store

```
&do ax = 1 &to 82
  &sv ax = %ax% * 1

&do ay = 1 &to 94
 &sv ay = %ay% * 1

Reselect fish50c axt polys
Resel ew_transec = %ax% and ns_transec = %ay%
;N
;N

grid
gridclip L2000_HL0_1rc F:\fragstats_ecochange_samples_l2000_hl_0_1\l2000hl0_1km_ew%ax%\L00HL0_1%ax%%ay% cover axt
quit
kill axt all

&end

&end
```

5. Clip 50x50 window from L1960_HL0_1rc and store

```
&do ax = 1 &to 82
  &sv ax = %ax% * 1

&do ay = 1 &to 94
 &sv ay = %ay% * 1

Reselect fish50c axt polys
```

```
Resel ew_transec = %ax% and ns_transec = %ay%
;N
;N

grid
gridclip L1960_HL0_1rc F:\fragstats_ecochange_samples_l1960_hl_0_1\l1960hl0_1km_ew%ax%\L60HL0_1%ax%%ay% cover axt
quit
kill axt all

&end

&end
```

6. Generate help files for FRAGSTATS (shown for the 1990 cover with HISLU classes only) and ArcGIS

6.1 change to a platform with fortran compiler

rm out

6.2 run FORTRAN program and adjust files

f77 gen_ba_file_frags_1990.f -→ yields executable file a.out
a.out -> yields files out.txt which is the batch file for fragstats, koord a file used to generate a point file with the fragstats results for the center coordinates, and a file called items used for further analyses.

rename out to out_90_50km_01_interv1.txt
rename items to items_90_50km_01_interv1.txt

open out_90_50km_01_interv1.txt in word
remove all blanks
exchange all $ by \
sve as text

example from out_90_50km_01_interv1.txt :

```
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_122, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_124, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_126, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_128, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1210, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1212, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1214, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1216, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1218, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1220, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1222, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1224, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1226, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1228, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1230, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1232, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1234, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1236, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1238, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1240, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1242, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1244, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1246, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1248, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1250, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1252, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1254, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1256, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1258, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1260, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1262, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1264, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1266, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1268, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1270, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1272, x, 8, x, x, IDF_ARCGRID
```

```
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1274, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1276, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1278, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1280, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1282, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1284, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1286, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1288, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1290, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1292, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew2\l90hl0_1294, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_142, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_144, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_146, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_148, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_1410, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_1412, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_1414, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_1416, x, 8, x, x, IDF_ARCGRID
F:\fragstats_ecochange_samples_l1990_hl_0_1\l1990hl0_1km_ew4\l90hl0_1418, x, 8, x, x, IDF_ARCGRID
.
.
.
```

gen_ba_file_frags_1990.f:

```
      PROGRAM G

    OPEN (UNIT=12,FILE='out',STATUS='NEW')
    OPEN (UNIT=13,FILE='koord',STATUS='NEW')
    OPEN (UNIT=14,FILE='items',STATUS='NEW')
    IYEAR = 1990
     IZAHL = 0
    DO  25 I=2,82,2
    DO 26 II=2,94,2
      IZAHL = IZAHL + 1
     IX = II
     IY = I
     AX = (((IX - 1) * 50000.) + 25000.) + 2575600.
     AY = (((IY - 1) * 50000.) + 25000.) + 1350900.
    IF (IX .LT. 10 .AND. IY .LT. 10)WRITE (12,21)IYEAR,
   .IYEAR,IY,IY,IX
    IF (IX .GE. 10 .AND. IY .GE. 10)WRITE (12,22)IYEAR,
   .IYEAR,IY,IY,IX
    IF (IX .LT. 10 .AND. IY .GE. 10)WRITE (12,23)IYEAR,
   .IYEAR,IY,IY,IX
    IF (IX .GE. 10 .AND. IY .LT. 10)WRITE (12,24)IYEAR,
   .IYEAR,IY,IY,IX


    WRITE (13,31)IZAHL,
   .AX,AY


    IF (IX .LT. 10 .AND. IY .LT. 10)WRITE (14,41)IZAHL,
   .AX,AY,IYEAR,IYEAR,IY,IY,IX
    IF (IX .GE. 10 .AND. IY .GE. 10)WRITE (14,42)IZAHL,
   .AX,AY,IYEAR,IYEAR,IY,IY,IX
    IF (IX .LT. 10 .AND. IY .GE. 10)WRITE (14,43)IZAHL,
   .AX,AY,IYEAR,IYEAR,IY,IY,IX
    IF (IX .GE. 10 .AND. IY .LT. 10)WRITE (14,44)IZAHL,
   .AX,AY,IYEAR,IYEAR,IY,IY,IX

21      FORMAT('F:$fragstats_ecochange_samples_l',I4,
   .'_hl_0_1$l',I4,'hl0_1km_ew',I1,'$l90hl0_1',I1,I1,
   .', x, 8, x, x, IDF_ARCGRID')
22      FORMAT('F:$fragstats_ecochange_samples_l',I4,
   .'_hl_0_1$l',I4,'hl0_1km_ew',I2,'$l90hl0_1',I2,I2,
   .', x, 8, x, x, IDF_ARCGRID')
```

```
23      FORMAT('F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I2,'$l90hl0_1',I2,I1,
    .', x, 8, x, x, IDF_ARCGRID')
24      FORMAT('F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I1,'$l90hl0_1',I1,I2,
    .', x, 8, x, x, IDF_ARCGRID')
     IF(IZAL.EQ.1000) IZAL=0

31      FORMAT(I5,',',F10.1,',', F10.1)

41      FORMAT(I5,',',F10.1,',', F10.1,',',
    .'F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I1,'$l90hl0_1',I1,I1,
    .', x, 8, x, x, IDF_ARCGRID')
42      FORMAT(I5,',',F10.1,',', F10.1,',',
    .'F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I2,'$l90hl0_1',I2,I2,
    .', x, 8, x, x, IDF_ARCGRID')
43      FORMAT(I5,',',F10.1,',', F10.1,',',
    .'F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I2,'$l90hl0_1',I2,I1,
    .', x, 8, x, x, IDF_ARCGRID')
44      FORMAT(I5,',',F10.1,',', F10.1,',',
    .'F:$fragstats_ecochange_samples_l',I4,
    .'_hl_0_1$l',I4,'hl0_1km_ew',I1,'$l90hl0_1',I1,I2,
    .', x, 8, x, x, IDF_ARCGRID')

26     CONTINUE
25     CONTINUE

     CLOSE (UNIT=12)
     CLOSE (UNIT=13)
     CLOSE (UNIT=14)
     STOP
     END
```

6.3 Generate point shape file with coordinates imported from koord.txt

---> all_p_50kmc

7. Run FRAGSTATS

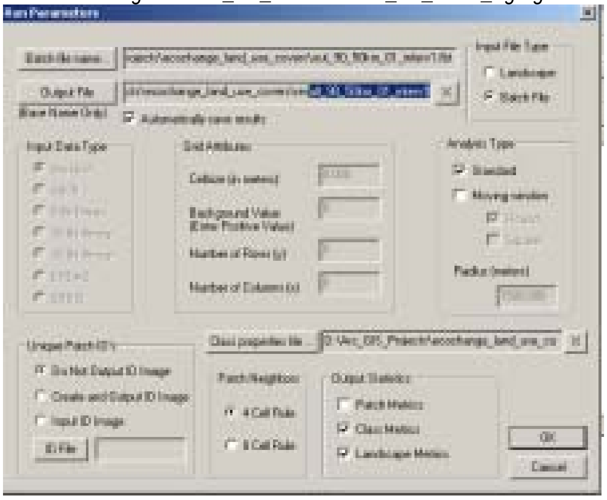
open batch editor and open with "all files" files
out_90_50km_01_interv1.txt

save as fbt file   with extention.fbt

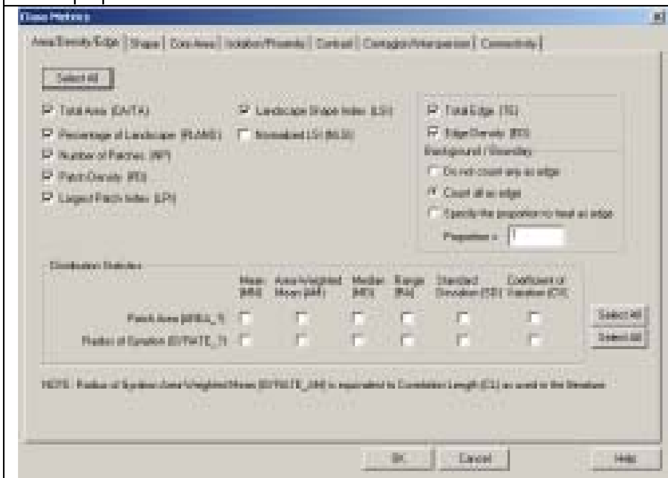
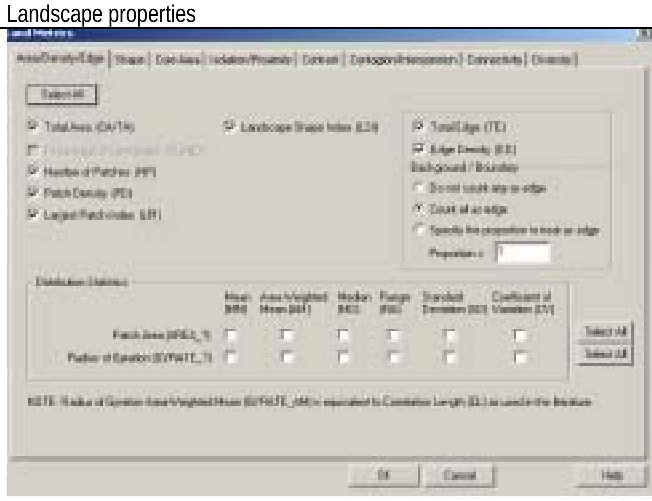
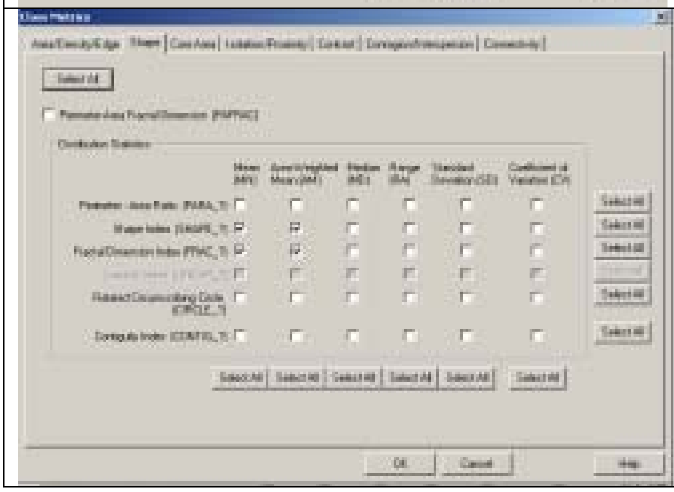
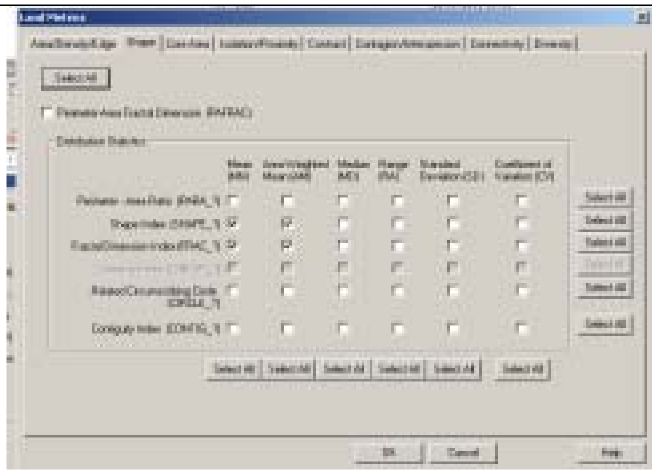
close

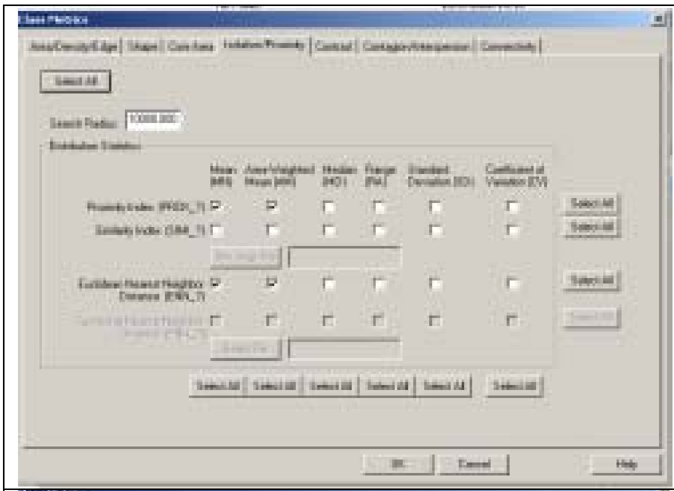
run fragstats (ca. 20 hrs)
for 1990 use file   1990_hl0_1km50kmwin_full_batch_frg.frg

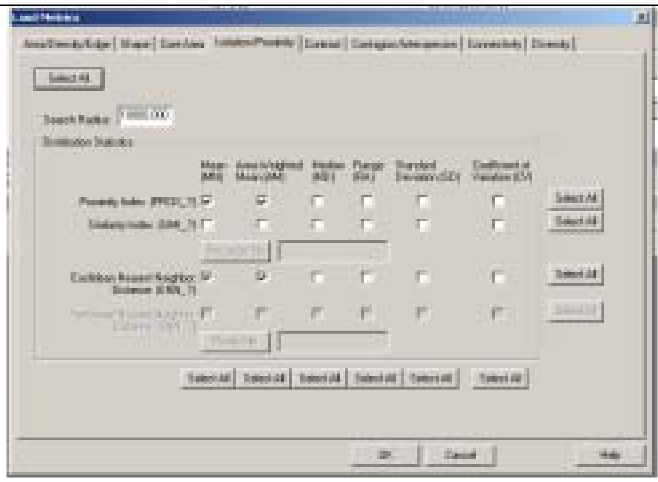
Gerneral settings of 1990_hl0_1km50kmwin_full_batch_frg.frg:

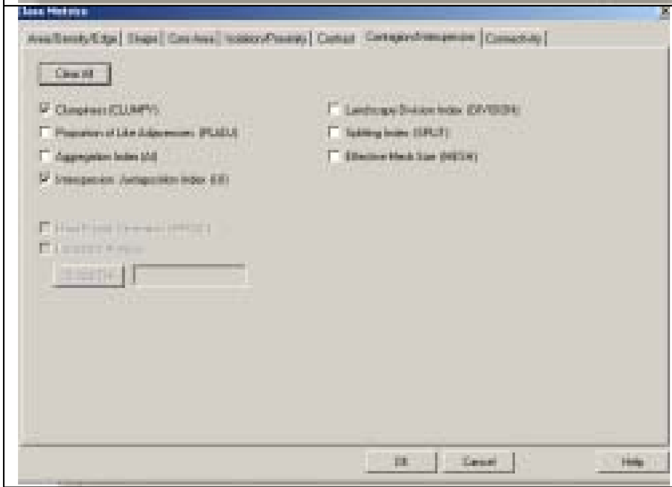


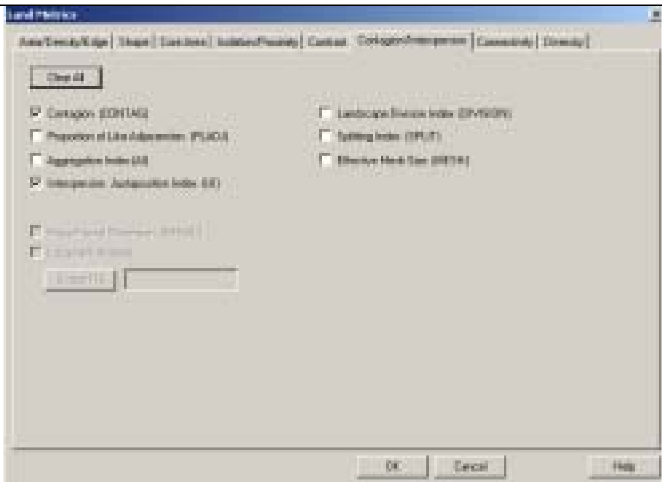
Class- and landscape properties of 1990_hl0_1km50kmwin_full_batch_frg.frg:

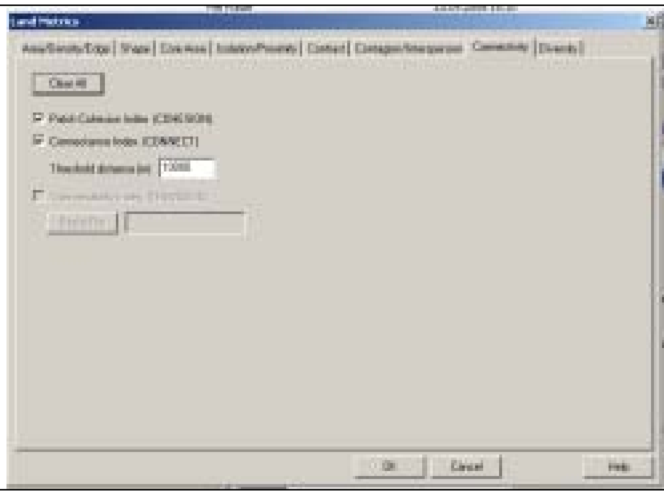
Class properties	Landscape properties
	
	

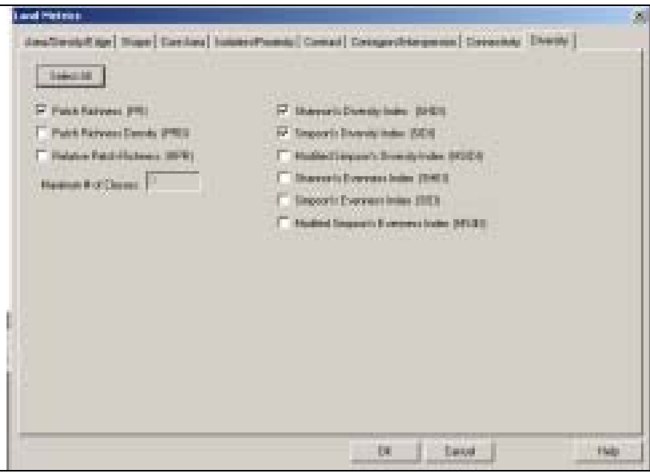












this saves results as
(a) D:\Arc_GIS_Projects\ecochange_land_use_covers\result_90_50km_01_interv1.class
(b) D:\Arc_GIS_Projects\ecochange_land_use_covers\result_90_50km_01_interv1.land
D:\Arc_GIS_Projects\ecochange_land_use_covers\result_90_50km_01_interv1.adj

Delete all blanks in (a) und (b); exchange all N/A by -9999.99 ersetzen and remove header; exchange extension to .txt

8. Import FRAGSTATS data into Workstation ARCINFO: &run aml90_50.txt to generate point covers with all metrics.

aml90_50.txt
Tables
Define items_90_50_i1
Id
4
5
b
x1
4
10
f
1
y1
4
10
f
1
ident
90
90
c
a
2
2
c
b
4
5
b
c
2
2
c
d
2
2
c
e
20
20

```
c
;N
;N
sel items_90_50_i1
add from items_90_50km_01_interv1.txt
save items_90_50_i1
quit
tables
dropitem items_90_50_i1 a b c d e
sel items_90_50_i1
sort id
quit
copy ALL_P_50KMC AP_9050KMCb
joinitem AP_9050KMCb.pat items_90_50_i1 AP_9050KMCb.pat id y ordered


Tables
Define r_90_50_i1_l
ident
90
90
c
TA
4
15
f
5
NP
4
15
f
5
PD
4
15
f
5
LPI
4
15
f
5
TE
4
15
f
5
ED
4
15
f
5
LSI
4
15
f
5
SHAPE_MN
4
15
f
5
SHAPE_AM
4
15
f
5
FRAC_MN
4
```

```
15
f
5
FRAC_AM
4
15
f
5
PROX_MN
4
15
f
5
PROX_AM
4
15
f
5
ENN_MN
4
15
f
5
ENN_AM
4
15
f
5
CONTAG
4
15
f
5
IJI
4
15
f
5
CONNECT
4
15
f
5
COHESION
4
15
f
5
PR
4
15
f
5
SHDI
4
15
f
5
SIDI
4
15
f
5
;N
;N

sel r_90_50_i1_l
add from result_90_50km_01_interv1land.txt
save r_90_50_i1_l
```

```
sel r_90_50_i1_l
sort ident
quit

copy AP_9050KMCb r90_50_01l
joinitem r90_50_01l.pat r_90_50_i1_l r90_50_01l.pat ident ident ordered


Tables
Define r_90_50_i1_c
ident
90
90
c
TYPE
20
20
c
CA
4
15
f
5
PLAND
4
15
f
5
NP
4
15
f
5
PD
4
15
f
5
LPI
4
15
f
5
TE
4
15
f
5
ED
4
15
f
5
LSI
4
15
f
5
SHAPE_MN
4
15
f
5
SHAPE_AM
4
15
f
5
FRAC_MN
```

```
4
15
f
5
FRAC_AM
4
15
f
5
PROX_MN
4
15
f
5
PROX_AM
4
15
f
5
ENN_MN
4
15
f
5
ENN_AM
4
15
f
5
CLUMPY
4
15
f
5
IJI
4
15
f
5
CONNECT
4
15
f
5
COHESION
4
15
f
5
;N
;N
sel r_90_50_i1_c
add from result_90_50km_01_interv1class.txt
save r_90_50_i1_c
quit

copyinfo r_90_50_i1_c r_90_50_i1grass
tables
sel r_90_50_i1grass
resel type cn 'grass'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1arab
tables
sel r_90_50_i1arab
```

```
resel type cn 'arable'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1nonag
tables
sel r_90_50_i1nonag
resel type cn 'non-agricultural'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1urb
tables
sel r_90_50_i1urb
resel type cn 'urban'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1forest
tables
sel r_90_50_i1forest
resel type cn 'forest'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1inlwat
tables
sel r_90_50_i1inlwat
resel type cn 'inlandwaters'
nsel
purge
y
sort ident
quit

copyinfo r_90_50_i1_c r_90_50_i1seaalcoast
tables
sel r_90_50_i1seaalcoast
resel type cn 'seaalongcoast'
nsel
purge
y
sort ident
quit

copy AP_9050KMCb r90_50_01cg
copy AP_9050KMCb r90_50_01ca
copy AP_9050KMCb r90_50_01cna
copy AP_9050KMCb r90_50_01cu
copy AP_9050KMCb r90_50_01cf
copy AP_9050KMCb r90_50_01ciw
copy AP_9050KMCb r90_50_01cs

joinitem r90_50_01cg.pat r_90_50_i1grass r90_50_01cg.pat ident ident ordered
joinitem r90_50_01ca.pat r_90_50_i1arab r90_50_01ca.pat ident ident ordered
joinitem r90_50_01cna.pat r_90_50_i1nonag r90_50_01cna.pat ident ident ordered
joinitem r90_50_01cu.pat r_90_50_i1urb r90_50_01cu.pat ident ident ordered
```

```
joinitem r90_50_01cf.pat r_90_50_i1forest r90_50_01cf.pat ident ident ordered
joinitem r90_50_01ciw.pat r_90_50_i1inlwat r90_50_01ciw.pat ident ident ordered
joinitem r90_50_01cs.pat r_90_50_i1seaalcoast r90_50_01cs.pat ident ident ordered
```

9. Display point covers with ArcView or ArcGIS

Appendix 2: ArcGis coverage files Landscape metrics Europe

File organization

- data_deliv_122
  - data_deliv_122_excel_txt_frg_appendix3
  - data_deliv_122_shape_appendix2

Data files

HISLU classes	
Year Name of coverage file	**Explanation**
1960	
r60_50_01cg	grassland
r60_50_01ca	arable
r60_50_01cna	Non-agricultural land
r60_50_01cu	urban
r60_50_01cf	forest
r60_50_01ciw	Inland water
r60_50_01cs	sea
r60_50_01l	**Landscape:** all hislu classes (7)
1990	
r90_50_01cg	grassland
r90_50_01ca	arable
r90_50_01cna	Non-agricultural land
r90_50_01cu	urban
r90_50_01cf	forest
r90_50_01ciw	Inland water
r90_50_01cs	sea
r90_50_01l	**Landscape:** all hislu classes (7)
2000	
r00_50_01cg	grassland
r00_50_01ca	arable
r00_50_01cna	Non-agricultural land
r00_50_01cu	urban
r00_50_01cf	forest
r00_50_01ciw	Inland water
r00_50_01cs	sea
r00_50_01l	**Landscape:** all hislu classes (7)

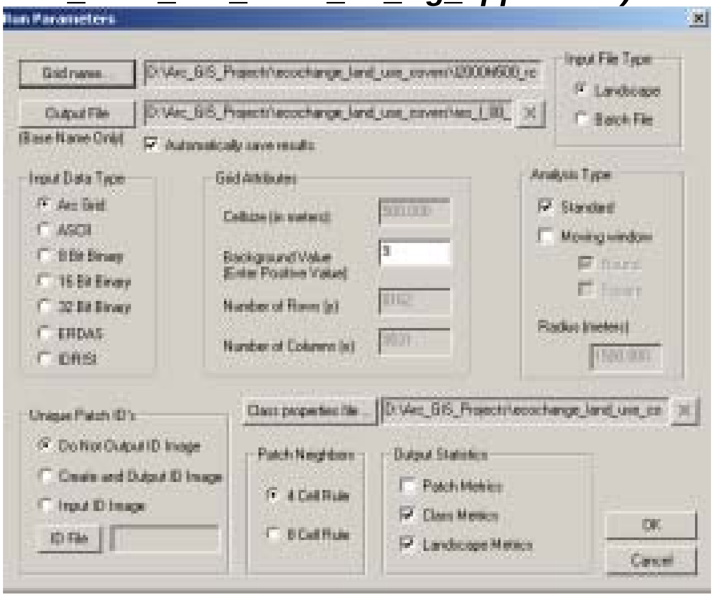
Grassland, forest, other vegetated	
Year Name of coverage file	**Explanation**
1990	
r90_50_gf141	Green urban areas
r90_50_gf231	Pastures
r90_50_gf311	Broad leaved forest
r90_50_gf312	Coniferous forest
r90_50_gf313	Mixed forest
r90_50_gf321	Natural grasslands
r90_50_gf322	Moors and heathland
r90_50_gf323	Sclerophyllous vegetation
r90_50_gf324	Transitional woodland-shrub
r90_50_gfngf	lumped remaining classes
r90_50_gfl	**Landscape:** all grassland, forest & other vegetated area classes + the lumped remaining classes (=10 classes)
2000	
r00_50_gf141	Green urban areas
r00_50_gf231	Pastures
r00_50_gf311	Broad leaved forest
r00_50_gf312	Coniferous forest
r00_50_gf313	Mixed forest
r00_50_gf321	Natural grasslands
r00_50_gf322	Moors and heathland
r00_50_gf323	Sclerophyllous vegetation
r00_50_gf324	Transitional woodland-shrub
r00_50_gfngf	lumped remaining classes
r00_50_gfl	**Landscape:** all grassland, forest & other vegetated area classes + the lumped remaining classes (=10 classes)
2 classes lumped Grassland, forest, other vegetated vs. matrix	
1990	
r90_50_yngre	lumped class consisting of units 231, 321, 311, 312, 313, 141, 322, 323, 324
r90_50_ynmat	lumped class consisting of all classes **not** consisting units 231, 321, 311, 312, 313, 141, 322, 323, 324
r90_50_ynl	**Landscape:** 2 above classes
2000	
r00_50_yngre	lumped class consisting of units 231, 321, 311, 312, 313, 141, 322, 323, 324
r00_50_ynmat	lumped class consisting of all classes **not** consisting units 231, 321, 311, 312, 313, 141, 322, 323, 324
r00_50_ynl	**Landscape:** 2 above classes

2 classes lumped intensive urban, agricultural use and non-vegetated areas vs.matrix	
Year Name of coverage file	**Explanation**
1990	
r90_50_ieint	lumped class consisting of units 111 through 213 and 331 through 335
r90_50_iemat	lumped class consisting of all classes **not** consisting units 111 through 213 and 331 through 335
r90_50_iel	Landscape: 2 above classes
2000	
r00_50_ieint	lumped class consisting of units 111 through 213 and 331 through 335
r00_50_iemat	lumped class consisting of all classes **not** consisting units 111 through 213 and 331 through 335
r00_50_iel	Landscape: 2 above classes

Appendix 3: Command files (.frg) and output for FRAGSTATS runs with covers at 500-m pixel resolution

File organization

General settings of FRAGSTATS runs at 500-m resolution (all .frg files in folder data_deliv_122_excel_txt_frg_appendix3)



Data files

Name of file	Explanation
1960_hl_5km.frg	FRAGSTATS command file for 1960
1990_hl_5km.frg	FRAGSTATS command file for 1990
2000_hl_5km.frg	FRAGSTATS command file for 2000
res_l_60_05kmsu_21_hislu_land.txt	All metrics at landscape level for 1960
res_l_90_05kmsu_21_hislu_land.txt	All metrics at landscape level for 1990
res_l_00_05kmsu_21_hislu_land.txt	All metrics at landscape level for 2000
res_l_60_05kmsu_21_hislu_class.txt	All metrics at class level for 1960
res_l_90_05kmsu_21_hislu_class.txt	All metrics at class level for 1990
res_l_00_05kmsu_21_hislu_class.txt	All metrics at class level for 2000
metrics_hislu_500m_land60_90_2000.xls	All metrics at landscape level for 1960, 1990 and 2000 as Excel file
metrics_hislu_500m_class60_90_2000.xls	All metrics at class level for 1960, 1990 and 2000 as Excel file

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Prepared by CR21 ALTERRA.

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Introduction

The major objective here is to develop a refinement of land cover information into relevant ecological classes (see page 97 of the ECOCHANGE proposal task 01.02.03 "refined classifications") and can be considered as part II of the deliverable report D01.02.02. This ecological refinement concerns the land cover information as produced within task T01.02.02, the pan-European Land Cover Mosaics (PLCM's), see also deliverable report D01.02.01 and http://www.synbiosys.alterra.nl/ecochange/plcm.aspx . The methodology used is based on the experience from the PEENHAB project (Mücher et al., 2004, 2005). Land cover information next to environmental data sets plays a crucial role in this methodology. Since it became clear that in-situ information is often crucial next to information derived from remotely sensed information (position paper Mucher et al 2006 presented at the final workshop BIOPRESS) much effort was put in the collection of vegetation relevés across Europe. The land cover refinements will focuss especially on the forest and grassland ecosystems, since they are the major focus of the ECOCHANGE project. Since no list of key species was yet available when we started with this activity we made a proposal (see also analytical protocol of WP 1.2) of interesting vegetation types and related Annex I habitat types (European Commission, 2007) to be modelled in terms of their probability in actual distribution across Europe. The following sections will the selected Annex I habitat types and relation vegetation types, their spatial modelling and results.

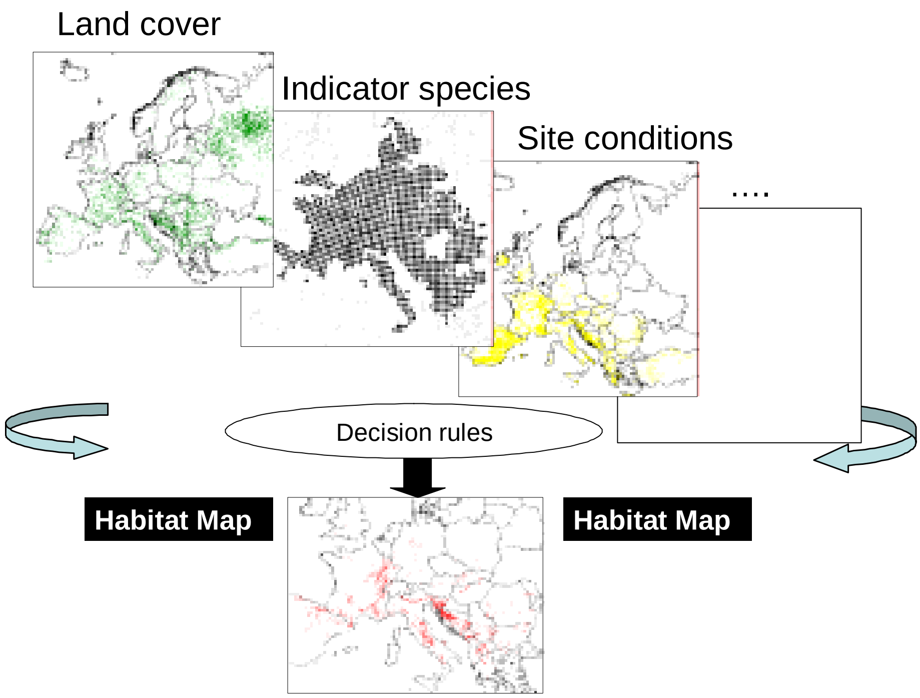


Figure 1 Flowchart of the methodological approach (Mücher et al 2005) to identify the spatial distribution of European Habitats.

Much effort was made on the establishment of the knowledge rules for the relationship between CORINE land cover classes (CEC, 1994; Bossard et al, 2000; Büttner et al, 2004) and the Annex 1 Habitats (European Commission, 2007), see also the website http://www.synbiosys.alterra.nl/ecochange/singleclasses.aspx . The knowledge rules were largly based on the ecological knowledge of Dr R.G.H. Bunce who was responsible for this specific part in the report. The following sections will discuss the selected Annex I habitat types and related vegetation types, the established knowledge rules, and their impmentation as spatial distribution models and the final map results for the selected habitat types.

Habitat and vegetation typology

The use of the Natura 2000 habitat types seems to be very logic since the European policys on nature and biodiversity conservation are stronlgly linked to the HABITAT Directive. However, the Annex I of the HABITAT directive is not a hierarchical system and cannot be applied at various scales. Since aggregation and desaggregation of land cover, habitats and vegetation types is a strong requirement for the ECOCHANGE project, we suugest to use the European vegetation classification next to the Annex I of the HABITAT Directive. The European vegetation classification is a hierarchical unifying system for habitats in Europe. It consists of 930 alliances, grouped into 237 alliances and 80 classes. In most cases the alliances can be linked to EUNIS and Annex I types. All Annex I habitat types should be linked in the end with the Plant Fuctional Types (PFTs) being used by the modellers (eg. LPJ-GUESS). On the basis of the European classification of vegetation types (Rodwell at al. 2002), as implemented in SynBioSys Europe, and a set of well-defined criteria, a preliminary set of 18 vegetation types have been selected. This will be discussed in the next sections.

Selecting of vegetation and habitat types

Within the scope of EcoChange the emphasis is on forest and grassland ecosystems, all within the Arctic-Alpine region. Additional, a wider spatial domain was defined that includes also Eastern Europe, Fennoscandian mountains, Mediterranean, and Central Europe. The criteria for the selecting of vegetation types have been defined as follows by us:

- Sensitive to climatic change
  - salt marsh vegetation along the coast;
  - snow bed vegetation and tall forbs vegetation in alpine en sub alpine regions)
  - bog vegetation
- Sensitivity to land use change
  - Grassland and heath types in sub alpine and alpine regions
  - Mediterranean shrub vegetation
- Availability of computerized plot observation data.

Three tables will be presented. One with the selected vegetation types (called Alliances in the hierarchical system of the European vegetation classification, see Rodwell eta al., 2002). For each type there is a short description and an indication there sensitive. The higher order level (Class) to which the selected types belong is mentioned each time above.

The second table presents a list of potential species for each of the vegetationtypes. This list is created by linking the vegetation types to Natura2000 habitat types and to extract the the species listed for the habitat types.

Table 1 Prelimanary list of 15 selected vegetation types (plant communities), according to the European Vegetation Classification. The types in grey represent the orders or alliances.

Code	Scientific name	Description	Sensivity
25	*Oxycocco-Sphagnetea*	*Ombrotrophic bog and wet heathland vegetation of acid oligotrophic peats*	
25A01	**Ericion tetralicis**	Wet heath and bog vegetation on drying deeper peats or winter-waterlogged peaty intergrades (Atlantic and sub-atlantic distribution)	Representative of heathlands and susceptable to changes in ground water levels and land use.
25C02	**Ledo-Pinion**	Pine-dominated swampy woodlands (East-European distribution)	Representative of heathlands and susceptable to changes in ground water levels and land use.
26	*Molinio-Arrhenatheretea*	*Anthropogenic pastures and meadows on deeper, more or less fertile soils in lowland regions*	
26I03	**Triseto-Polygonion bistortae**	Meadows of well-drained, relatively fertile mineral soils in low-input agricultural systems of montane regions	Very sensitive to changes in agricultural practice.
28	*Festuco-Brometea*	*Steppes, rocky steppes and sandy grasslands of the sub-continental temperate and sub-boreal regions*	
28F05	**Festucion valesiacae**	Sub-continental closed fescue pastures and swards of central Europe	Sensitive to changes in agricultural practice.
42	*Mulgedio-Aconitetea*	*Scrub and tall-herb vegetation at high altitudes, moistened and fertilised by percolating water*	
42A01	**Adenostylion alliariae**	Tall-herb communities of central European mountains	Sensitive to climatic change and maybe land use.
43	*Salicetea herbaceae*	*Vegetation of long-lasting snow-beds and slopes irrigated by melt waters*	
43A04	**Salicion herbaceae**	Dwarf-willow and moss dominated communities of snow-beds on lime-poor soils and rocks	Wide spread at high altitudes in the Alps and southern Norway, progressively lower in the North of Norway. Distribution can accurately estimated and very sensitive to climatic change
44	*Elyno-Seslerietea*	*Alpine and sub-alpine calcareous grasslands*	
44D08	**Seslerion albicantis**	Alpine and sub-alpine calcareous blue-grass swards	In the mountains this is one of highest grazed pastures susceptable to declining grazing pressure.
46	*Juncetea trifidi*	*Pastures, rush-heaths and fjell-field on lime-poor soils above the forest belt in alpine and sub-alpine zones*	

46A04	**Caricion curvulae**	Alpine acid swards of the Alps and eastern and southern Carpathians	Sensitive to climatic change, likely to be colonized by trees and srubs (possibily bu Pinus mugo and Juneperus species)
46A08	**Juncion trifidi**	Rush-heaths of Scandinavia, the Alps and the western Carpathians	Sensitive to climatic change, likely to be colonized by trees and srubs (possibily bu Pinus mugo and Juneperus species)
46B05	**Nardion strictae**	Dense chionophilous grassy swards of the subalpine and alpine belts of the Alps, Carpathians and northern Apennines	Sensitive to land use
59	Querco-Fagetea	Mixed broadleaved woodland of more temperate climates in central and western Europe	
59B05	**Cephalanthero-Fagion**	**Thermophilous beech forests mostly on limestone**	Sensitive to climatic change
62	*Loiseleurio-Vaccinietea*	*Arctic-boreal and (sub)alpine dwarf-shrub heathlands*	
62A02	**Loiseleurio-Diapension**	Arctic-boreal chionophilous tundra scrub	Sensitive to change in climat (moisture and temperature). Not effected by agricultaral activities
62A05	**Rhododendro-Vaccinion**	Subalpine chionophilous wind-swept dwarf shrub heath of the Alps and Carpathians	Alpine low scrub mainly sensitive to grazing pressure
63	*Erico-Pinetea*	*Calcareous relict montane pine woods of the Balkans, the Alps and Carpathians*	
63A01	**Erico-Pinion sylvestris**	Relict open pine woods of the Alps, Carpathians and northern Dinarides	Will probably expand due to climatic change and/or abandoment (ask Jozef)
66	*Vaccinio-Piceetea*	*Coniferous forest communities, and related heaths, of more acidic soils*	
66B01	**Pinion mugo**	Subalpine silicicolous krummholz of mountains of central and southwestern Europe	Might expand due to changes in climate and agricultural abandonment

This Table was presented during the March workshop in 2007 in Wageningen and was well perceived as a preliminary selection of plant communities. In the months after the workshop the table has been slightly changed with the removal of the Mediterranean plant communities (Rosmarinion officinalis & Cistion ladaniferi) and Coastal plant communities (Armerion maritimae and Puccinellion phryganodis). Instead, Nardion stricae has been added as an association under Juncetea trifidi and Cephalantero-fagion under Querco-Fagetea. Finally, it lead to the selection of 18 Annex I habitat types (see Table 2), for which European distribution maps will be produced.

Table 2 Table of selected Natura 2000 habitat types and their relation to vegetation types, according to the European Vegetation Classification.

Nr.	Natura 2000 code	Natura 2000 description	Code	Vegetation type
1	4060	Alpine and Boreal heaths	62A02	Loiseleurio-Diapension
			62A05	Rhododendro-Vaccinion
			63A01	Erico-Pinion sylvestris
2	4070	Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)	66B01	Pinion mugo
			25C02	Ledo-Pinion
3	6150	Siliceous alpine and boreal grasslands	46A04	Caricion curvulae
			46A08	Juncion trifidi
			46B05	Nardion strictae
4	6170	Alpine and subalpine calcareous grasslands	44D08	Seslerion albicantis
5	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates(Festuco-Brometalia) (* important orchid sites)	28C02	Bromion erecti
6	6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	46A04	Caricion curvulae
7	6240	Sub-pannonic steppic grasslands	28F	Festucetalia valesiacae
8	6250	Pannonic loess steppic grasslands	28E	Festucetalia vaginatae
9	7110	Active raised bogs	25A01	Ericion tetralicis
10	7130	Blanket bogs (* if active bog)	25A01	Ericion tetralicis
11	9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	59B05	Cephalanthero-Fagion
12	9410	Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)	66C01	Dicrano-Pinion
13	9420	Alpine Larix decidua and/or Pinus cembra forests		
14	9510	Southern Apennine Abies alba	66A01	Abieti-Piceion

In-situ data

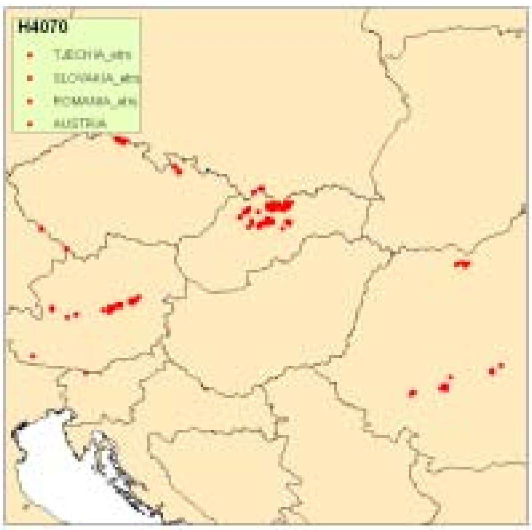
To perform the various analyses within EcoChange the availability of in situ vegetation data (plot observations or relevés) is highly required. The estimation is that throughout Europe there are more than one million computerized plot observations stored in numerous local databases. Most of these observations are available in so-called Turboveg databases. Turboveg (Hennekens and Schaminée, J.H.J 2001) is a software package (for Microsoft Windows®) that was developed in The Netherlands for the processing of plot observations. It’s an easy-to-use data base management system and provides methods for input, import, selection, and export of plot dat. In 1994, Turboveg was accepted as the standard computer package for the European Vegetation Survey. Currently it has been installed in most European countries with more than thousand users.

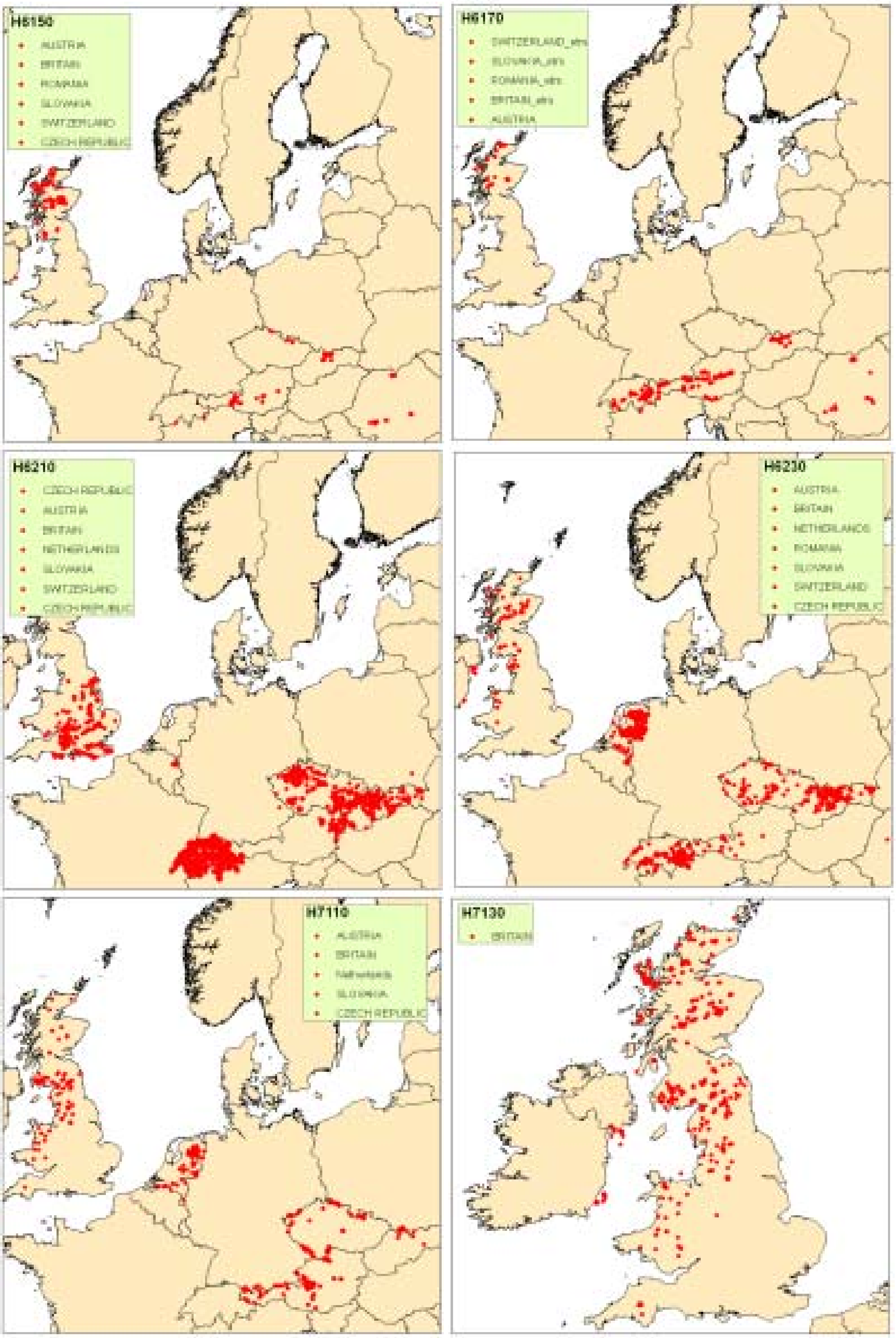
For the EcoChange project in-situ (stored in Turboveg databases) has been obtained through the network of EcoChange partners and the network of SynBioSys Europa (Schaminée et al., 2007). In Table 1 an overview is given of all the collected vegetation releves. Unfortunately, there are still a lot of EU countries for which we did not succeed yet to obtain vegetation plot data, although we know that they exist.

Table 3 Overview of collected vegetation releves

Country	Contact person	# of releves	Selected	Long/Lat	Precision	Vegetation types	Remarks
Netherlands	stephan.hennekens@wur.nl	420,000	890	yes	point & 5x5 km	All requested delivered	
Britain		28,536	2,900	yes	100x100m	All requested delivered	
Germany	dengler@uni-lueneburg.de						Data expected soon
Belgium	Heidi.DEMOLDER@inbo.be	856	856	yes	point	Acid+Basic graslands	
Austria	wolfgang.willner@vinca.at	917	4,300	yes	35km2	All requested delivered	
Tjech republic	chytry@sci.muni.cz	5,985	8,762	yes	point	All requested delivered	
Slovakia	jozef.sibik@savba.sk	17,910	15,003	yes	point	All requested delivered	
Bulgaria	iva@bio.bas.bg	137	137	yes	point	Acid+Basic graslands	
Slovenia	urban@zrc-sazu.si	0	0	no			Approached, but no geo refe
Frankrijk	brisse.henry@orange.fr	0	0				Databank Sophie, H. Brisse i
Spain	idoia.biurrun@ehu.es	190	190	yes	10x10km	Acid+Basic graslands	
	mcaceres@ub.edu	1900					No yet approached
Roemenia	popanamaria19@yahoo.com	2000		yes	500 * 500 m	All types	
Switserland	niklaus.zimmermann@wsl.ch	14,900	14,900	yes	mostly 10x10m	All grassland types	
Poland		0	0				Approached, but no respons
Estonia		0	0				?
Latvia		0	0				?
Lithuania		0	0				?
Italy		0	0				?
Hungary	bdz@botanika.hu	0	0				Approached, but no respons
Norway	Nigel.Yoccoz@ib.uit.no	0	0				Approached, but no respons
Sweden		0	0				?
Denmark		0	0				?
		493,331	47,938				

The vegetation releves were classified into the relevant vegetation classes of Table 2, which are related to the specific Annex I habitat types of interest, using the TurboVeg software and additional specific criteria are mentioned in Annex I.




H6150
H6170
H6210
H6230
H7110
H7130

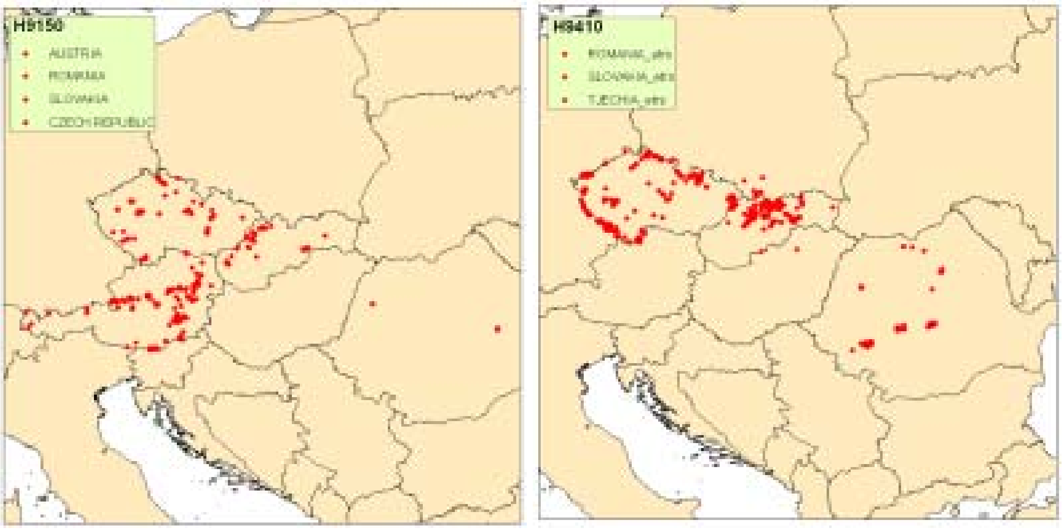


Figure 2 Locations of the cllected vegetation releves in relation to the specific habitat types.

Knowledge rules

A first formal relation between the Annex I habitats and CORINE land cover (CEC, 1994; Bossard et al, 2000; Büttner et al, 2004) was made in the PEENHAB project (Mücher et al., 2004, 2005). The relationship between CORINE land cover (CLC) and Natura 2000 habitats is now being improved per biogeographic region (Metzger et al. 2005) and additional rules are being created for topography. Next to important information about the threats and vegetation succession of the specific habitat type within the specific environmental region. Within the ECOCHANGE project the emphasis is on grassland and forest ecosystems. This means that habitats related to these ecosystems are being prioritized.

Many detailed comments have been made on various sections of the text in order to provide the background to the rules. In some cases where species have been given the incorrect names and where the terms used are not in regular English scientific usage than interpretations have been made of their probable intended meaning. However, it is essential to point out that the interpreters are technically trained and that these details are unlikely to have influenced their interpretation of the satellite images in terms of land cover. In the long term it is essential that the variation in the land cover classes is assessed objectively to determine the actual proportions of different habitats on the ground. Such information will greatly enhance the value of the existing land cover databases and will extend the range of potential uses of the CLC. In this respect, also the EBONE project will examine the possibilities of improving the matrices between the CLC and habitats in order to formalize these relationships. As Evans (2006) has shown phytosociology is the basis of many of the Annex I Habitat classes and also there have been different regional interpretations of their meaning. The first stage of validation is therefore to discuss the rules with staff in Alterra and then Doug Evans of the Topic Centre. The following sources of information have been used in preparing the current document:

1. Interpretation Manual of European Union Habitats
2. EUNIS website (http://eunis.eea.europa.eu/index.jsp)
3. Tables of Annex 1 habitats by Biogeographic regions
4. Working Paper on CLC equivalents (Romao, Evans and Halada , 2006)

5. CORINE land cover technical report
6. PEENHAB report (Mücher et al., 2005)
7. The list of Annex 1 habitats comprising HNV farmland by Environmental Zone and various other HNV documents e.g. Anderson et al (??)
8. Consultation with Doug Evans and some local experts

Evans (2006) describes in detail how the Annex 1 Habitats were constructed. The Interpretation manual of European Union Habitats is a living document. Evans also indicates that the names are much more difficult to change than their descriptions. The present document is a scientific amplification and interpretation of those descriptions, and will subsequently be discussed with Doug Evans.

The Annex 1 and its Priority Habitats are determined by an ongoing series of meetings held under the auspices of the EU. There has been no intention to complete a land cover key with total coverage of the land surface of Europe nor to provide a hierarchy for the classes. The EUNIS system was developed to provide this function but is unfortunately not suitable for field mapping. Because Annex 1 is legally binding it is essential that in the long term the habitats must be mapped in a consistent and reproducible way. The present document is a product of the ECOCHANGE project, but will also provide the framework for developing field rules for the habitats to be delivered by the EBONE expert system on a field computer.

The descriptions in the Interpretation manual of European Habitats include a wide range of levels of detail from three pages for species rich Nardus grasslands; to three lines for Castanea sativa forests but even in the former case there is no definition as to the number of species as a threshold for the class. Although some habitats are point features e.g.Tufa springs, it is unlikely that small patches of other habitats would be considered as valid records of that habitat. As Evans (2006) has pointed out the majority of Annex 1 habitats are based on vegetation associations with the principal exceptions of the landscape units, of which there are about 20. These associations are defined according to the descriptions in the literature which avoid gradients which are present differentially in some vegetation zones, especially in mountain areas. Highly disturbed vegetation and succession phases are also not included. The response of many countries has been to use broad interpretations of the Annex 1 descriptions e.g. in north-west Spain acidophilous beech forests (9120) are included in the biogeographic information submitted on Natura 2000 sites although the region is not mentioned as containing 9120 in the Annex I descriptions. Doug Evans has emphasized that the Annex I descriptions are not exhaustive as to their regional distributions. Furthermore it is recognized that the biogeographic references in the habitat names do not preclude that habitat from occurring outside that region.

In other cases, as in the Netherlands, closely linked associations have been added to the Annex I habitats present in Natura 2000 sites. The implications of this process are that a given list of habitats from different countries may not involve the same range of characteristics. The only way to determine the actual situation is to take stratified random samples of Annex I habitats in different Environmental Zones and actually record in the field what is present. Highly managed habitats e.g. species rich fallow and cropland, are not included in Annex I although they may be present in habitat complexes such as Machair. Many red data book species are present in such habitats and will therefore not be included under the current Annex I list Similarly agricultural land which is in the process of being abandoned is not included because the main objective of Annex 1 is to : "identify undisturbed/semi-natural habitats for protection". The Annex 1 habitats are not hierarchical but such a structure is currently being prepared for the expert system in EBONE.

Habitats may occur at several spatial levels, e.g. points, linear features, patches, and landscapes. The implication of these comments is that the majority of lowland agricultural landscapes do not have Annex 1 habitats present, hence there is a need to identify residual biodiversity in such areas by using other habitat categories (e.g. Bunce et al., 2008). Including linear and point elements.

There are many possibilities of refinement of the relationships identified in the present document especially by consultation with the available literature eg on tree lines and the range of altitudes occupied by different vegetation associations. Many of the terms used in Annex 1 are not defined which leads to differences in interpretation For example Fennoscandia may include the Baltic coast of Germany or not whilst alpine and montane are notoriously difficult to define.Evans (2006) states that the names of Annex 1 Habitats can only be altered by a decision from the Council of Ministers, whereas the descriptions can be changed by agreement of the Habitats Committee. The present document however is only concerned with the interpretation of those descriptions.

CORINE land cover manual

The English text contains many words eg briars and hortillonage that are not in general use in the ecological literature. Some terms eg heathland are incorrectly used and some species e.g. Ostrya carpinifolia do not belong to the land covers concerned. The English names of some species are also given the wrong Latin names e.g. briars are given as Rubus species Some of the descriptions are very general so that it is difficult to know what is included. The text in the present document includes commentaries on the manual and is designed to support the interpretation given as well as to help future users because the assumptions are described eg that briars probably do no mean Rosa spp which are only rarely seen as a dominant member of scrub habitats, whereas Rubus is widespread in this role throughout Europe. Similar problems have been encountered By Romeo Et al and in the HNV project.. Their information has been included in the present report.
As with Annexe 1 the only way to obtain quantitative more reliable data is to visit actual locations or use extant data . However another approach is to contact local recorders and experts to establish the range of regional interpretations that are present. and what they actually record in given situations. For example the boundaries between raised bog and blanket bogs is clear in well developed situations and in many regions but in Ireland and Scotland there are many overlaps and further confusion with valley bogs which do not fit into either of the other two categories.
The interpretation of some classes means that a given Annexe 1 habitat may appear in different places but with different rules being used to identify it. Paracchini et al give seeral examples of this process. Some land covers may have a wide range of biodiversity linked to them e.g vineyards and olive groves so that local rules could be developed to define potential biodiversity mote accurately. Thus in mountain foothills and on shallow soils in the Gredos mountains the vinyards are rich whereas in much of Andalucia they are intensively managed. Many of these problems were also encountered in the High Nature Farmland (HNV) project.

Each of the Annex I habitats has the following description fields in this document:

1. Mapping rules: these mapping rules are constructed from the information provided in the Interpretation manual of European habitats on where the habitat occurs. This information is supplemented by field experience of the author and by discussions with phytosociologists in the Ecochange project. In due course literature could be consulted to confirm that the altitudinal ranges are correct. Consultation will also be held with Doug Evans of the Topic Centre in Paris to further check the descriptions.

2. Indicator species: the indicator species are in most cases a subset of the Annex I plant species. A subset has been made since the selected species are the most characteristic and stable species present within the habitat

3. GHC BioHab. These are General Habitat Classes (GHC) as defined within the BIOHAB project. The basis of the General Habitat Categories is the classification of plant Life forms produced by the Danish botanist Raunkiaer early in the 20th Century. These Life forms e.g. annuals or trees. They are based on the scientific hypothesis that habitat structure is related to the environment. The BioHab General Habitat Categories cover the Pan-European region (except Turkey) with 130 GHC's derived from 16 Life Forms (Bunce et al., 2008) The Codes for the General Habitat Categories are in this document: **LHE** = leafy hemicryptophytes(herbs), **CHE** = caespitose hemicryptophytes (grasses), **SUC** = succulents, **THE** = therophytes (annuals), **HEL** =helophytes (marsh plants) **CRY** = mosses, liverworts and lichens, **DCH** = espaliers below 5cm, **SCH**=dwarf scrub 5-30cm, **LPH** = low scrub,30-60cm, **MPH** = mid scrub 60cm-2.0 m, **TPH** = tall scrub2m-5m., **FPH** = forest over 5 m, **CON** = conifer, **DEC** = deciduous, **EVR** = evergreen, **NLE** = non leafy evergreen, **SPI** = spiny/summer deciduous

4. Field identification: comments on the probable ease of identification of the habitat in the field.

5. Occurrence: three categories are used: rare, where the habitat is present in isolated patches, usually small, common, where it is distributed widely but does not cover large areas in the landscape and abundant where it is not only widespread but is also dominant. These are qualified where necessary.

6. Direct threats: based on the knowledge of the vegetation and literature . The information could also be supplemented later by other experts.

7. Potential impacts of climate change: based on knowledge of the vegetation, literature and the change in Environmental Zones described by Metzger et al (2008).

8. Vegetation succession due to abandonment: conversion of the present composition into BioHab plant lifeform categories followed by an interpretation of likely successional changes together with possible timescales.

9. Distribution. This is the distribution of the specific habitat over the various Environmental Zones (Metzger et al., 2005). The codes, based on the BioHab handbook (Bunce et al 2005) are as follows for the Environmental Zones:
ALS = Alpine South, **BOR** = Boreal, **NEM** = Nemoral, **ATN** = Atlantic North, **ATC** = Atlantic Central, **ALS** = Alpine South, **PAN** = Pannonian, **CON** = Continental, **LUS** = Lusitanean, **MDM**-Mediterranean Mountains, **MDN** = Mediterranean North, **MDS** = Mediterranean South

Distribution (sites) has been obtained directly from the Natura 2000 database intersected with the Environmental Zones. Distribution (Bunce) is based on expert knowledge from Bob Bunce. Besides, note that the code **CLC** refers to the CORINE land cover class. **Annex I** is standing for the Annex I of the Habitat Directive.

For the selected habitats the knowledge rules are given in the sections below. For all other habitat types, the knowledge rules are given in Annex II.

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HABITAT DISTRIBUTION MODELLING & RESULTS

The following sections will give the results of the habitat distribution modelling for each specific habitat type. All models were implemented within ARGIS 9.2 model builder. An example of such a model is given below. All resulting habitat distribution maps have a spatial resolution of 100 meters. Since this spatial resolution can be hardly visualised in this document for entire Europe, the results are also highlighted for specific details of the European habitat distribution maps.

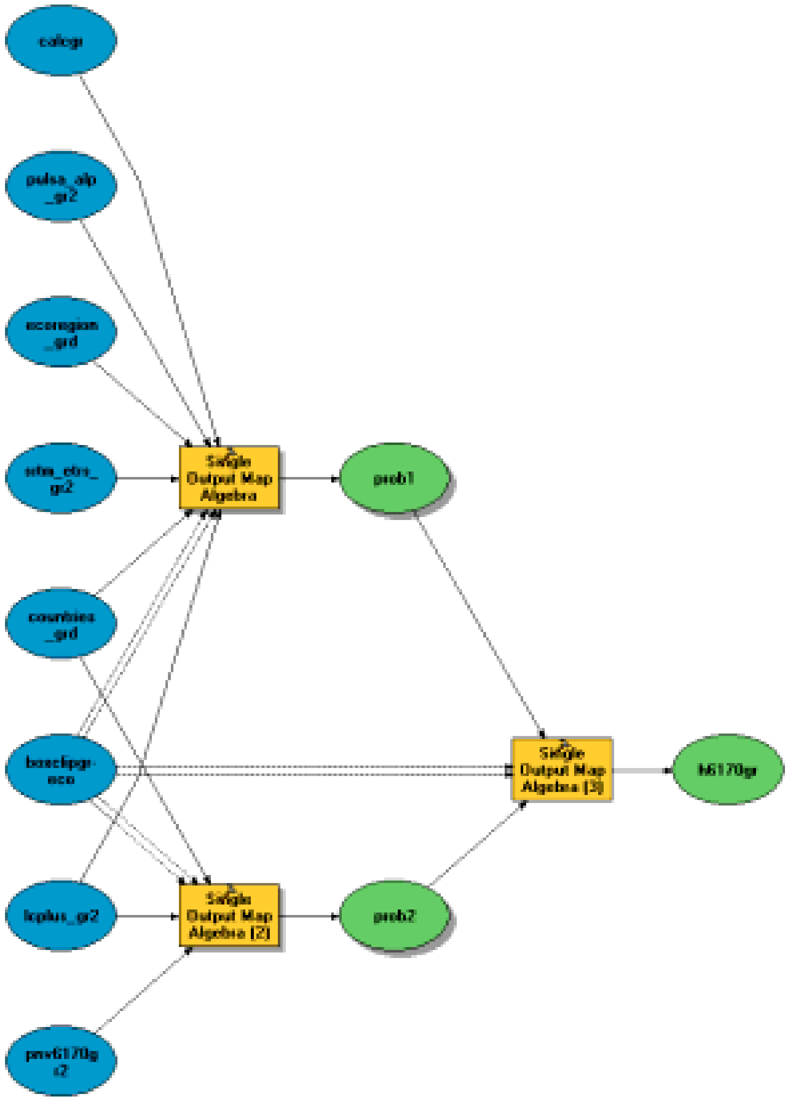

Figure 3 Example of the constructed ditribution model for Annex I habitat type H6170 "Alpine and subalpine calcareous grasslands" made with the modelbuilder in ARCGIS 9.2

For more details on the data sets we refer also to the submitted ECOCHANGE publication: Mücher, C.A., Hennekens, S.M., Bunce, R.G.H., Schaminée J.H.J. and M.E. Schaepman (2008). Modelling the Spatial Distribution of Natura 2000 Habitats across Europe. Submitted in February to Landscape & Urban Planning Manuscript Number: LAND-D-07-00306.

H4060 Alpine and Boreal heaths

Annex I description

Alpine and Boreal heaths
Natura 2000 habitat type code **4060**
Palearctic habitat code (and Corine Biotopes) **31.4**
Priority habitat: No
Parent: Temperate heath and Scrub (4000)
Description

Small, dwarf or prostrate shrub formations of the alpine and subalpine zones of the mountains of Eurasia dominated by ericaceous species, [Dryas octopetala], dwarf junipers, brooms or greenweeds; [Dryas] heaths of the British Isles and Scandinavia.

Sub-types :

- 31.41 - Alpide dwarf ericoid wind heaths. *Loiseleurio-Vaccinion.* Very low, single-stratum, carpets of trailing azalea, *Loiseleuria procumbens*, prostate *Vaccinium* spp. or other prostate ericoid shrublets, accompanied by lichen, of high windswept, mostly snowfree, localities in the alpine belt of the high mountains of the Alpine system.
- 31.42 - Acidocline alpenrose heaths. *Rhododendro-Vaccinion*. *Rhododendron* spp.-dominated heaths of acid podsols in the Alps, the Pyrenees, the Dinarids, the Carpathians, the Balkan Range, the Pontic Range, the Caucasus and the Himalayan system, often with *Vaccinium* spp., sometimes with dwarf pines.
- 31.43 - Mountain dwarf juniper scrub. *Juniperion nanae*, *Pino-Juniperion sabinae* p., *Pino-Cytision purgantis* p.Usually dense formations of prostrate junipers of the higher levels of southern Palaearctic mountains.
- 31.44 - High mountain *Empetrum-Vaccinium* heaths. *Empetro-Vaccinietum uliginosi.*Dwarf heaths dominated by *Empetrum hermaphroditum*, *Vaccinium uliginosum*, with *Arctostaphylos alpina, Vaccinium myrtillus, Vaccinium vitis-idaea* and lycopodes (*Huperzia selago*, *Diphasiastrum alpinum*), mosses (*Barbilophozia lycopodioides*, *Hylocomium splendens*, *Pleurozium schreberi*, *Rhythidiadelphus triquetrus*) and lichens (*Cetraria islandica*, *Cladonia arbuscula*, *Cladonia rangiferina*, *Cladonia stellaris*, *Cladonia gracilis*, *Peltigera aphthosa*) of the sub-alpine belt of the Alps, the Carpathians, the Pyrenees, the Central Massif, the Jura, the Northern Apennines, characteristic of relatively windswept, snow-free stations, in frost-exposuresituations that are, however, less extreme than those prevailing where communities of 31.41dominate. Unlike the formations of 31.41, those of 31.44 are clearly two-layered.
- 31.45 - Boreo-alpine heaths Alpine heaths of the highlands and islands of Scotland, alpine and lowland boreal heaths of Iceland, alpine heaths of boreal mountains, in particular of the mountains of Scandinavia, of the Urals, of the mountains of Siberia, alpine heaths of Far Eastern mountains at, or just south of, the limits of the boreal zone, with *Juniperus nana*, *Loiseleuria procumbens*, *Empetrum hermaphroditum*, *Arctostaphylos uva-ursi*, *Arctostaphylos alpina* and elements of Alpine flora.
- 31.46 - *Bruckenthalia* heaths: only outside the European Union.
- 31.47 - Alpide bearberry heaths. *Mugo-Rhodoretum hirsuti* p., *Juniperion nanae* p., i.a.Interpretation Manual - EUR25 Page 44 Mats of *Arctostaphylos uva-ursi* or *Arctostaphylos alpina* of the alpine, sub-alpine and locally, montane, belts of the Alps, the Pyrenees, the northern and central Apennines, the Dinarids, the Carpathians, the Balkan Range, the Rhodopides (south to the Slavianka-Orvilos, the Menikion, the Pangeon, the Falakron and the Rhodopi), the Moeso-Macedonian mountains (including Athos), the Pelagonides (south to the Greek Macedonian border ranges Tzena, Pinovon and Kajmakchalan) and Olympus, in the Thessalian mountains, mostly on calcareous substrates.
- 31.48 - Hairy alpenrose-erica heaths. *Mugo-Rhodoretum hirsuti* p. Forest substitution heaths, treeline fringe formations and alpine heaths or mats of calcareous soils in the Alps and the Dinarides, with *Rhododendron hirsutum*, *Rhododendron intermedium*, *Rhodothamnus chamaecistus* and *Erica herbacea*, often accompanied by *Clematis alpina*, *Daphne striata*, *Daphne mezereum*, *Globularia cordifolia*, *Arctostaphylos uva-ursi*. *Rhododendron hirsutum* and, mostly in the Austrian Alps, *Erica herbacea* are the most frequent dominants; other shrubs can locally play that role. *Arctostaphylos* spp.-dominated facies have, however, been included in 31.47.
- 31.49 - Mountain avens mats Dwarf heaths formed by mats of the woody *Dryas octopetala* in high Palaearctic mountains, in boreal regions and in isolated Atlantic coastal outposts.
- 31.4A - High mountain dwarf bilberry heaths *Vaccinium*-dominated dwarf heaths of the sub-alpine belt of southern mountains, in particular, of the northern and central Apennines, the Balkan Range, the Helenides, the Pontic Range and the Caucasus, with *Vaccinium myrtillus*, *Vaccinium uliginosum* s.l., *Vaccinium vitis-idaea* and, locally, *Empetrum nigrum*. They are richer in grassland species than the communities of 31.44 and often take the appearance of alpine grassland with dwarf shrubs. *Vaccinium myrtillus* also plays a much more dominant role, in lieu of *Vaccinium uliginosum* and *Empetrum hermaphroditum*.
- 31.4B - High mountain greenweed heaths Low *Genista* spp. or *Chamaecytisus* spp. heaths of the sub-alpine, low alpine or montane belts of high southern nemoral mountains, in particular of the southern Alps, the Apennines, the Dinarides, the southern Carpathians, the Balkan Range, the Moeso-Macedonian mountains, the Pelagonides, the northern Pindus, the Rhodopides, the Thessalian mountains.

Plants
31.41 - Loiseleuria procumbens, Vaccinium spp.; 31.42 - Rhododendron ferrugineum; 31.44 - Empetrum hermaphroditum, Vaccinium uliginosum; 31.45 - Juniperus nana, Loiseleuria procumbens, Empetrum hermaphroditum, Arctostaphylos uva-ursi, Arctostaphylos alpina; in Fennoscandia also Betula nana, Cassiope tetragona, Cornus suecica, Juniperus communis, Phyllodoce caerulea, Vaccinium myrtillus and Cladonia alpestris; 31.47 - Arctostaphylos uva-ursi, Arctostaphylos alpina; 31.48 - Rhododendron hirsutum, Rhododendron intermedium, Rhodothamnus chamaecistus and Erica herbacea; 31.49 - Dryas octopetala; 31.4A - Vaccinium myrtillus, Vaccinium uliginosum s.l., Vaccinium vitis-idaea; 31.4B - Genista radiata, G. holopetala, G. hassertiana, Chamaecytisus eriocarpus, C. absinthioides.
Geographic distribution
Austria, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain, Sweden, United Kingdom. Sub-type distribution: 31.41 alpine belt of the high mountains of the Alpine system; 31.42 the Alps, the Pyrenees, the Dinarids, the Carpathians, the Balkan Range, the Pontic Range, the Caucasus and the Himalayan system; 31.43 the higher levels of southern Palaearctic mountains; 31.44 the sub-alpine belt of the Alps, the Carpathians, the Pyrenees, the Central Massif, the Jura, the Northern Apennines; 31.45 Scotland, Iceland, boreal mountains, in particular of the mountains of Scandinavia, of the Urals, of the mountains of Siberia, Far Eastern mountains at, or just south of, the limits of the boreal zone; 31.47 alpine, sub-alpine and locally, montane, belts of the Alps, the Pyrenees, the northern and central Apennines, the Dinarids, the Carpathians, the Balkan Range, the Rhodopides (south to the Slavianka-Orvilos, the Menikion, the Pangeon, the Falakron and the Rhodopi), the Moeso-Macedonian mountains (including Athos), the Pelagonides (south to the Greek Macedonian border ranges Tzena, Pinovon and Kajmakchalan) and Olympus, in the Thessalian mountains, mostly on calcareous substrates; 31.48 the Alps and the Dinarides; 31.49 high Palaearctic mountains, in boreal regions and in isolated Atlantic coastal outposts; 31.4A the sub-alpine belt of southern mountains, in particular, of the northern and central Apennines, the Balkan Range, the Helenides, the Pontic Range and the Caucasus; 31.4B the sub-alpine, low alpine or montane belts of high southern nemoral mountains, in particular of the southern Alps, the Apennines, the Dinarides, the southern Carpathians, the Balkan Range, the Moeso-Macedonian mountains, the Pelagonides, the northern Pindus, the Rhodopides, the Thessalian mountains;
http://eunis.eea.europa.eu/habitats-factsheet.jsp?tab=0&idHabitat=10087

ECOCHANGE rules

CLC:	**322** - Moors and heath lands
Annex I:	**4060** - Alpine and Boreal heaths
Mapping rules:	Alpine North / Boreal over 800m Atlantic North over 900 m small patches on exposed coastal areas in the north) Alpine South over 1800 m. No soils as highly variable, although skeletal soils eg rankers predominate.
Indicator species:	-
GHC (BioHab):	- SCH/EVR but locally DCH/EVR/DEC + Moist acid soils + upto 30% bare ground/rocks + key indicators. Also LPH/CON MPH/EVR
Field identification:	Although highly variable because this class has a well recognisable landscape context and consistent life form structure it will probably be readily identified.
Occurrence:	-Occurs in large areas in the centre of its range – small patches on edge
Direct threats:	At low altitudes overgrazing locally although in some areas grazing may have halted scrub invasion. decline in grazing can therefore lead to quite rapid changes. Reindeer grazing can cause erosion in Scandinavia.
Climate change:	The increased temperatures likely in many of these mountains will favour scrub expansion at lower levels as shown by Kienast. However the class may well be able to move higher except where it is caused by extreme exposure.
Succession:	Colonisation: status Shrubby chamaephytes or L PH or even Mid phanerophytes in some situations. May remain as Shrubby chamaephytes in extreme situations and especially in the Scandinavian mountains at mid altitudes Low

<table>
<tr><td></td><td colspan="12">phanerophytes to Mid phanerophytes 10 and Tall phanerophytes 15 at low altitudes Low phanerophytes to Mid phanerophytes 10 Tall phanerophytes 15 possibly Forest phanerophytes 20.
.</td></tr>
<tr><td>Distribution (sites):</td><td>ALN</td><td>BOR</td><td>nem</td><td>ATN</td><td>ALS</td><td>CON</td><td>ATC</td><td>pan</td><td>LUS</td><td>MDM</td><td>mdn</td><td>mds</td></tr>
<tr><td>Distribution (Bunce):</td><td>ALN</td><td>BOR</td><td>nem</td><td>atn</td><td>ALS</td><td>CON</td><td>atc</td><td>pan</td><td>lus</td><td>mdm</td><td>mdn</td><td>mds</td></tr>
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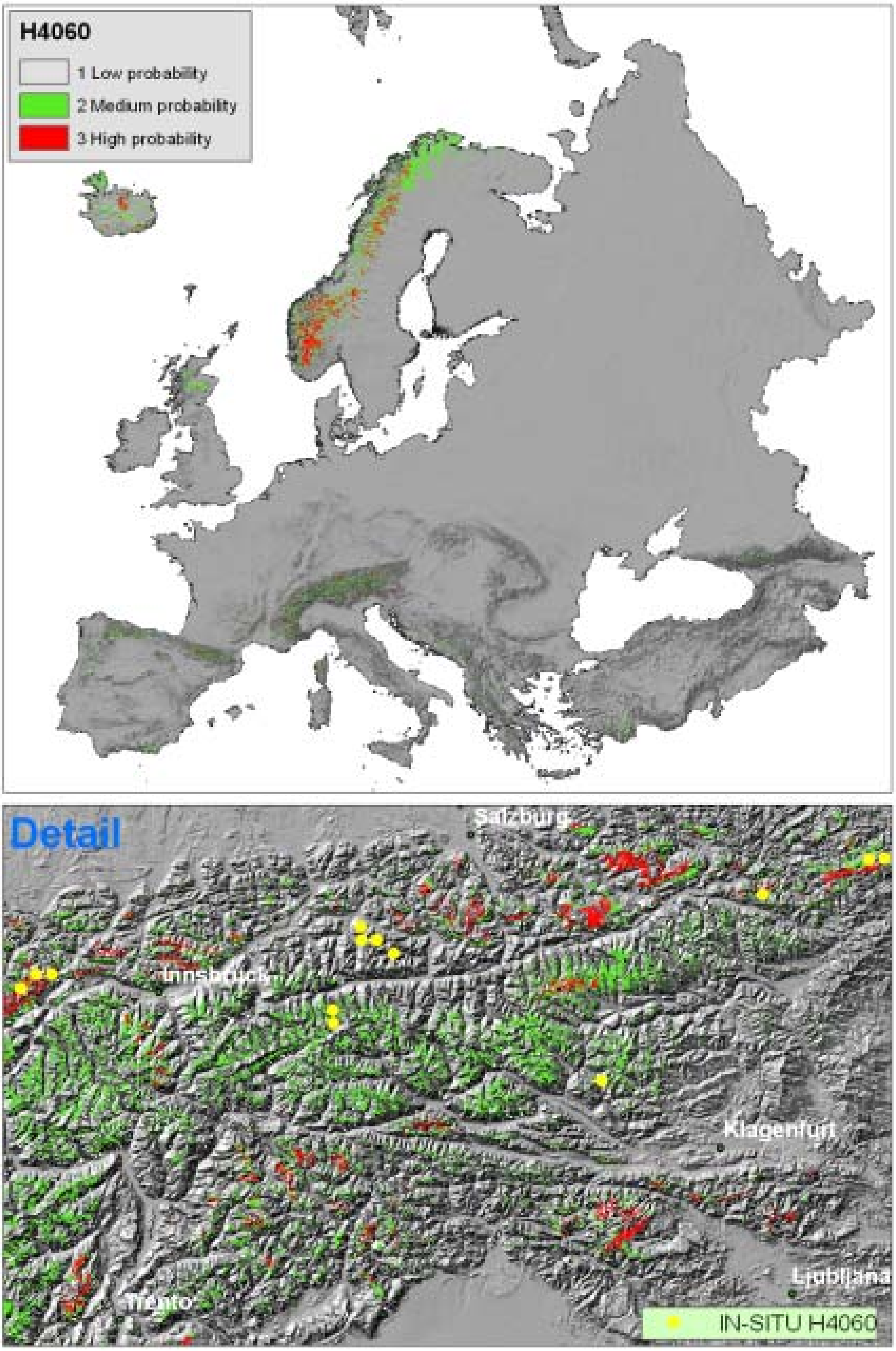
Photo 1 H4060 Alpine and boreal heath in Mountains Sweden (photo Bob Bunce, 2005).

RESULT H4060 ALPINE AND BOREAL HEATHS



H4070 Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)

Annex I description

Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)
Natura 2000 habitat type code **4070**
Palearctic habitat code (and Corine Biotopes) **31.5**
Priority habitat: Yes
Parent: Temperate heath and Scrub (4000)
Description
Pinus mugo formations usually with *Rhododendron* spp. of the dry eastern inner Alps, the northern and southeastern outer Alps, the southwestern Alps and the Swiss Jura, the eastern greater Hercynian ranges, the Carpathians, the Apennines, the Dinarides and the neighbouring Pelagonides, the Pirin, the Rila and the Balkan Range.
Plants
Pinus mugo, Rhododendron hirsutum, R. ferrugineum. Rhodothamnus chamaecistus
Geographic distribution
Alps (Austria, France, Germany, Italy) and Apennines
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10088

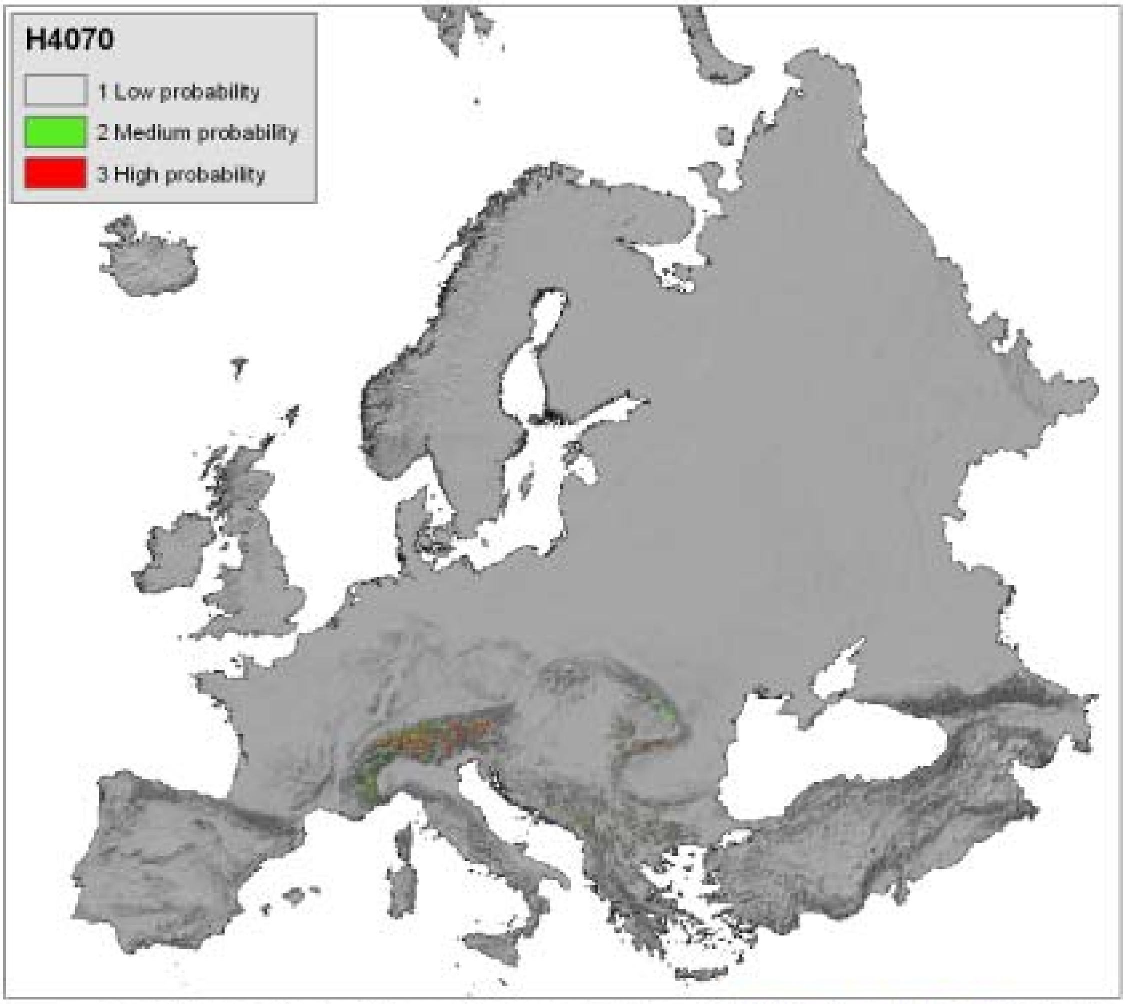
ECOCHANGE rules

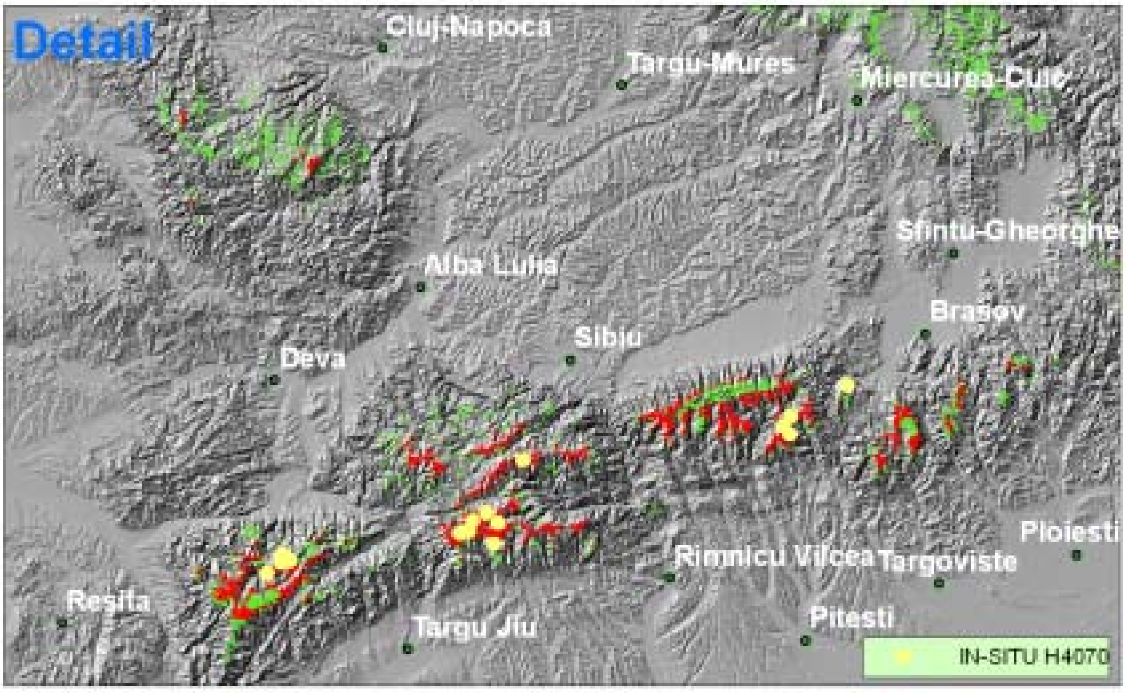
CLC:	**322** - Moors and heath lands										
Annex I:	**4070** - Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)										
Mapping rules:	Alpine South over 1800 m plus distribution of Pinus mugo.										
Indicator species:	Pinus mugo, Rhodendendron chamaecistus, Rhodondendron hirsutum.										
GHC (BioHab):	-MPH/EVR/CON + moist acid soils + montane situation + indicators										
Field identification:	:straightforward if a minimal cover of 30% is assumed.										
Occurrence:	-often in large units but loccaly in small patches										
Direct threats:	Burning and clearance for grazing.										
Climate change:	Likely to expand upwards with higher temperatures.										
Succession:	Colonisation: climax in most cases. .										
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Photo 2 H4070 - Bushes with Rhododendron hirsutum (Mugo-Rhododendretum hirsuti) on Schneeberg, Austria (Photo Thomas Wrbka)

Photo 3 H4070 - Bushes with Pinus mugo (Mugo-Rhododendretum hirsuti) on Schneeberg, Austria (Photo Thomas Wrbka)

RESULT H4070 BUSHES WITH PINUS MUGO AND RHOD. HIRSUTUM





H6150 Siliceous alpine and boreal grasslands

Annex I Description

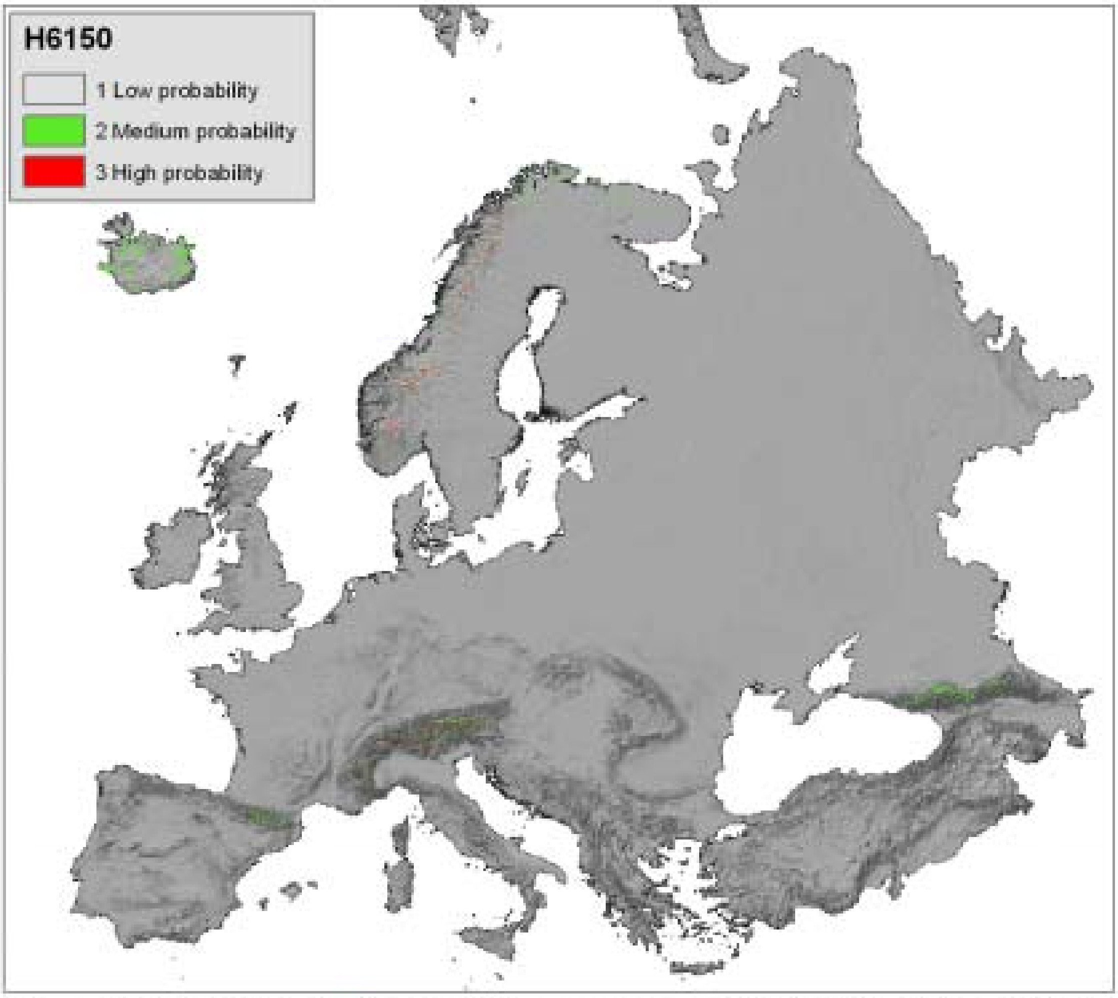
Siliceous alpine and boreal grasslands
Natura 2000 habitat type code **6150**
Palearctic habitat code (and Corine Biotopes) **36.32** (36.11, 36.32, 36.34)
Priority Habitat: No
Parent: Natural grasslands (6100)
Description
Boreo-alpine formations of the higher summits of mountains in the Alps and Scandanavia with outliers elsewhere such as the Tatra, with *Juncus trifidus*, *Carex bigelowii*, mosses and lichens. Also included are associated snowbed communities.
Plants
Juncus trifidus, *Carex bigelowii, Cassiope tetragona.*
Geographic distribution
Boreo-alpine formations of the higher summits of the boreal mountains of northern Finland and Sweden, of Scotland, northern England and northern Wales, with [Juncus trifidus, Carex bigelowii], mosses and lichens. Austria (Alpine), Czech Republic (Continental), Germany (Alpine, Continental), Finland (Alpine, Boreal), France (Alpine), Italy (Alpine), Poland (Alpine), Sweden (Alpine, Boreal), Slovenia (Alpine), Slovakia (Alpine), United Kingdom (Atlantic)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10115

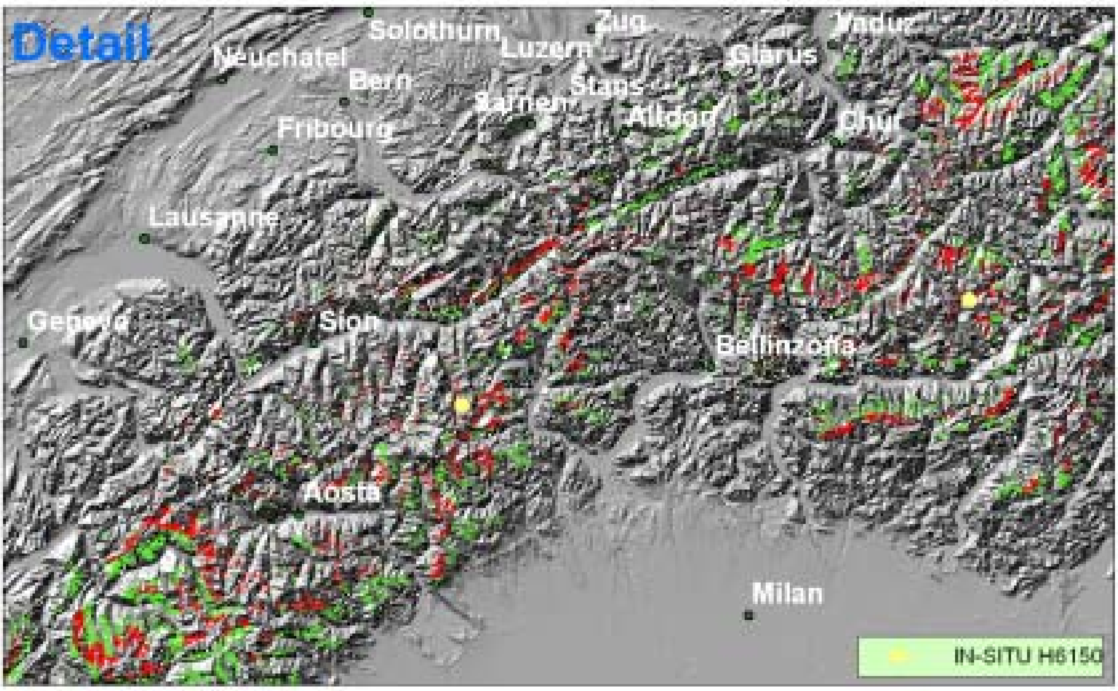
ECOCHANGE rules

CLC:	**321** - Natural grasslands (incl. Pastures)											
Annex I:	**6150** - Siliceous alpine and boreal grasslands											
Mapping rules:	Acid rocks / soils. Look at adjacency of 332 and 333. Alpine South over 1500m./ Alpine north/Boreal over 700m, Atlantic North over 900m											
Indicator species:	Juncus trifidus, Carex bigelowii.											
GHC (BioHab):	-CHE/CRY + some dwarf chamaephytes + shallow acidic soils + mud bare rock + indicator species											
Field identification:	Needs instructions to separate from related vegetation, but reasily identifiable											
Occurrence:	-Except in Atlantic North occurs in large units above the critical altitude											
Direct threats:	-Overgrazing											
Climate change:	Will allow tree / shrub growth to higher altitudes.											
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Cryptogames –Dwarf chamaephytes 5-10 years Shrubby chamaephytes 5-10 years maybe to Low phanerophytes5-10 years. .											
Distribution (s)	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	*CON*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Photo 4 H6150: Alpine Carex curvula turf on siliceous parent material; Mannlibode (ca. 2400 m) south of Reckingen, Oberwallis/Switzerland (Photo U. Bohn).

RESULT H6150 SILICEOUS ALPINE AND BOREAL GRASSLANDS





H6170 Alpine and subalpine calcareous grasslands

Annex I description

Alpine and subalpine calcareous grasslands
Natura 2000 habitat type code **6170**
Palearctic habitat code (and Corine Biotopes) **36.41 -> 36.45**
Priority habitat: No
Parent: Natural grasslands (6100)
Description Alpine and subalpine grasslands of base-rich soils, with *Dryas octopetala, Gentiana nivalis, Gentiana campestris, Alchemilla hoppeana, Alchemilla conjuncta, Alchemilla flabellata, Anthyllisvulneraria, Astragalus alpinus, Aster alpinus, Draba aizoides, Globularia nudicaulis, Helianthemum nummularium ssp. grandiflorum, Helianthemum oelandicum* ssp. *alpestre, Pulsatilla alpina* ssp.*alpina, Phyteuma orbiculare, Astrantia major, Polygala alpestris* (36.41 to 36.43) of mountain ranges such as the Alps, Pyrenees, Carpathians and Scandinavia. Also included are the grasslands of the subalpine (oro-Mediterranean) and alpine levels of the highest mountains of Corsica (36.37), and the Mesophile, closed, short turfs of the subalpine and alpine levels of the southern and central Apennines, developed locally above treeline, on calcareous substrates (36.38). Can also include associated snowpatch communities (e.g. *Arabidion coeruleae*). Sub-types : • 36.41 - Closed calciphile alpine grasslands Mesophile, mostly closed, vigorous, often grazed or mowed, grasslands on deep soils of the subalpine and lower alpine levels of the Alps, the Pyrenees, the mountains of the Balkan peninsula, and, locally, of the Apennines and the Jura. • 36.42 - Wind edge naked-rush swards Meso-xerophile, relatively closed and unsculptured swards of *Kobresia myosuroides* (*Elynamyosuroides*) forming on deep, fine soils of protruding ridges and edges exposed to strong winds in the alpine and nival levels of the Alps, the Carpathians, the Pyrenees, the Cantabrian Mountains, Scandinavian mountains and, very locally, the Abruzzi and the mountains of the Balkan peninsula, with *Oxytropis jacquinii* (*Oxytropis montana*), *Oxytropis pyrenaica*, *Oxytropis carinthiaca*, *Oxytropis foucaudii*, *Oxytropis halleri*, *Antennaria carpatica*, *Dryas octopetala*, *Draba carinthiaca*, *Draba siliquosa*, *Draba fladnizensis*, *Draba aizoides*, *Gentiana tenella*, *Erigeron uniflorus*, *Dianthus glacialis*, *Dianthus monspessulanus* ssp. *sternbergii*, *Potentilla nivea*, *Saussurea alpina*, *Geranium argenteum*, *Sesleria sphaerocephala*, *Carex atrata*, *Carex brevicollis*, *Carex foetida*, *Carex capillaris*, *Carex nigra, Carex curvula* ssp. *rosae* and *Carex rupestris*. Scandinavian *Kobresia* grasslands with *Carex rupestris* are included. • 36.43 - Calciphilous stepped and garland grasslands Interpretation Manual - EUR25 Page 59 Xero-thermophile, open, sculptured, stepped or garland grasslands of the Alps, the Carpathians, the Pyrenees, the mountains of the Balkan peninsula and the Mediterranean mountains, with very local outposts in the Jura. • 36.44 - Alpine heavy metal communities: included in habitat 6130 'Calaminarian grasslands (*Violetalia calaminariae*)', • 36.37 - Oro-Corsican grasslands Grasslands of the subalpine (oro-Mediterranean) and alpine levels of the highest mountains of Corsica. • 36.38 - Oro-Apennine closed grasslands Mesophile, closed, short turfs of the subalpine and alpine levels of the southern and central Apennines, developed locally above treeline, on calcareous substrates.
Plants
36.41 to 36.43 - *Dryas octopetala, Gentiana nivalis, Gentiana campestris, Alchemilla hoppeana, Alchemilla conjuncta, Alchemilla flabellata, Anthyllis vulneraria, Astragalus alpinus,Aster alpinus, Draba aizoides, Globularia nudicaulis, Helianthemum nummularium ssp.grandiflorum, Helianthemum oelandicum* ssp. *alpestre, Pulsatilla alpina* ssp. *alpina, Phyteumaorbiculare, Astrantia major, Polygala alpestris*; 36.37 - *Plantago subulata* ssp. *insularis, Saginapilifera, Armeria multiceps, Paronychia polygonifolia, Bellardiochloa violacea, Phleum brachysrachyum, Geum montanum, Sibbaldia procumbens, Veronica alpina*; 36.38 - F*estucaviolacea* ssp. *macrathera, Trifolium thalii*.
Geographic distribution
Austria (Alpine), Germany (Alpine), Spain (Alpine, Atlantic, Mediterranean) France (Alpine, Continental, Mediterranean), Greece (Mediterranean)

Italy (Alpine, Continental, Mediterranean), Poland (Alpine), Sweden (Alpine) Slovenia (Alpine), Slovakia (Alpine), United Kingdom (Atlantic)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10117

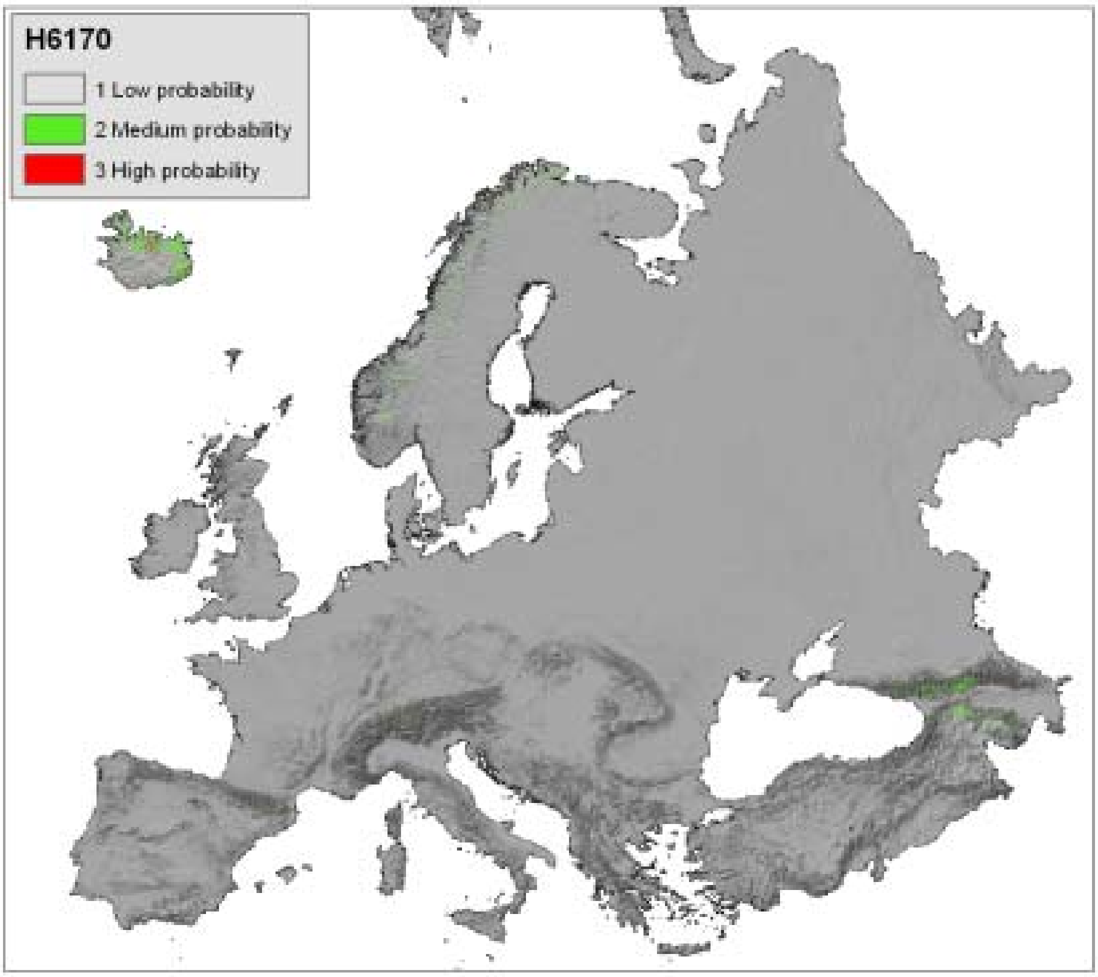
ECOCHANGE rules

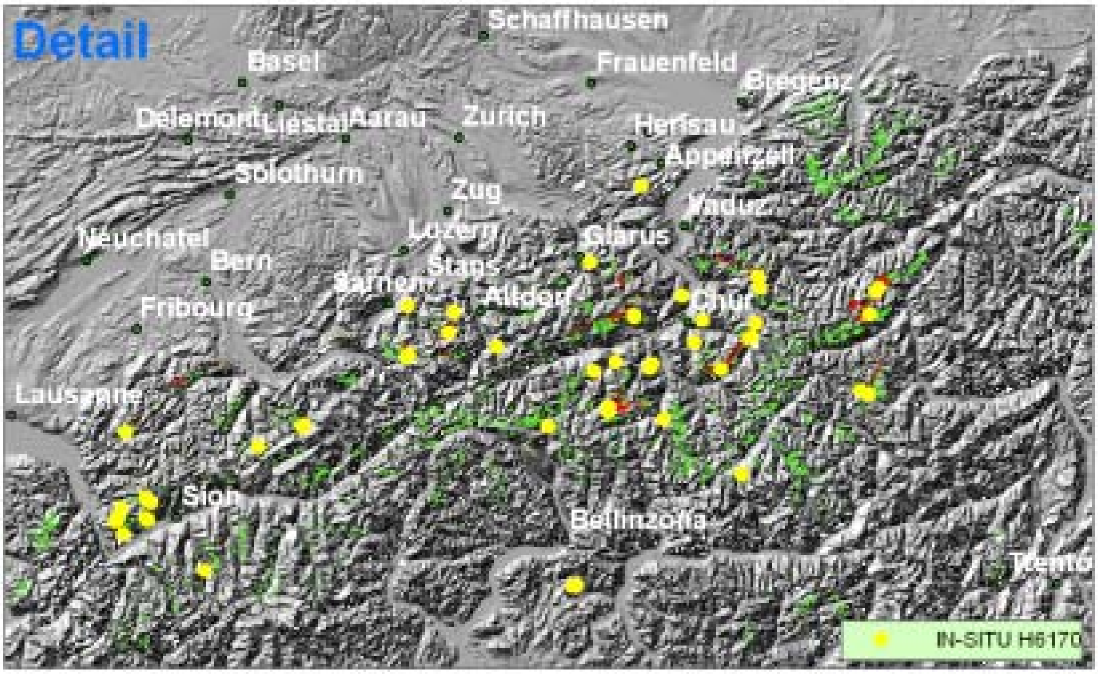
CLC:	**321** - Natural grasslands (incl. Pastures)										
Annex I:	**6170** - Alpine and subalpine calcareous grasslands										
Mapping rules:	Calcareous soils / rocks probably mainly skeletal but also deeper soils given in the description. Alpine North / Boreal over 700m, Atlantic North over 800m, Lusitanian / Mediterranean mountains over 2000m, Alpine South / Continental over1000m.										
Indicator species:	Dryas octopetala, Gentiana nivalis, Draba aizoides.										
GHC (BioHab):	-CHE/LHE + moist calcareous soils + open ground upto 3-% + montane situations + indicator species										
Field identification:	Contains many vegetation classes and experience probably needed for exact allocation.										
Occurrence:	-occurs in large units in the centre of its distributions – small patches towards the edge										
Direct threats:	Decline or cessation in grazing. Rate of change determines rate of development.										
Climate change:	May move higher but threatened at lower levels by increased tree / shrub growth.										
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Ceaspitose hemicryptophytes if not grazed Shrubby chamaephytes 5-10 Low phanerophytes 5-10 Tall phanerophytes 5-10 but only with climate change otherwise only Low phanerophytes. .										
Distribution (sites):	**ALN**	*bor*	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Photo 5 H6170 Alpine acalcareous grasslands at Ötscher Mountains, Austria (Photo Thomas Wrbka)

Photo 6 Photo 6 H6170 Alpine acalcareous grassland with Dryas octopetala and Anthyllis vulneraria at Ötscher Mountains, Austria (Photo Thomas Wrbka).

RESULT H6170 ALPINE AND SUBALPINE CALCAREOUS GRASSLANDS





*H6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)*

Annex I Description

Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) , (* important orchid sites)
Natura 2000 habitat type code **6210**
Palearctic habitat code (and Corine Biotopes) **34.31 -> 34.34**
Priority habitat: Yes
Parent: Semi-natural dry grasslands and scrubland facies (6200)
Description
Dry to semi-dry calcareous grasslands of the *Festuco-Brometea*. This habitat is formed on the one hand by steppic or subcontinental grasslands (*Festucetalia valesiacae*) and, on the other, by the grasslands of more oceanic and sub-Mediterranean regions (*Brometalia erecti*); in the latter case, a distinction is made between primary *Xerobromion* grasslands and secondary (semi-natural) *Mesobromion* grasslands with *Bromus erectus*; the latter are characterised by their rich orchid flora. Abandonment results in thermophile scrub with an intermediate stage of thermophile fringe vegetation (*Trifolio-Geranietea*). Interpretation Manual - EUR25 Page 61. Important orchid sites should be interpreted as sites that are important on the basis of one or more of the following three criteria: (a) the site hosts a rich suite of orchid species (b) the site hosts an important population of at least one orchid species considered not very common on the national territory (c) the site hosts one or several orchid species considered to be rare, very rare or exceptional on the national territory.
Plants
Mesobromion - *Anthyllis vulneraria, Arabis hirsuta, Brachypodium pinnatum, Bromus inermis,Campanula glomerata, Carex caryophyllea, Carlina vulgaris, Centaurea scabiosa, Dianthus carthusianorum, Eryngium campestre, Koeleria pyramidata, Leontodon hispidus, Medicago sativa* ssp. *falcata, Ophrys apifera, O. insectifera, Orchis mascula, O. militaris, O. morio, O. purpurea, O. ustulata, O. mascula, Polygala comosa, Primula veris, Sanguisorba minor, Scabiosa columbaria,Veronica prostrata, V. teucrium. Xerobromion - Bromus erectus, Fumana procumbens, Globularia elongata, Hippocrepis comosa. Festucetalia valesiacae: Adonis vernalis, Euphorbia seguierana,Festuca valesiaca, Silene otites, Stipa capillata, S. joannis.*
Geographic distribution
Austria (Alpine Continental), Belgium (Atlantic Continental), Czech Republic (Continental Pannonian), Germany (Alpine Atlantic Continental), Denmark (Atlantic Continental), Estonia (Boreal), Spain (Alpine Atlantic Mediterranean), Finland (Boreal), France (Alpine Atlantic Continental Mediterranean), Greece (Mediterranean), Hungary (Pannonian), Ireland (Atlantic), Italy (Alpine Continental Mediterranean), Lithuania (Boreal), Luxembourg (Continental), Latvia (Boreal) Netherlands (Atlantic), Poland (Alpine Continental), Portugal (Mediterranean), Sweden (Alpine Boreal Continental), Slovenia (Alpine), Slovenia (Continental) Slovakia (Alpine), Slovakia (Pannonian), United Kingdom (Atlantic)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10120

ECOCHANGE rules

CLC:	**321** - Natural grasslands (incl. Pastures)											
Annex I:	**6210** - Semi-natural dry grasslands and scrubland facies on calcareous substrates(Festuco-Brometalia) (* important orchid sites)											
Mapping rules:	Calcareous soils. Boreal / Nemoral Below 200m Atlantic North below 300m All Atlantic Central Continental / Alpine South below 700m Mediterranean mountains below1400m.											
Indicator species:	Arabis hirsuta, Dianthus carthusianorum, Ophrys apifera, Orchis mascula, Bromus erecta, Adonis vernalis.											
GHC (BioHab):	-LHE/CHE + dry calcareous soils + indication											
Field identification:	Difficult as many vegetation associations are included-instructions as to local conditions therefore needed for regional surveyors. Also a definition of important orchid sites is required.											
Occurrence:	-Could be large patches locally but often fragmented											
Direct threats:	Decline in grazing.											
Climate change:	Could expand into mesic grasslands on south facing slopes but rate likely to be slow because of closed swards.											
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Ceaspitose hemicryptophytes 5 without grazing Shrubby chamaephytes 10 Low phanerophytes 5 Mid phanerophytes 5 Tall phanerophytes 10 Forest phanerophytes 10. .											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	*mdn*	*mds*

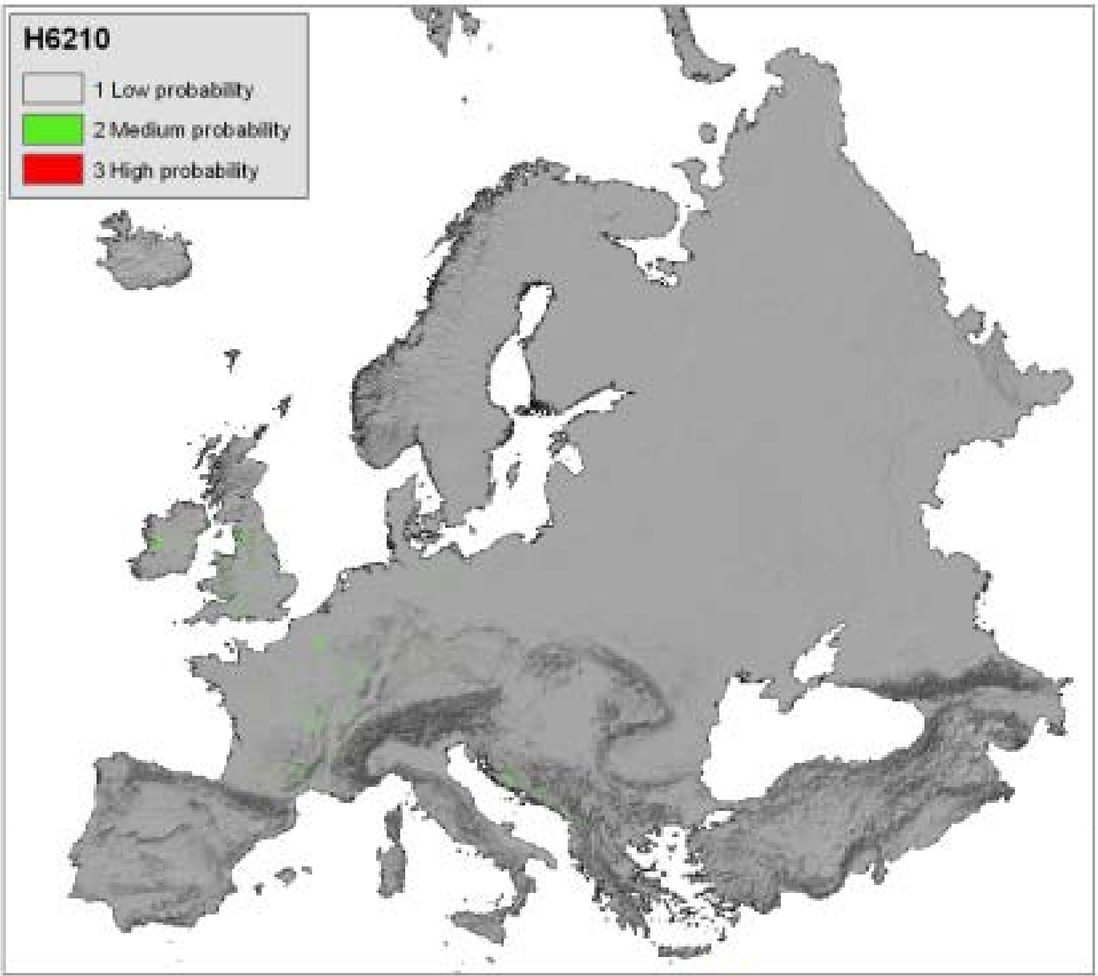
Photo 7 H6210: Chalk grassland in South Limburg (Gerendal, The Netherlands) with Orhis purpurea and Orchis militaris (C.A.J. Kreuth)

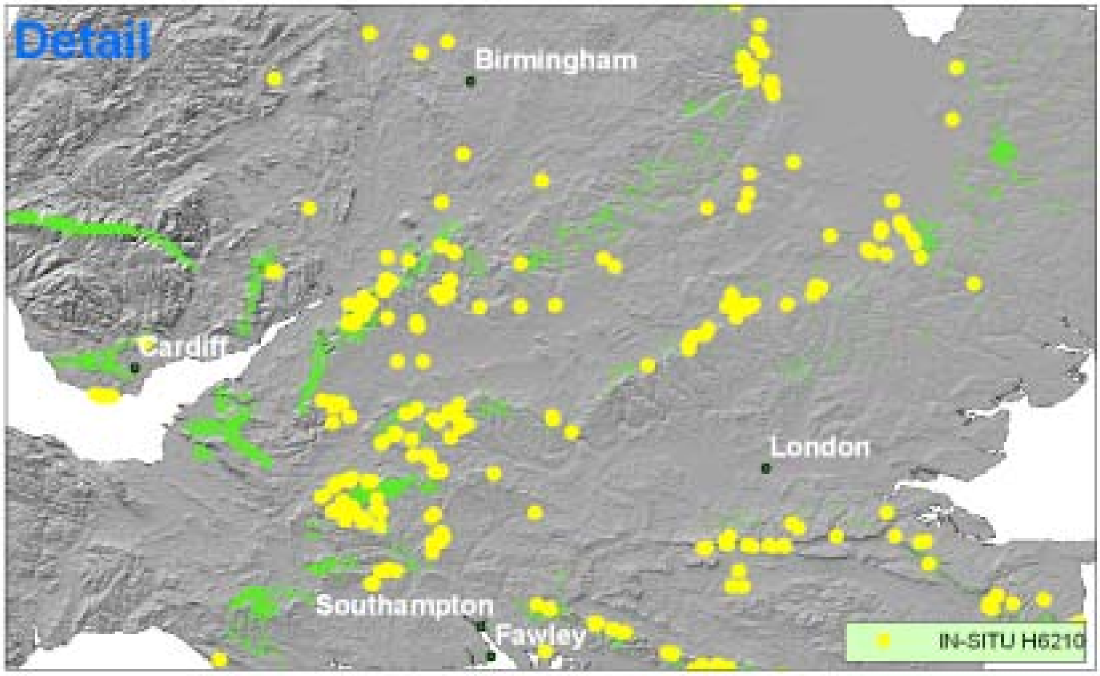
Photo 8 H6210 Orchid rich calcareous grassland on slope of Wrakeler berg, South-Limburg, the Netherlands (Photo Sander Mucher).

Photo 9 6210: Chalk grassland in South Limburg (Wrakelberg, The Netherlands) with several thousand of individuals of Gymnadenia conopsea (J.H.J. Schaminée)

Photo 10 H6210. Calcareous grassland in a groundwater protection area in South Limburg, the Netherlands (Photo Sander Mucher)

RESULT H6210 SEMI-NATURAL DRY GRASSLANDS AND SCRUBLAND FACIES ON CALCAREOUS SUBSTRATES





H6230. Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

Annex I description

Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)
Natura 2000 habitat type code **6230**
Palearctic habitat code (and Corine Biotopes) **35.1**
Priority Habitat: **Yes**
Parent: Semi-natural dry grasslands and scrubland facies (6200)
Description
Closed, dry or mesophile, perennial *Nardus* grasslands occupying siliceous soils in Atlantic or sub-Atlantic or boreal lowland, hill and montane regions. Vegetation highly varied, but the variation is characterised by continuity. *Nardetalia*: 35.1-*Violo-Nardion* (*Nardo-Galion saxatilis, Violion caninae*); 36.31- *Nardion*. Species-rich sites should be intrepreted as sites with are remarkable for a high number of species. In general, the habitats which have become irreversibly degraded through overgrazing should be excluded.
Plants
Antennaria dioica, Arnica montana, Campanula barbata, Carex ericetorum, C. pallescens, C. panicea, Festuca ovina, Galium saxatile, Gentiana pneumonanthe, Hypericum maculatum, Hypochoeris maculata, Lathyrus montanus, Leontodon helveticus, Leucorchis albida, Meum athamanticum, Nardus stricta, Pedicularis sylvatica, Platanthera bifolia, Polygala vulgaris, Potentill aaurea, P. erecta, Veronica officinalis, Viola canina.
Geographic distribution
Alps, Pyrenees, Apennines, Jura, Hercynian ranges, Netherlands, British Isles, Iberia peninsula, Luxembourg, Finland, Sweden. Entire EU
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10122

ECOCHANGE rules

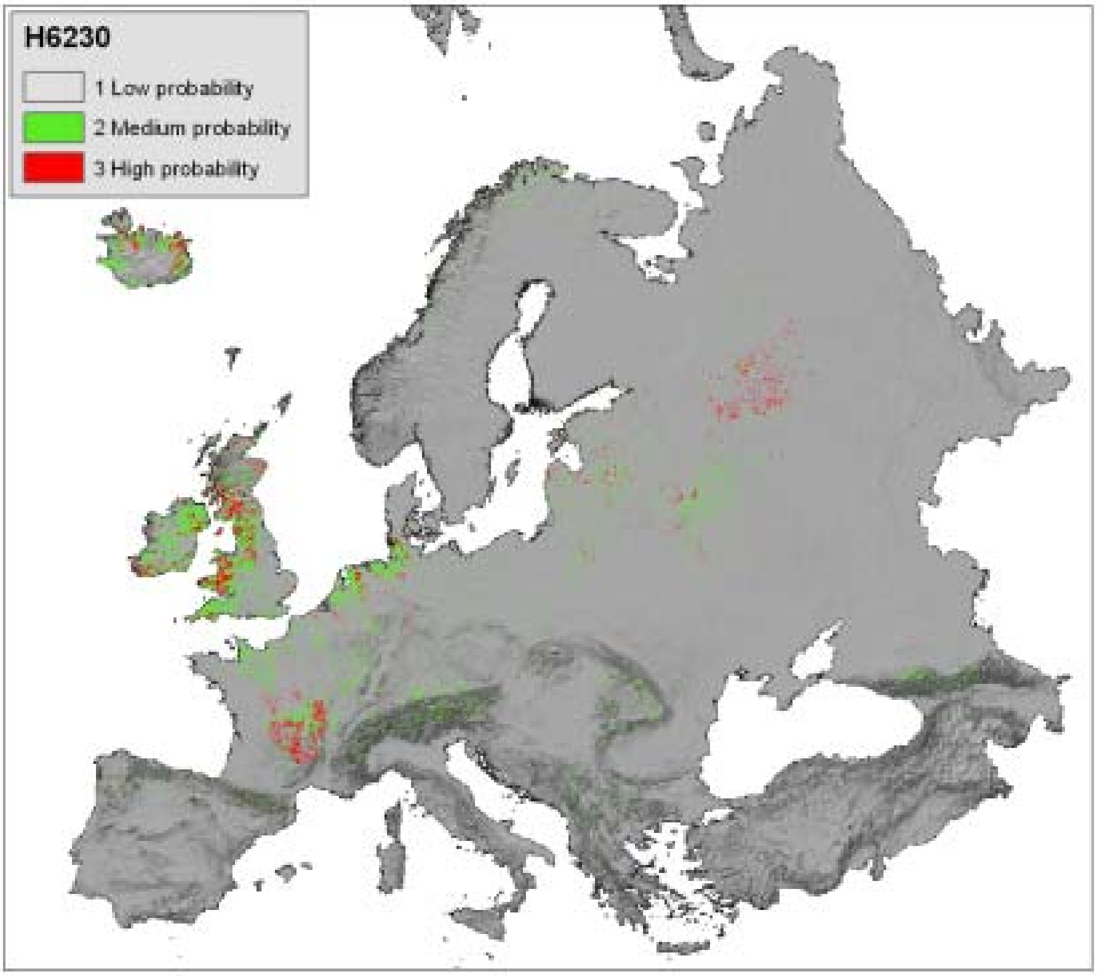
CLC:	**321** - Natural grasslands (incl. Pastures)
Annex I:	**6230** - Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)
Mapping rules:	Making rules for this class is difficult because it depends on interpretation of the term species rich. If it is assumed that the extensive generally species poor Nardus grasslands of the Atlantic zone are included then it is widespread. More species rich grasslands with Nardus are rare in GB but are rather common at quite high elevations in the Alps. The comment in the text suggests that irreversibly degraded grasslands should be excluded which probably means many of those in GB. The rules below cover the whole range but mean that very different frequencies are likely to be involved. Siliceous soils / rocks Alpine North / Boreal below 700m Nemoral / Atlantic Central all altitudes Atlantic North below 900 m, Continental / Alpine South / Pannonian over 700 m but under 2000m, Lusitanian over 1000 m, Mediterranean mountains over 1500 m.
Indicator species:	Antennaria dioica, Galium saxatile.

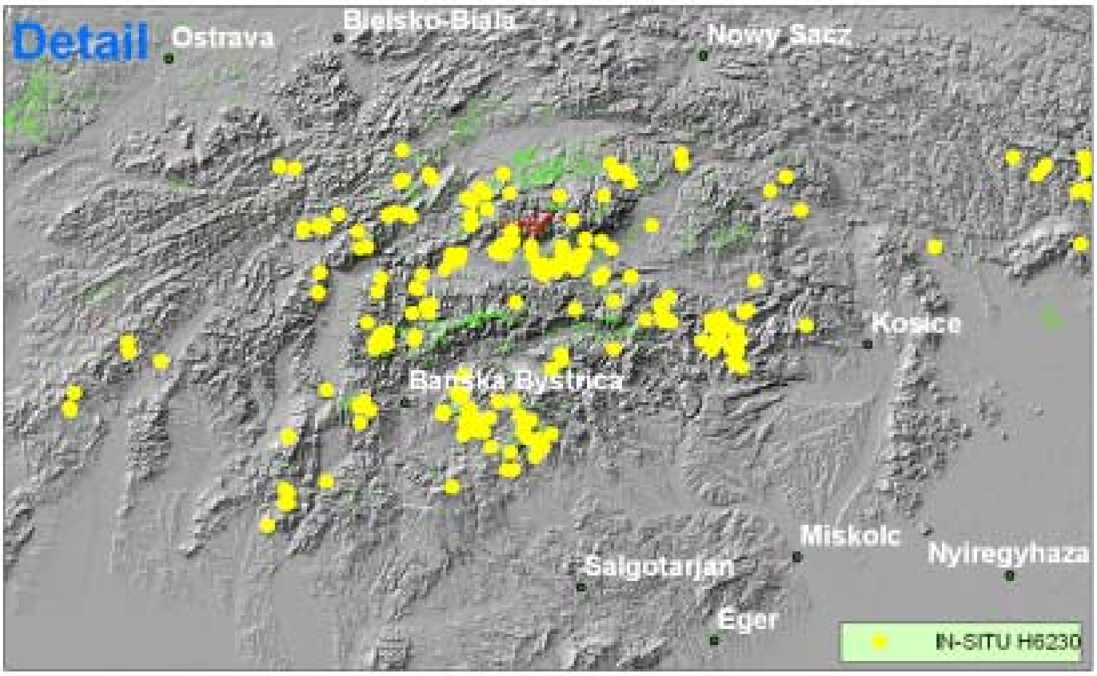
GHC (BioHab):	-CHE/LHE + moist neutral/acidic soils + Nardus + wide range of speceis											
Field identification:	Depends on the definition of species rich but the associations are well defined.											
Occurrence:	-often occurs in large units in the centre of its range, smaller patches elsewhere											
Direct threats:	Mostly maintained by grazing but some of the higher sites may be above the tree line.											
Climate change:	The class covers a high of altitude so probably robust although tree / shrub colonization at higher levels would be favoured if grazing declines. The proportion of montane species may also decline as more competitive species are likely to expand.											
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes- Nardus will expand with less grazing and will therefore change to Ceaspitose hemicryptophytes , further development depends on altitude, low altitudes will end up as Forest phanerophytes ,mid Tall phanerophytes high Shrubby chamaephytes. .											
Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	*mdm*	*mdn*	*mds*

Photo 11 H6230 Species rich Nardus grassland on silicious substrate in the mountain area of Jauerling, Austria (Photo Thomas Wrbka).

Photo 12 H6230 Species rich Nardus grassland on silicious substrate in the mountain area of Yspertal, Austria (Photo Thomas Wrbka)

RESULT H6230 SPECIES-RICH NARDUS GRASSLANDS ON SILICEOUS SUBSTRATES IN MOUNTAIN AREAS





H6240. Sub-pannonic steppic grasslands

Annex I description

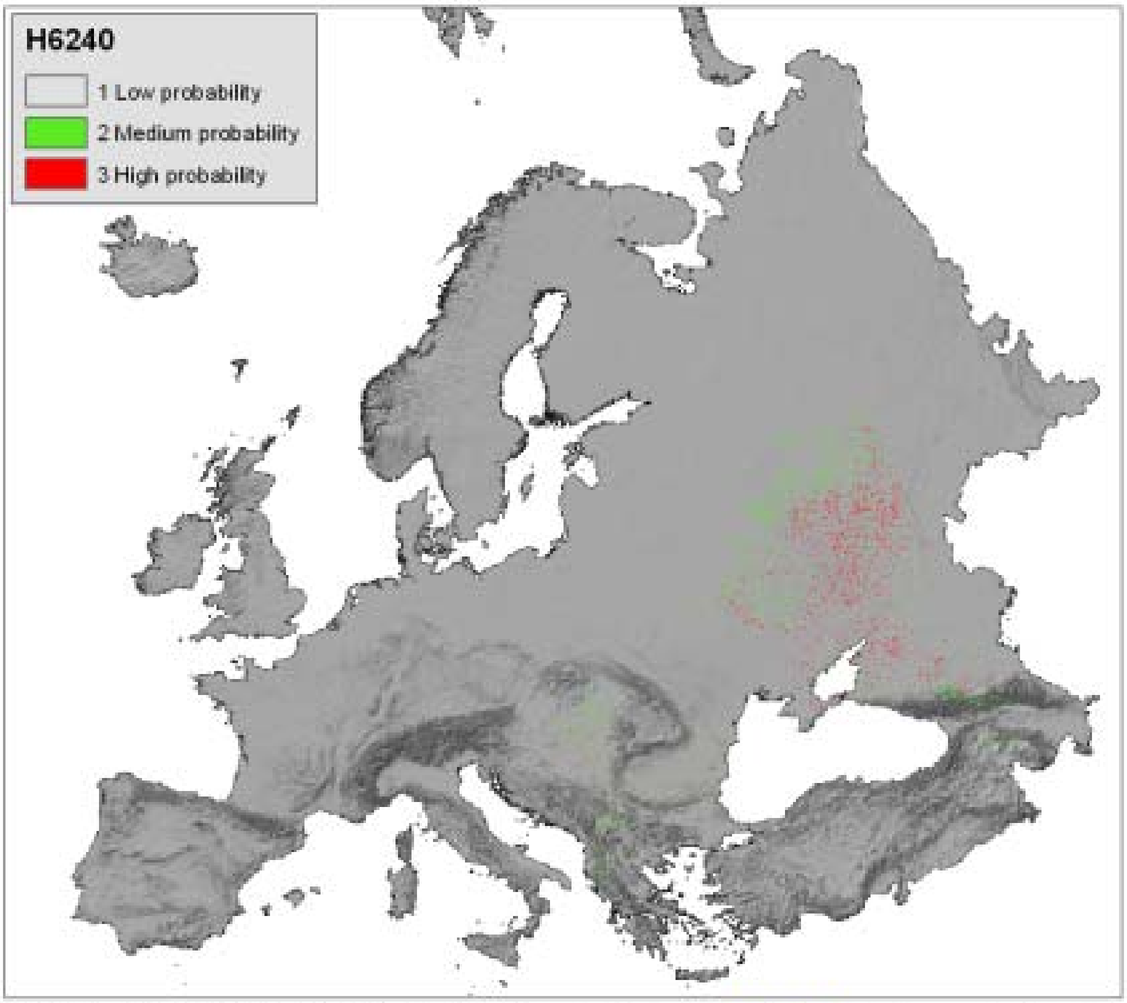
Sub-pannonic steppic grasslands
Natura 2000 habitat type code **6240**
Palearctic habitat code (and Corine Biotopes) **34.315**
Priority habitat: Yes
Parent: Semi-natural dry grasslands and scrubland facies (6200)
Description
Steppic grasslands, dominated by tussock-grasses, chamaephytes and perennials of the alliance *Festucion vallesiacae* and related syntaxa. These xerotherme communities are developed on southern exposed slopes with AC-soils on rocky substrate and on clay-sandy sedimentation layers enriched with gravels. They are partially of natural, partially of anthropogenic origin.
Plants
Festuca vallesiaca, Allium flavum, Gagea pusilla, Hesperis tristis, Iris pumila, Ranunculus illyricus, Teucrium chamaedrys, Medicago minima, Globularia cordifolia, Helianthemum canum, Poabadensis, Scorzonera austriaca, Potentilla arenaria, Seseli hippomarathrum, Alyssum alyssoides,Artemisia austriaca, Chrysopogon gryllus, Astragalus austriacus, A. excapus, A. onobrychis, Oxytropis pilosa, Daphne cneorum, Iris humilis ssp. *arenaria, Carex humilis, Festuca rupicola, Stipa capillata, S.joannis, Botriochloa ischaemum.*
Geographic distribution
Austria (most important sites: south slopes of the Leitha mountains, Hainburger mountains, mountains of the Waschberg range). Austria (Alpine, Continental), Czech Republic (Continental, Pannonian) Germany (Atlantic, Continental), France (Alpine, Mediterranean), Hungary (Pannonian), Italy (Alpine, Continental), Slovakia (Alpine, Pannonian)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10123

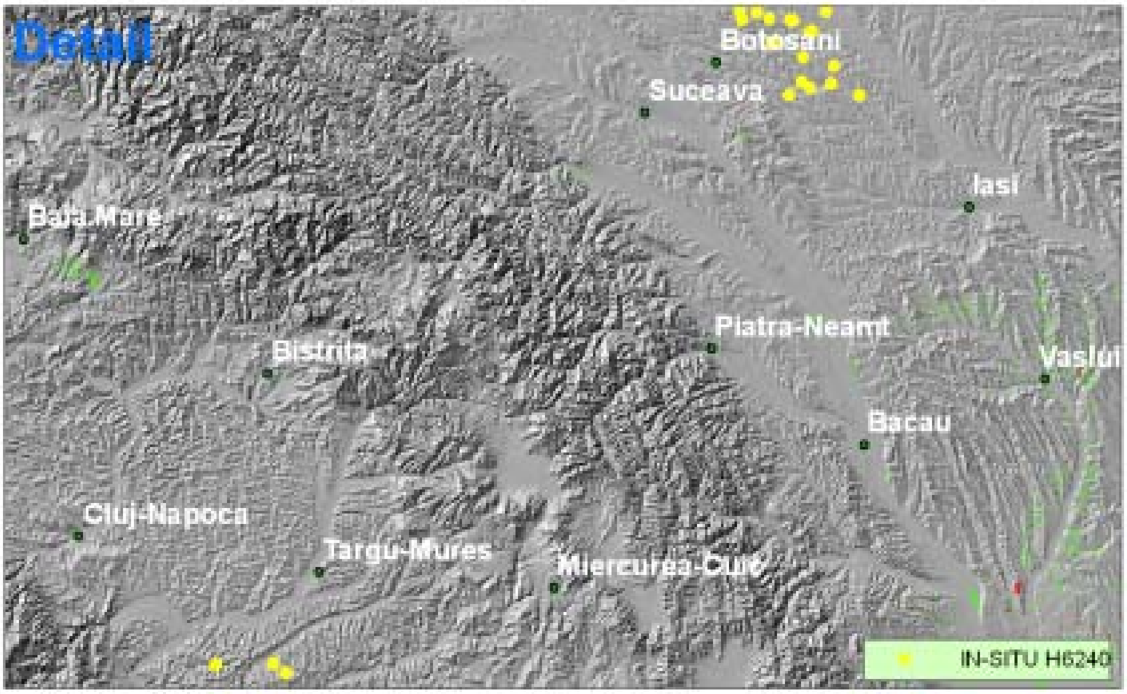
ECOCHANGE rules

CLC:	**321** - Natural grasslands (incl. Pastures)
Annex I:	**6240** - Sub-pannonic steppic grasslands
Mapping rules:	Pannonian and eastern Continental classes below 500 m clays / sands / gravels. South facing.
Indicator species:	Alyssum alyssoides, Astragalus austriacus, Iris humilis ssp. Arenaria, Stipa capillata.
GHC (BioHab):	-CHE/LHE + xeric soils + variable soil structure + species + expert judgement
Field identification:	Straightforward because detailed description of a restricted vegetation type included.
Occurrence:	-probably in small fragmented
Direct threats:	Some are more or less climax others depend on grazing but probably mostly the former so limited threats except for fertilization.
Climate change:	Could expand under the likely drier conditions but adjacent land may be cultivated so expansion unlikely.
Succession:	Colonization: status: probably Ceaspitose hemicryptophytes / Leafy hemicryptophytes with a representation of Shrubby chamaephytes which may expand without any management but otherwise stable.

	.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*

RESULTS H6240 SUB-PANNONIC STEPPIC GRASSLANDS





H6250. Pannonic loess steppic grasslands

Annex I description

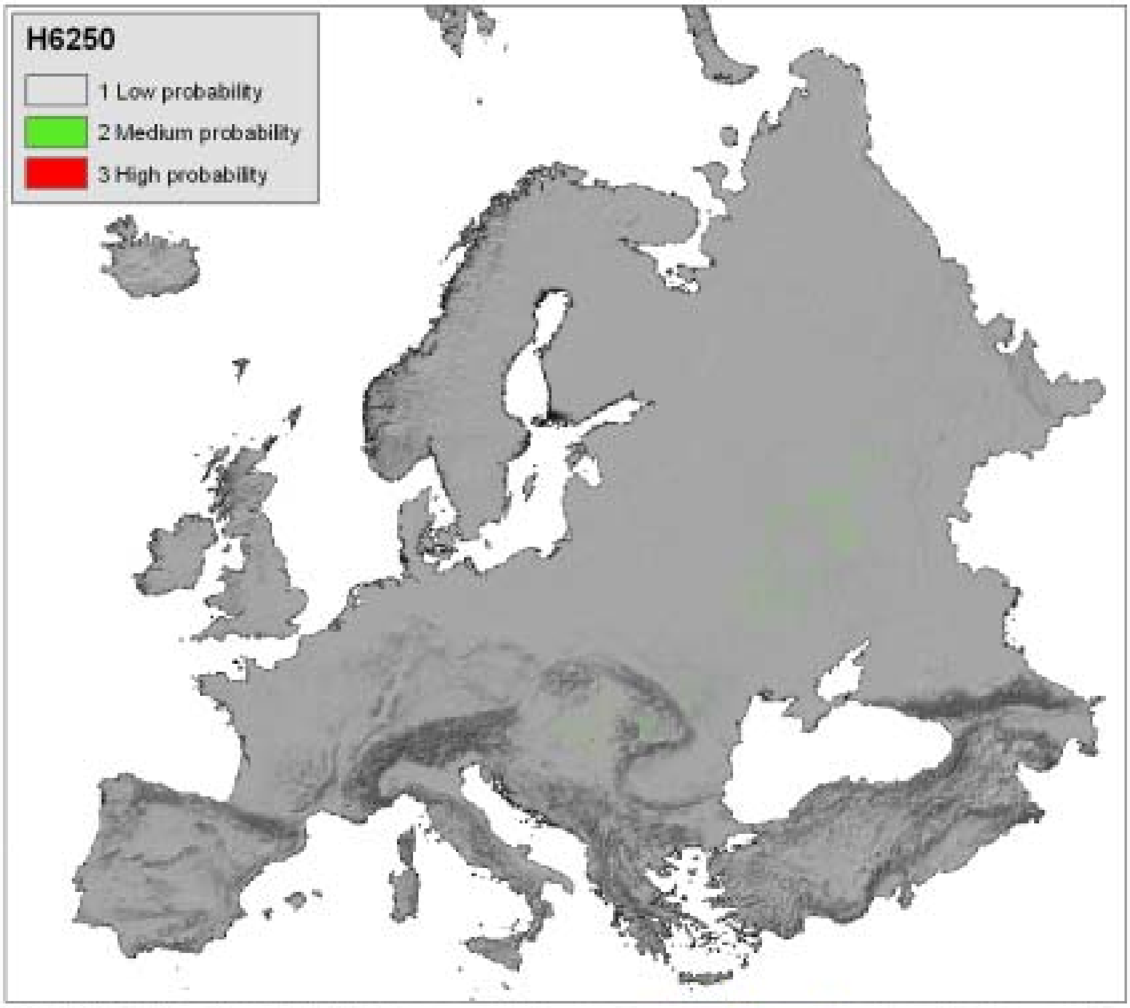
Pannonic loess steppic grasslands
Natura 2000 habitat type code **6250**
Palearctic habitat code (and Corine Biotopes) **34.91**
Priority habitat: **Yes**
Parent: Semi-natural dry grasslands and scrubland facies (6200)
Description
Grassland communities rich in perennial grasses and herbs on loess deposits. Originally covering large areas, nowadays restricted to specific land forms like loess ridges formed by fluviatile erosion and accumulation.
Plants
Artyemisia pontica, Astragalus vesicarius, A. austriacus, A. onobrychis, Crambe tataria, Nonea pulla, Salvia nemorosa, Ornithogalum pannonicum, Agropyron pectinatum, Phlomis tuberosa, Bromus inermis, Festuca rupicola, Falcaria vulgaris, Peucedanum alsaticum, Elymus hispidus, Chamaecytisussupinus, Achillea pannonica..
Geographic distribution
Austria (Alpine), Austria (Continental), Czech Republic (Pannonian), Hungary (Pannonian), Slovakia (Pannonian)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10124

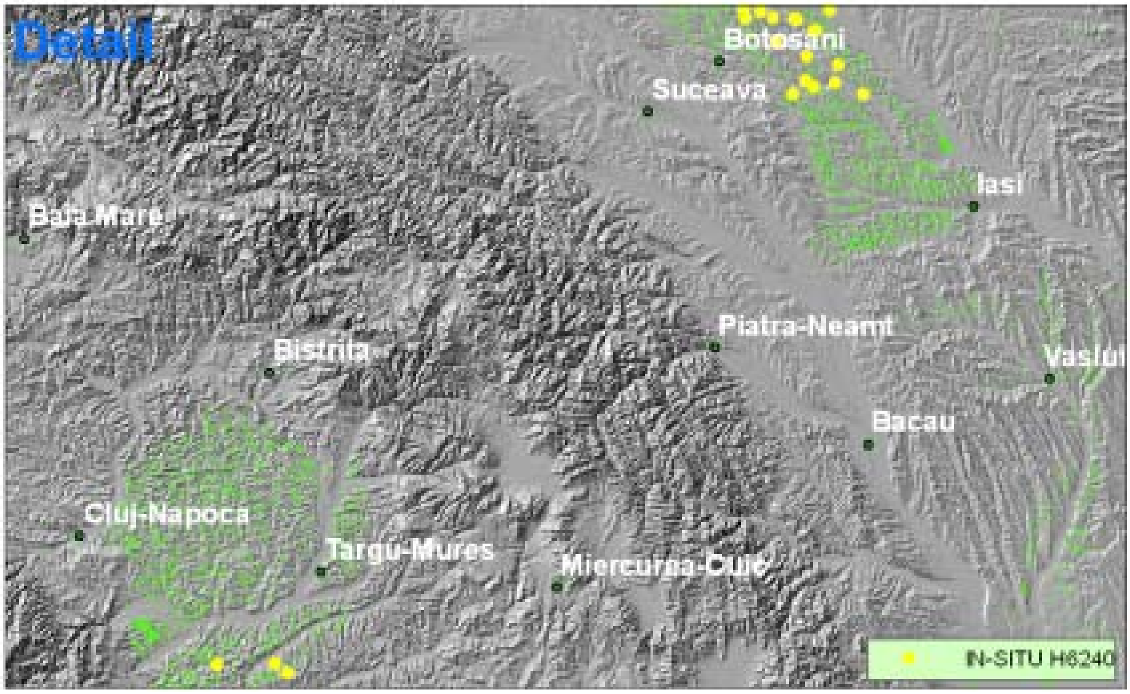
ECOCHANGE rules

CLC:	**321** - Natural grasslands (incl. Pastures)											
Annex I:	**6250** - Pannonic loess steppic grasslands											
Mapping rules:	Pannonian below 500 m. Loess soils.											
Indicator species:	Artemesia pontica, Ornithogalum pannonicum, Achillea pannonica.											
GHC (BioHab):	-CHE/LHE + xeric loess soils + critical species + expert knowledge											
Field identification:	As 6240.											
Occurrence:	-Small fragmented units											
Direct threats:	Information on management needs to be checked.											
Climate change:	Could expand into other grasslands but likely to be slow because of surrounding cultivated land.											
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes may be susceptible to expansion of Shrubby chamaephytes and Low phanerophytes and eventually Mid phanerophytes but restricted by xeric conditions. .											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*

Photo 13 H6250: Transcaucasian steppe landscape in hilly country east of Tbilisi near the David Gareji monastery/Georgia (U. Bohn).

RESULT H6250 PANNONIC LOESS STEPPIC GRASSLANDS





H7110. Active raised bogs

Annex I Description

Active raised bogs
Natura 2000 habitat type code **7110**
Palearctic habitat code (and Corine Biotopes) **51.1**
Piority Habitat: **Yes**
Parent: Sphagnum acid bogs (7100)
Description
Acid bogs, ombrotrophic, poor in mineral nutrients, sustained mainly by rainwater, with a water level generally higher than the surrounding water table, with perennial vegetation dominated by colourful Sphagna hummocks allowing for the growth of the bog (*Erico-Sphagnetalia magellanici, Scheuchzerietalia palustris* p., *Utricularietalia intermedio-minoris* p., *Caricetalia fuscae* p.). The term "active" must be taken to mean still supporting a significant area of vegetation that is normally peat forming, but bogs where active peat formation is temporarily at a standstill, such as after a fire or during a natural climatic cycle e.g., a period of drought, are also included.
Plants
Erico-Sphagnetalia magellanici- Andromeda polifolia, *Carex pauciflora, Cladonia* spp., *Drosera rotundifolia, Eriophorum vaginatum, Odontoschisma sphagni, Sphagnum magellanicum, S.imbricatum, S. fuscum, Vaccinium oxycoccos;* in the Boreal region also *Betula nana, Chamaedaphne calyculata, Calluna vulgaris, Ledum palustre* and *Sphagnum angustifolium.* Scheuchzerietalia palustris *p.*, Utricularietalia intermedio-minoris *p.*, Caricetalia fuscae *p.- Carex fusca, C. limosa,Drosera anglica, D. intermedia, Eriophorum gracile, Rhynchospora alba, R. fusca, Scheuchzeria palustris, Utricularia intermedia, U. minor, U. ochroleuca*; in the Boreal region also *Sphagnumbalticum* and *S. majus*.
Geographic distribution
Austria, Belgium, Denmark, Finland, France, Germany, Italy, Ireland, Netherlands, Spain (Pyrenees and Cantabrian mountains), Sweden, United Kingdom. EU27
http://eunis.eea.europa.eu/habitats-factsheet.jsp?tab=0&idHabitat=10142

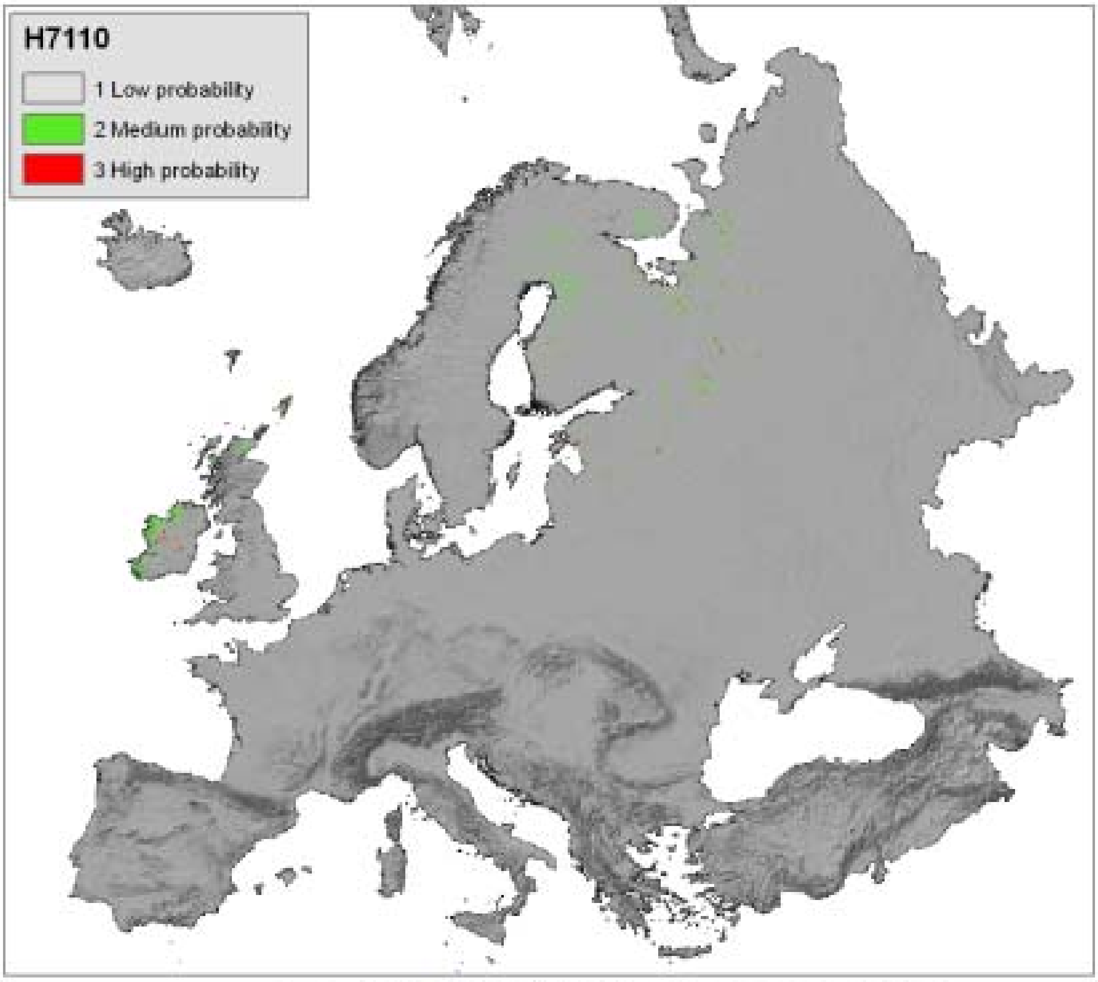
ECOCHANGE rules

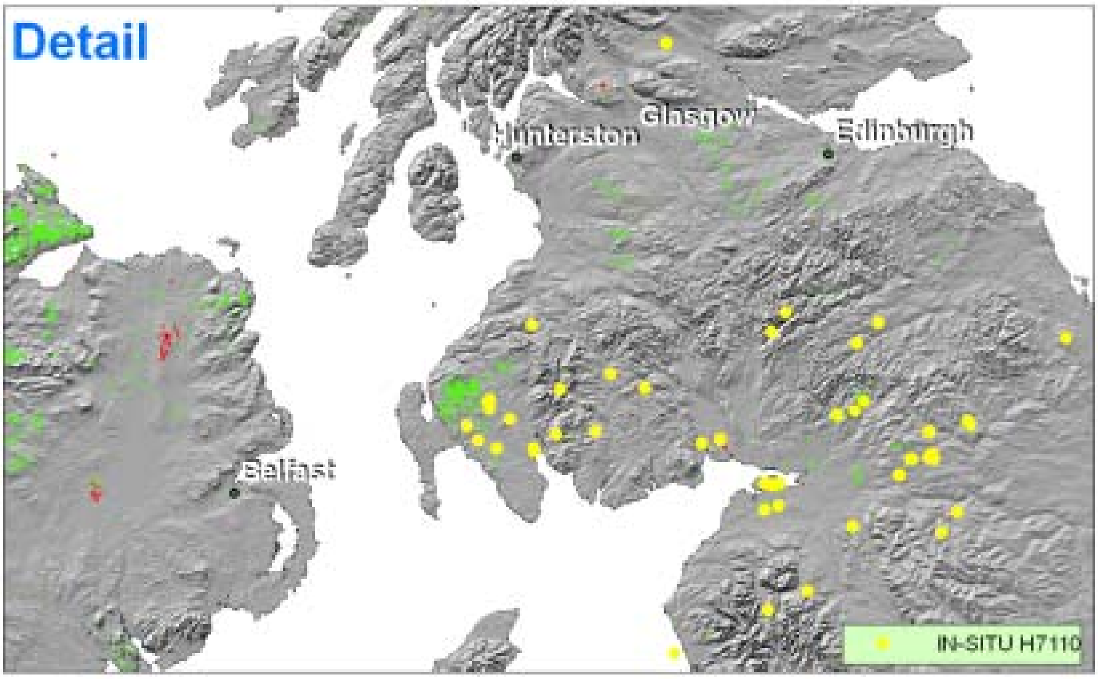
CLC:	**412** - Peat bogs
Annex I:	**7110** - Active raised bogs
Mapping rules:	Atlantic Central / Atlantic North / Boreal / Nemoral below 300m.
Indicator species:	Andromeda polifolia, Vaccinium oxycoccos, Drosera anglica, Drosera intermedia.
GHC (BioHab):	Complexes of Cryptogames / Aquatic / Dwarf chamaephytes / Ceaspitose hemicryptophytes qualified with bog.
Field identification:	Difficult to separate from 7120 – Sphagnum dominated areas indicate quality habitat.
Occurrence:	Usually in discrete units but in the Atlantic zones difficult to separate from other bogs.
Direct threats:	Drainage, peat cutting.
Climate change:	Increases the rate of drying out and colonization by scrub and loss of Sphagnum species.

Succession:	Colonization by Low phanerophytes / Mid phanerophytes and eventually Tall phanerophytes. drying out and destruction of the bog surface. .											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Photo 14 Active raised bogs at Endla, Estonia (Photo Mucher).

RESULT H7110. ACTIVE RAISED BOGS





*H7130. Blanket bogs (* if active bog)*

Annex I Desciption

Blanket bogs (* if active bog)
Natura 2000 habitat type code **7130**
Palearctic habitat code (and Corine Biotopes) **52.1 & 52.2**
Priority Habitat: **Yes**
Parent: Sphagnum acid bogs (7100)
Description
Extensive bog communities or landscapes on flat or sloping ground with poor surface drainage, in oceanic climates with heavy rainfall, characteristic of western and northern Britain and Ireland. In spite of some lateral water flow, blanket bogs are mostly ombrotrophic. They often cover extensive areas with local topographic features supporting distinct communities [*Erico-Sphagnetalia magellanici*: *Pleurozio purpureae-Ericetum tetralicis, Vaccinio-Ericetum tetralicis* p.; *Scheuchzerietalia palustris* p., *Utricularietalia intermedio-minoris* p., *Caricetalia fuscae* p.]. Sphagna play an important role in all of them but the cyperaceous component is greater than in raised bogs. The term "active" must be taken to mean still supporting a significant area of vegetation that is normally peat forming. Sub-types in the British Isles 52.1 – HyperAtlantic blanket bogs of the western coastlands of Ireland, western Scotland and its islands, Cumbria, Northern Wales ; bogs locally dominated by sphagna (*Sphagnum auriculatum*, Interpretation Manual - EUR25 Page 74 *S. magellanicum*, *S. compactum*, *S. papillosum*, *S. nemoreum*, *S. rubellum*, *S. tenellum*, *S. subnitens*), or, particularly in parts of western Ireland, mucilaginous algal deposits (*Zygogonium*). 52.2 – Blanket bogs of high ground, hills and mountains in Scotland, Ireland, Western England and Wales.
Plants
52.1- *Calluna vulgaris, Campylopus atrovirens, Carex panicea, Drosera rotundifolia, Erica tetralix, Eriophorum vaginatum, Molinia caerulea, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Pinguicula lusitanica, Pleurozia purpurea, Polygala serpyllifolia, Potentilla erecta,Racomitrium languginosum, Rhynchospora alba, Schoenus nigricans, Scirpus cespitosus, Sphagnum pulchrum, S. strictum, S. compactum, S. auriculatum*. 52.2 - *Calluna vulgaris, Diplophyllum albicans,Drosera rotundifolia, Empetrum nigrum, Erica tetralix, Eriophorum vaginatum, Mylia taylorii,Narthecium ossifragum, Rubus chamaemorus, Scirpus cespitosus, Vaccinium myrtillis*.
Geographic distribution
Austria (Alpine), Estonia (Boreal), Spain (Atlantic), Spain (Mediterranean), France (Atlantic), Greece (Mediterranean), Ireland (Atlantic), Italy (Alpine), Italy (Continental), Portugal (Macaronesian), Sweden (Alpine), United Kingdom (Atlantic)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10144

ECOCHANGE rules

CLC:	**412** - Peat bogs
Annex I:	**7130** - Blanket bogs (* if active bog)
Mapping rules:	Atlantic Central / Atlantic North above 300m.
Indicator species:	Drosera rotundifolia, Eriophorum vaginatum, Empetrum nigrum, Rubus chamaemorus.
GHC (BioHab):	Leafy hemicryptophytes, but usually with under 30% Low phanerophytes / Evergreen.
Field identification:	Several key species enable identification notably Rubus chamaemorus and Eriophorum vaginatum.

Occurrence:	Large units where present.											
Direct threats:	Overgrazing and conversion to agriculture; drainage.											
Climate change:	Will lead to drying out and colonization by grasses.											
Succession:	At low altitudes could be colonized by Low phanerophytes / Mid phanerophytes but only if climate change reduces the water saturation. .											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

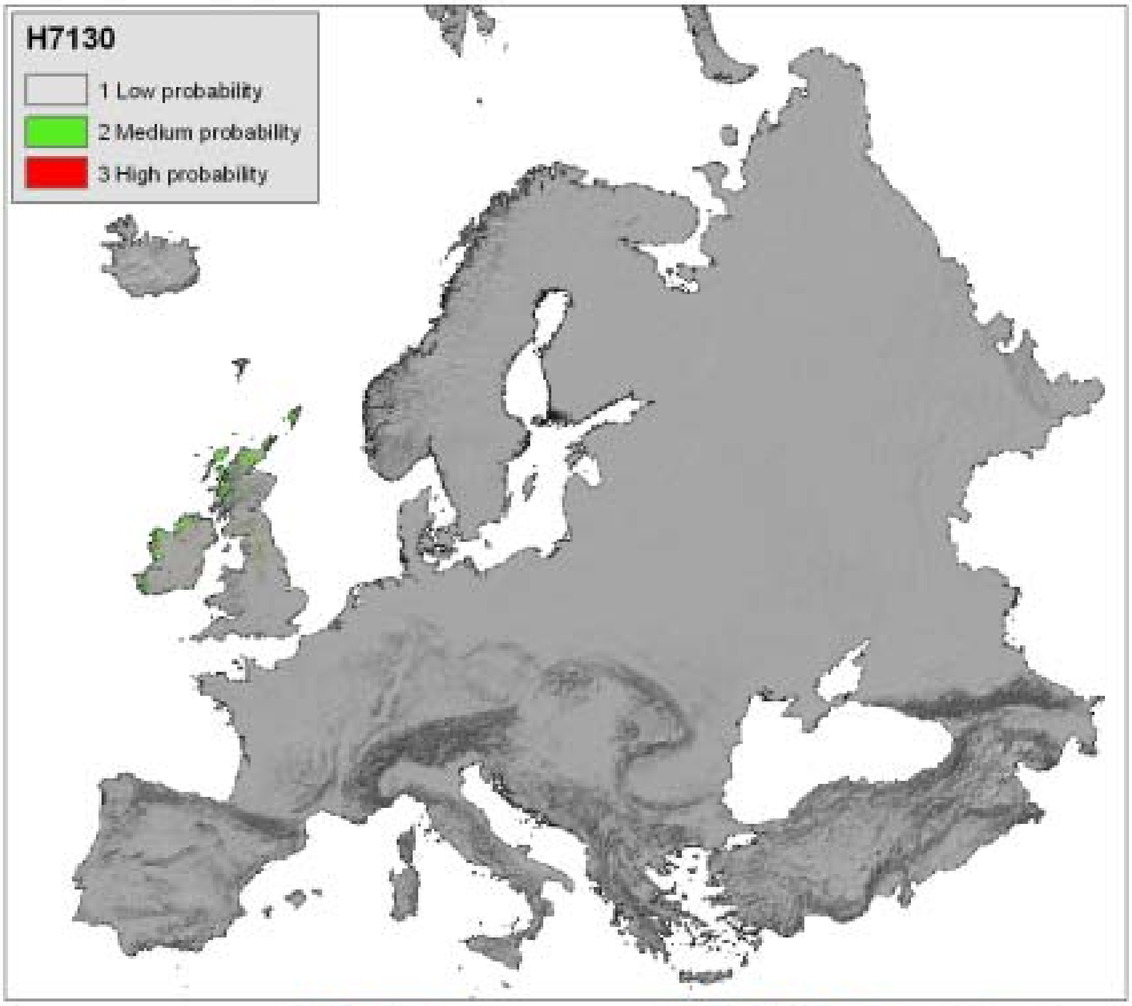
Photo 15 Lowland blanket bogs, Conemera, Ireland.

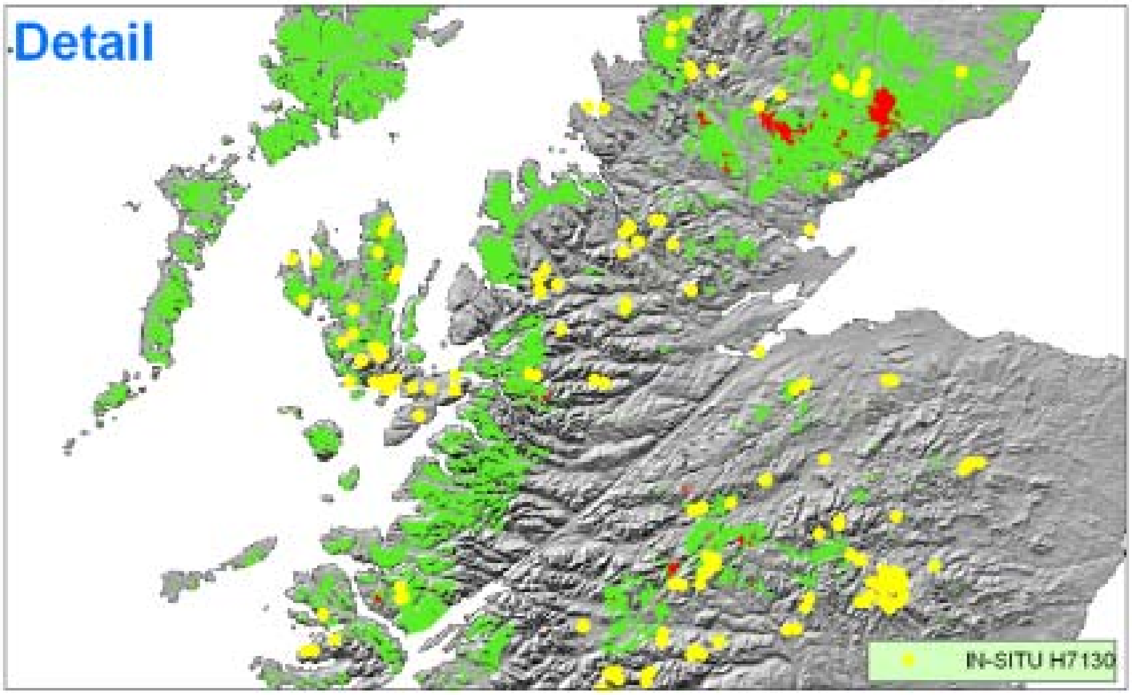
(source: http://144.41.253.33/lacope/gallery/gallery/albums/connemara/Lowland_blanket_bogs_and_lakes.jpg)

Photo 16 H7130: Irish lowland blanket bog (S5) with Molinia caerulea, Myrica gale, Schoenus nigricans and Calluna vulgaris, Nephin Mountain behind with dry heath and scree; Owenboy, Co. Mayo/western Ireland (N. Lockhart).

Photo 17 H7130: Extensive Irish blanket bogs of the lowlands, with numerous bog pools; Owenduff Valley, Co. Mayo/Ireland (J. Cross).

RESULTS H7130. BLANKET BOGS





H9150. Medio-European limestone beech forests of the Cephalanthero-Fagion

Annex I Description

Medio-European limestone beech forests of the Cephalanthero-Fagion
Natura 2000 habitat type code **9150**
Palearctic habitat code (and Corine Biotopes) **41.16**
Priority Habitat: No
Parent: Forestst of Temperate Europe (9100)
Description
Xero-thermophile *Fagus sylvatica* forests developed on calcareous, often superficial, soils, usually of steep slopes, of the medio-European and Atlantic domaines of Western Europe and of central and northern Central Europe, with a generally abundant herb and shrub undergrowth, characterized by sedges (*Carex digitata*, *Carex flacca*, *Carex montana*, *Carex alba*), grasses (*Sesleria albicans*, *Brachypodium pinnatum*), orchids (*Cephalanthera* spp., *Neottia nidus-avis*, *Epipactis leptochila*, *Epipactis microphylla*) and thermophile species, transgressive of the *Quercetalia pubescentipetraeae*. The bush-layer includes several calcicolous species (*Ligustrum vulgare*, *Berberis vulgaris*) and *Buxus sempervirens* can dominate. Sub-types : • 41.161 - Middle European dry-slope limestone beech forests Middle European sedge and orchid beech woods of slopes with reduced water availability. • 41.162 - North-western Iberian xerophile beech woods *Fagus sylvatica* forests of relatively low precipitation zones of the southern ranges of the Pais Vasco and of superficially dry calcareous soils of the Cordillera Cantabrica, with *Brachypodiumpinnatum* ssp. *rupestre*, *Sesleria argentea* ssp. *hispanica*, *Carex brevicollis*, *Carex ornithopoda*, Interpretation Manual - EUR25 Page 98 *Carex sempervirens*, *Carex caudata*, *Cephalanthera damasonium*, *C. longifolia*, *Epipactis helleborine*, *Epipactis microphylla*, *Neottia nidus-avis*.
Plants
Fagus sylvatica, Carex digitata, *C. flacca*, *C. montana*, *C. alba, Sesleria albicans, Brachypodium pinnatum, Cephalanthera* spp., *Neottia nidus-avis*, *Epipactis leptochila*, *Epipactis microphylla, Buxus sempervirens*.
Geographic distribution
EU27 (minus the Netherlands and Portugal)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10189

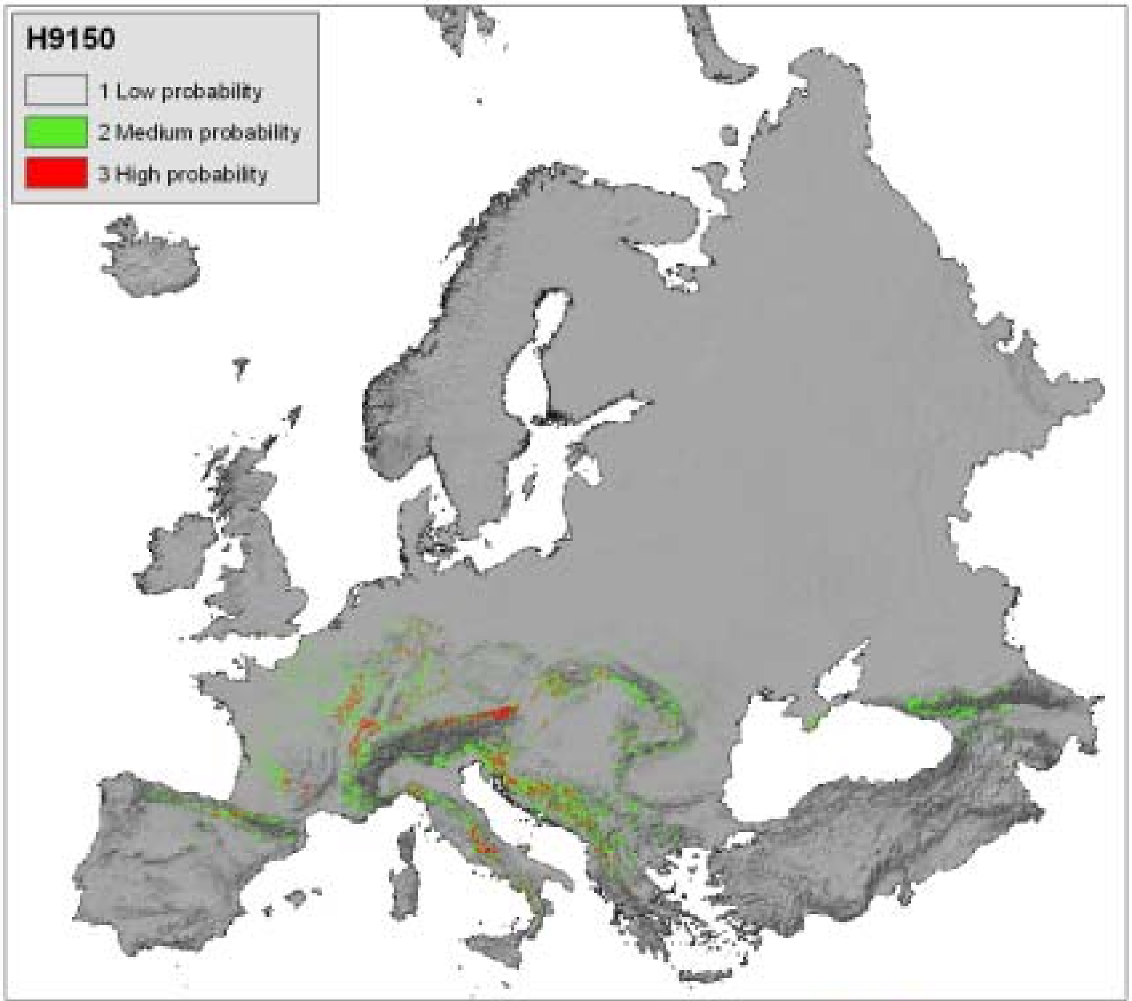
ECOCHANGE rules

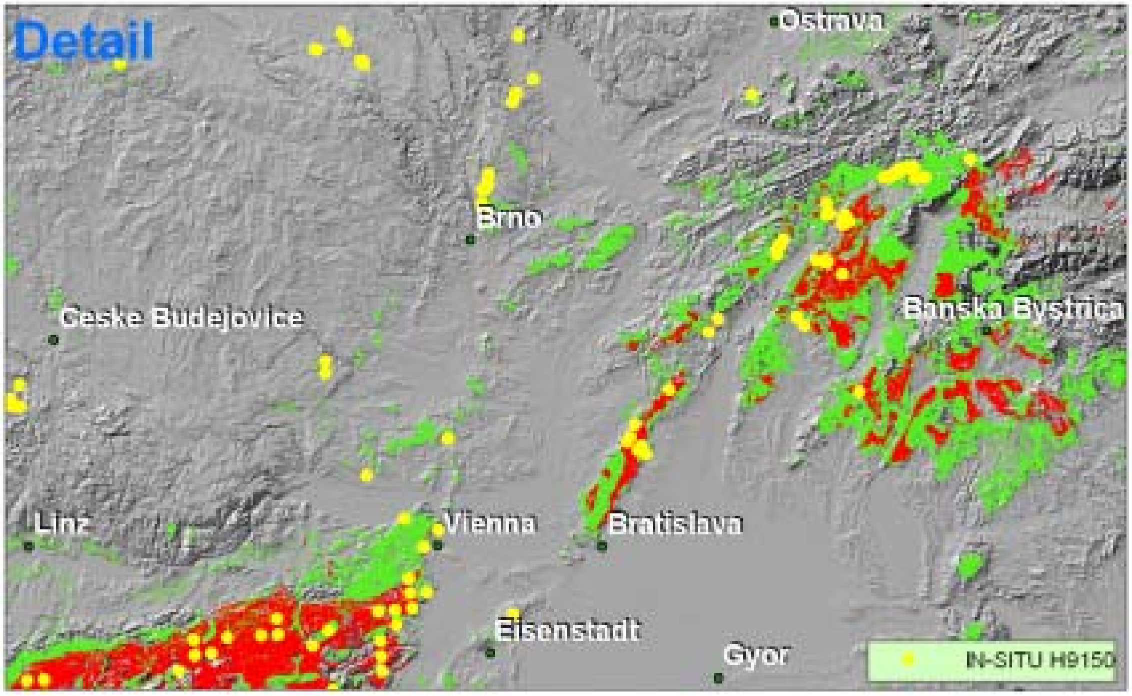
CLC:	**311** - Broad-leaved forest
Annex I:	**9150** - Medio-European limestone beech forests of the Cephalanthero-Fagion
Mapping rules:	Atlant. Central all Alpine South / Continental 400-1200 + Calcareous soils + Fagus.
Indicator species:	Fagus sylvatica, Carex digita, Cephalantera spp., Neotttia nidus-avis.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus over 70% + shallow dry calcareous soils + steep slopes + ground flora species.
Field identification:	A well defined category but grades into 9130.

Occurrence:	Widespread in large patches but often replaced by Picea abies in the Alps.											
Direct threats:	Felling withy deeper soils conversion to conifer.											
Climate change:	Thermophilic species will be favoured.											
Succession:	Climax.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*

Photo 18 Medio-European limestone beech forest on a slope above the Ticha orlice river, Ceskomoravska-mezihori hills, Eastern Bohemia, Czech Republic (photo Pavel Kovar).

RESULT H9150 MEDIO-EUROPEAN LIMESTONE BEECH FORESTS





H9410. Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)

Annex I description

Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)
Natura 2000 habitat type code **9410**
Palearctic habitat code (and Corine Biotopes) **42.21** -> **42.23** (42.25)
Priority Habitat: No
Parent: Temperate Mountainous Coniferous Forests (9400)
Description
Sub-alpine and alpine conifer forests (dominated by *Picea abies* and *Picea orientalis).* Sub-types: • 42.21 - Alpine and Carpathian sub-alpine spruce forests. *Piceetum subalpinum.Picea abies* forests of the lower sub-alpine level, and of anomalous stations in the montane level, of the outer, intermediate and inner Alps; in the latter, they are often in continuity with the montane spruce forests of 42.22. The spruces are often stunted or columnar; they areaccompanied by an undergrowth of decidedly sub-alpine affinities. *Picea abies* forests of thelower sub-alpine level of the Carpathians. • 42.22 - Inner range montane spruce forests. *Piceetum montanum. Picea abies* forests of the montane level of the inner Alps, characteristic of regions climatically unfavourable to both beech and fir. Analogous *Picea abies* forests of the montane and collinear levels of the inner basin of the Slovakian Carpathians subjected to a climate of high continentality. • 42.23 - Hercynian sub-alpine spruce forests Sub-alpine *Picea abies* forests of high Hercynian ranges 21. • 42.25 - Peri-Alpine spruce forests Spontaneous *Picea abies* formations occupying outlying altitudinal or edaphic enclaves within the range of more predominant vegetation types of the montane levels of the outer Alps, the Carpathians, the Dinarides, the Jura, the Hercynian ranges, the subalpine levels of the Jura, the western Hercynian ranges and the Dinarides
Plants
Picea abies, *Vaccinium* spp.
Geographic distribution
Austria (Alpine, Continental), Czech Republic (Continental) Germany (Alpine, Continental), France (Alpine, Continental), Greece (Mediterranean), Italy (Alpine, Continental, Mediterranean), Poland (Alpine, Continental), Slovenia (Alpine), Slovakia (Alpine)
Weblink: http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10228

ECOCHANGE rules

CLC:	**312** - Coniferous forest										
Annex I:	**9410** - Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)										
Mapping rules:	Alpine South / Continental 800 m-1700 m ?. Mediterranean Mountains but north of Pyreneees only										
Indicator species:	Picea abies, and rarely, Picea orientalis.										
GHC (BioHab):	- Forest phanerophytes/conifer over 70% + moist acid soils + key species										
Field identification:	Well defined species patterns but depends whether converted Fagus/and/or plantation forests are included.										
Occurrence:	Extensive forests often artificially pure spruce from forest practice. Also many converted Fagus forests.										
Direct threats:	Felling										
Climate change:	Could threaten spruce dominance by encouraging disease at lower altitudes										
Succession:	Climax but structure will change with age										
Distribution (s):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (B):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

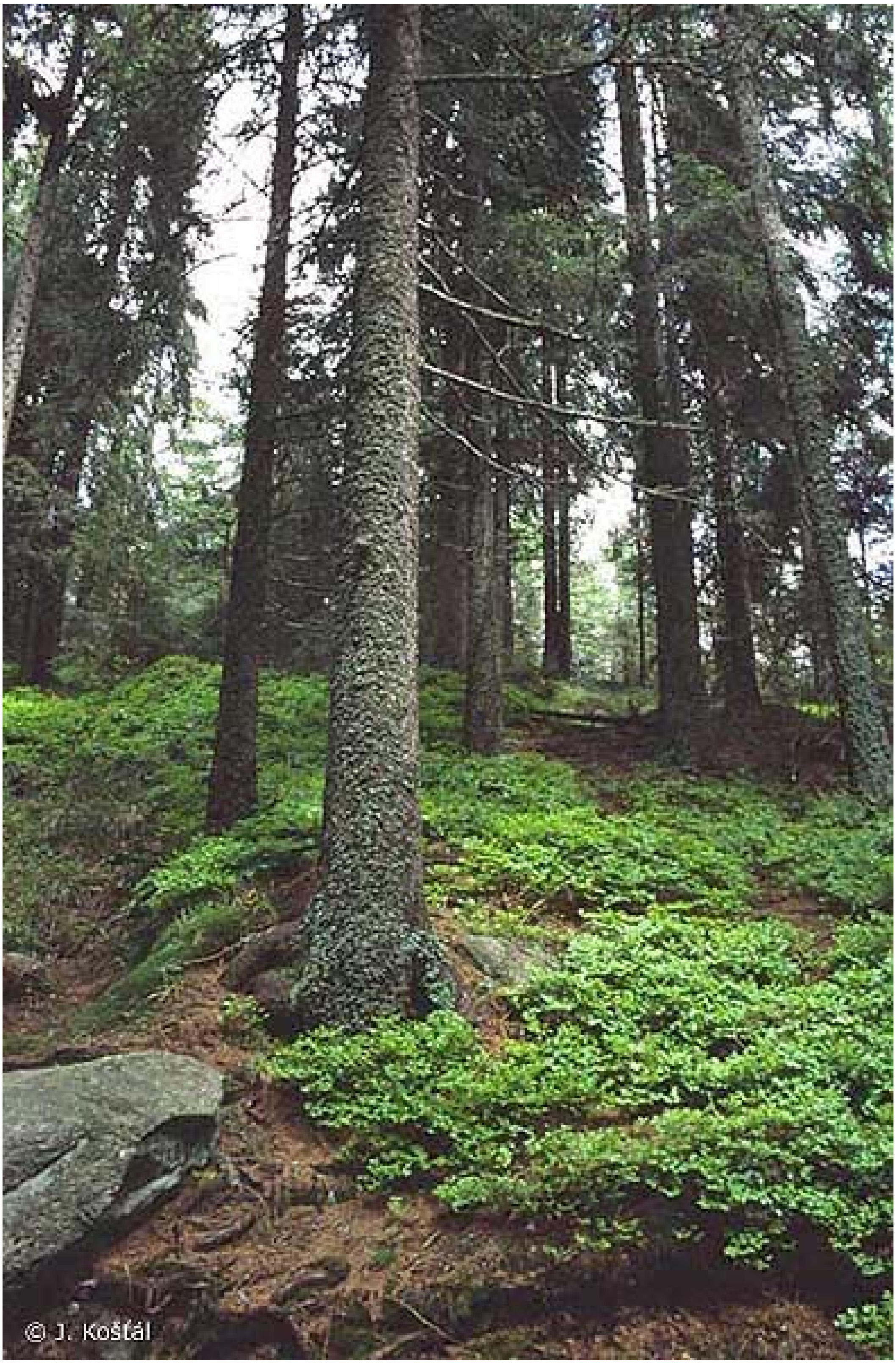
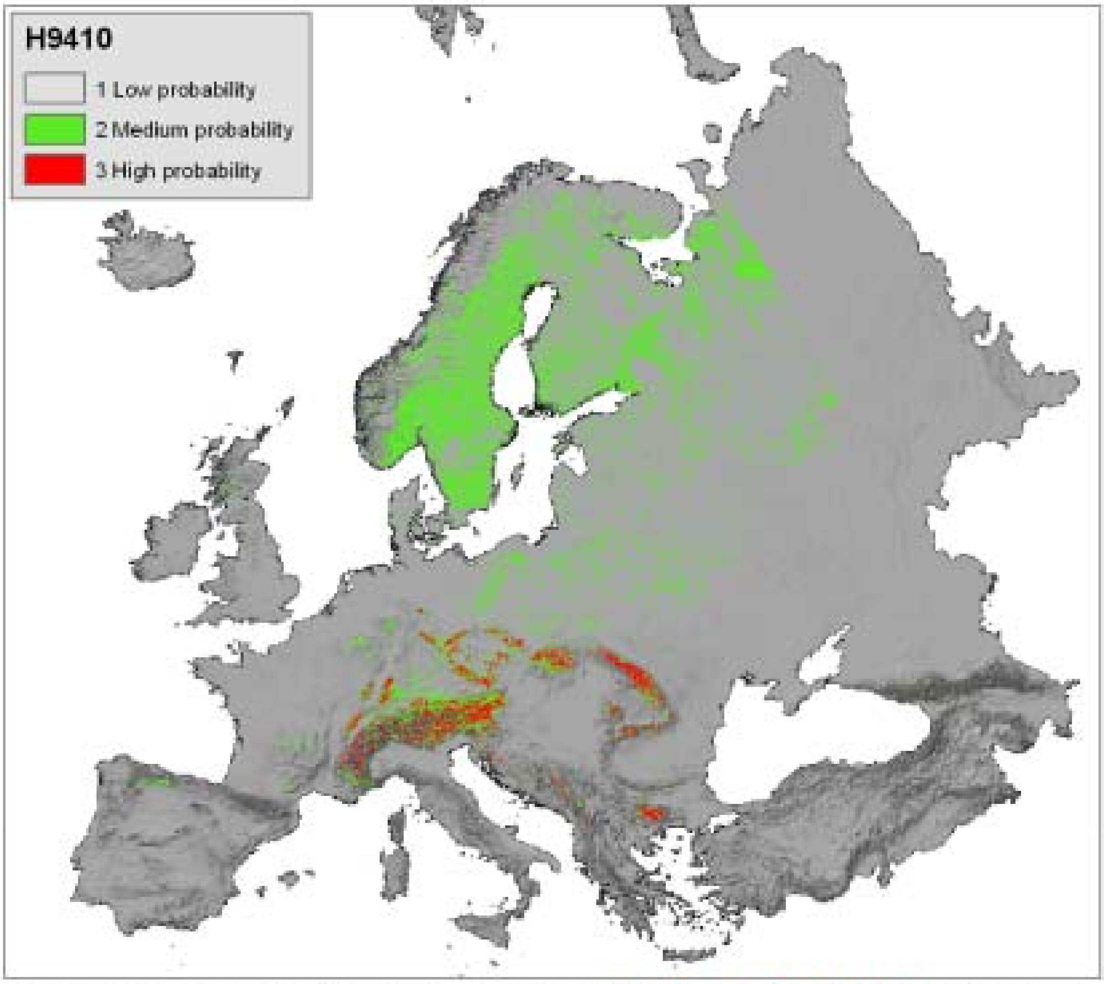
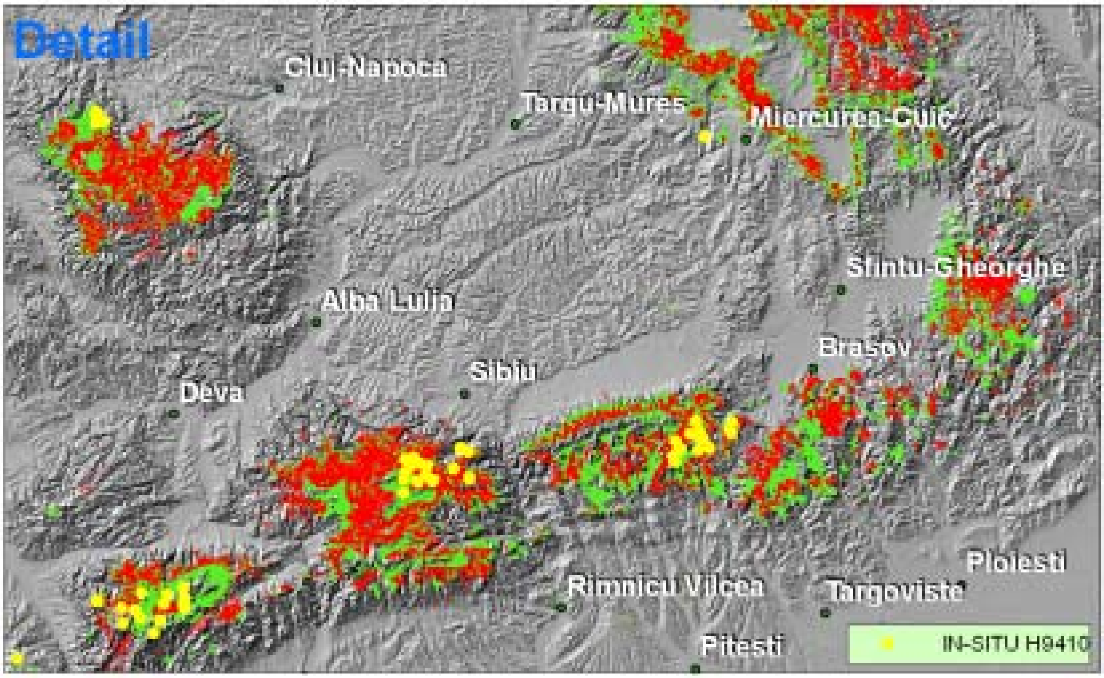


Photo 19 Vysoké Tatry, Štrbské pleso, at 1400 m. Asociácia: Vaccinio myrtilli-Piceetum, zväz: Piceion excelsae, trieda: Vaccinio-Piceetea with Vaccinium myrtillus (Photo: Jaroslav Košťál, 14.6.2006)

Source: http://www.sbs.sav.sk/atlas/admin/img/Vaccinio%20myrtilli-Picetum.JPG

RESULT H9410 ACIDOPHILOUS PICEA FORESTS OF THE MONTANE TO ALPINE LEVELS





H9420. Alpine Larix decidua and/or Pinus cembra forests

Annex I Description

Alpine Larix decidua and/or Pinus cembra forests
Natura 2000 habitat type code **9420**
Palearctic habitat code (and Corine Biotopes) **42.31 & 42.32**
Priority Habitat: No
Parent: Temperate Mountainous Coniferous Forests (9400)
Description
Forests of the sub-alpine and sometimes montane levels, dominated by *Larix decidua* or *Pinus cembra*; the two species may form either pure or mixed stands, and may be associated with *Piceaabies* or *Pinus uncinata*. Sub-types: • 42.31 - Eastern Alpine siliceous larch and arolla forests. *Larici-Cembretum*. Sub-alpine *Larix decidua*, *Pinus cembra*, or *Larix decidua-Pinus cembra* forests of the eastern and central Alps, mostly of the inner ranges, usually on siliceous substrates, with an often species-poor undergrowth comprising *Vaccinium myrtillus*, *Rhododendron ferrugineum*, *Calamagrostis villosa*, *Luzula albida*. • 42.32 - Eastern Alpine calcicolous larch and arolla forests. *Laricetum*, *Larici-Cembretum Rhododendretosum hirsute.* Sub-alpine and montane *Larix decidua*, *Larix decidua - Picea abies*, *Pinus cembra* or *Larixdecidua-Pinus cembra* forests of the eastern and central Alps, mostly of the outer ranges, on calcareous substrates, with a usually species-rich undergrowth including *Erica herbacea*, *Polygala chamaebuxus*, *Rhododendron hirsutum* or *Pinus mugo*. • 42.35 - Carpathian larch and arolla forests Uncommon *Larix decidua* or *Pinus cembra* formations of the Carpathians, each occurring as a single dominant, together as codominants, or mixed with *Picea abies*.
Plants
Larix decidua, Pinus cembra.
Geographic distribution
Austria (Alpine), Germany (Alpine), France (Alpine), Italy (Alpine) Poland (Alpine), Slovakia (Alpine).
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10229

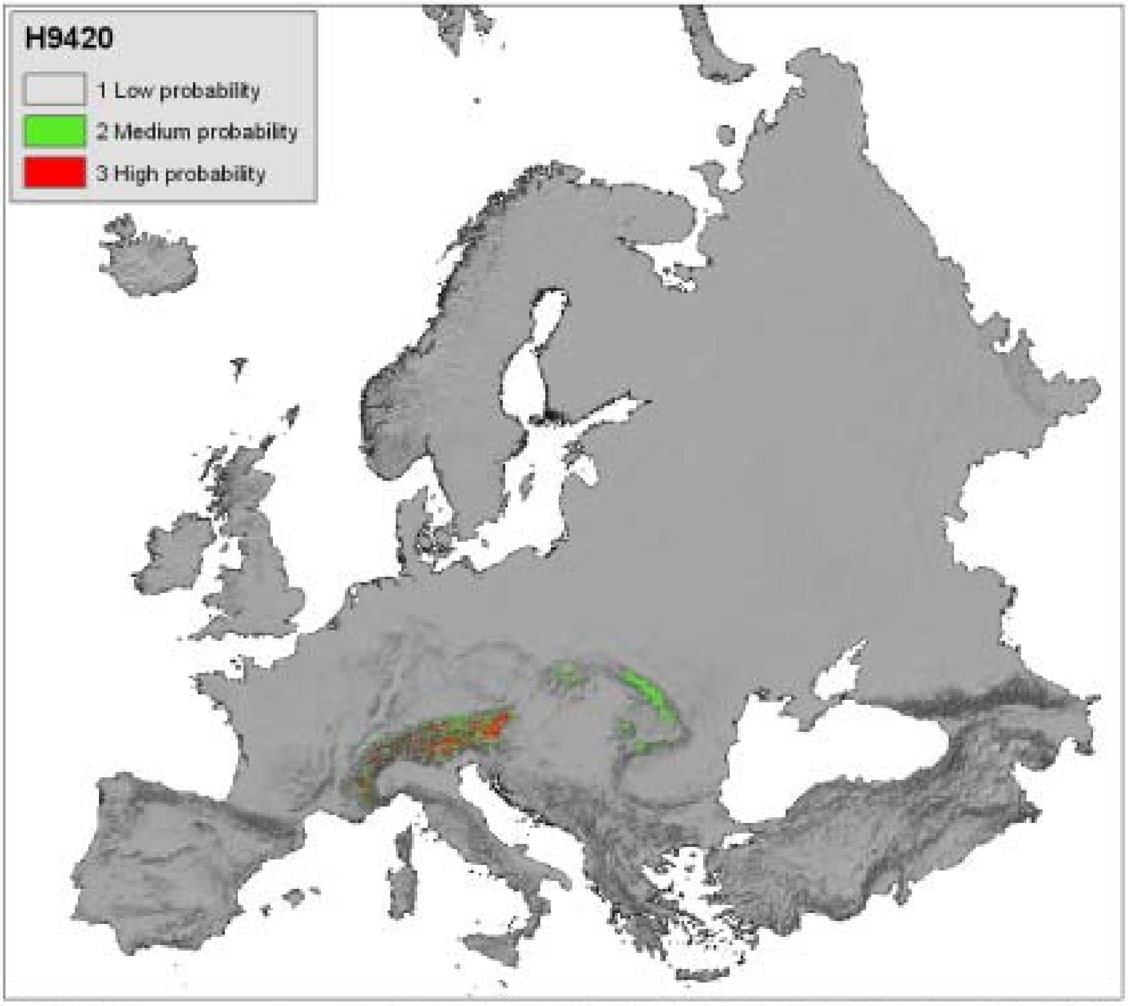
ECOCHANGE rules

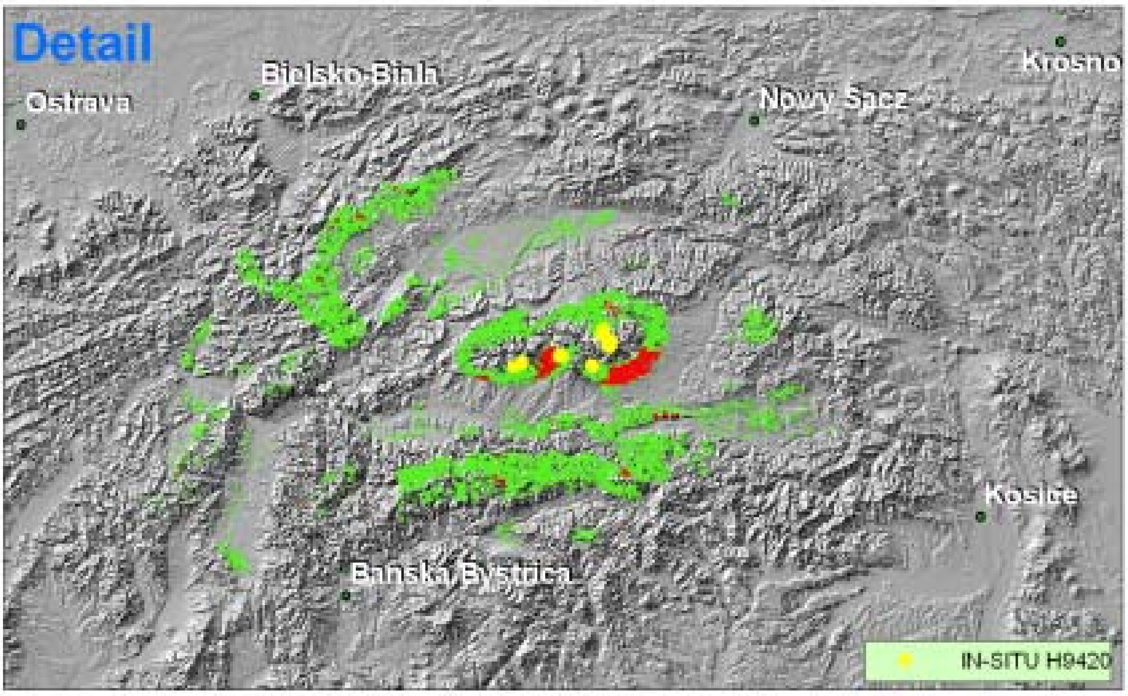
CLC:	**312** - Coniferous forest										
Annex I:	**9420** - Alpine Larix decidua and/or Pinus cembra forests										
Mapping rules:	Alpine South 1000-1700 m?. Mediterranean mountains over 100m but north of Pyrenees only plus native distribution of Larix / P.cembra.										
Indicator species:	Larix decidua, Pinus cembra, Vaccinium myrtillus.										
GHC (BioHab):	- Forest phanerophyte/Conifer over 70%/ + Larix or P.cembra but only native stands + moist acid soils + species indicators										
Field identification:	Usually present as more or less pure stands so readily identifiable.										
Occurrence:	Often present as altitudinal bands and relatively small patches. May be confused with deciduous forest in CLC and may be also below the minimum mappable unit.										
Direct threats:	Felling and conversion to grazing land or spruce										
Climate change:	Could exert pressure on tree health at lower altitudes but also increase altitude range										
Succession:	Probaly climax but proportions of species may change with age.										
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*

Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Photo 20 9420: Subalpine arolla pine (Pinus cembra) forest in the Alps at the forestline in combination with dwarf shrub communities (C19); Oberhauser Zirbenwald, Defereggen Valley, Eastern Tyrol/Austria (K. Zukrigl).

RESULT H9420. ALPINE LARIX DECIDUA AND/OR PINUS CEMBRA FORESTS





H9510. Southern Apennine Abies alba

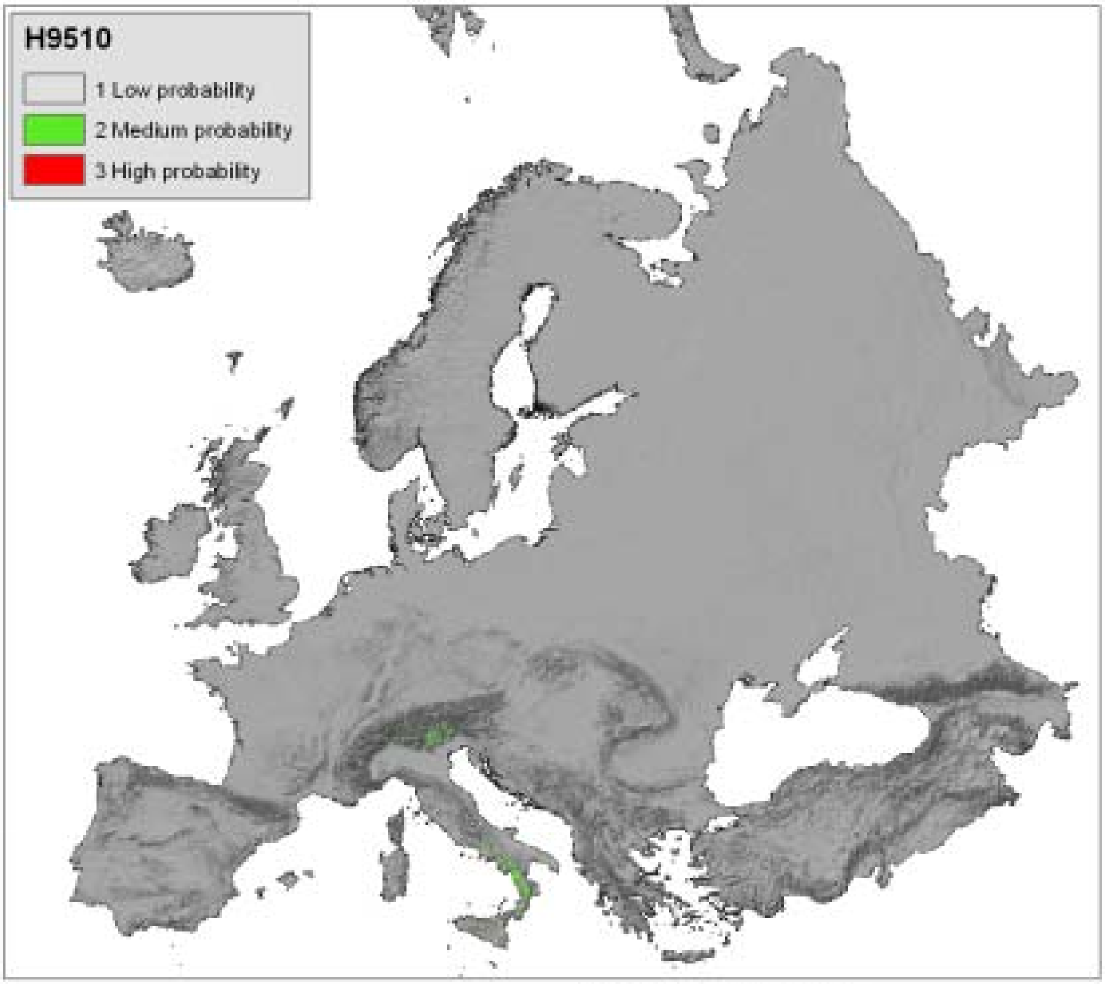
Annex I description

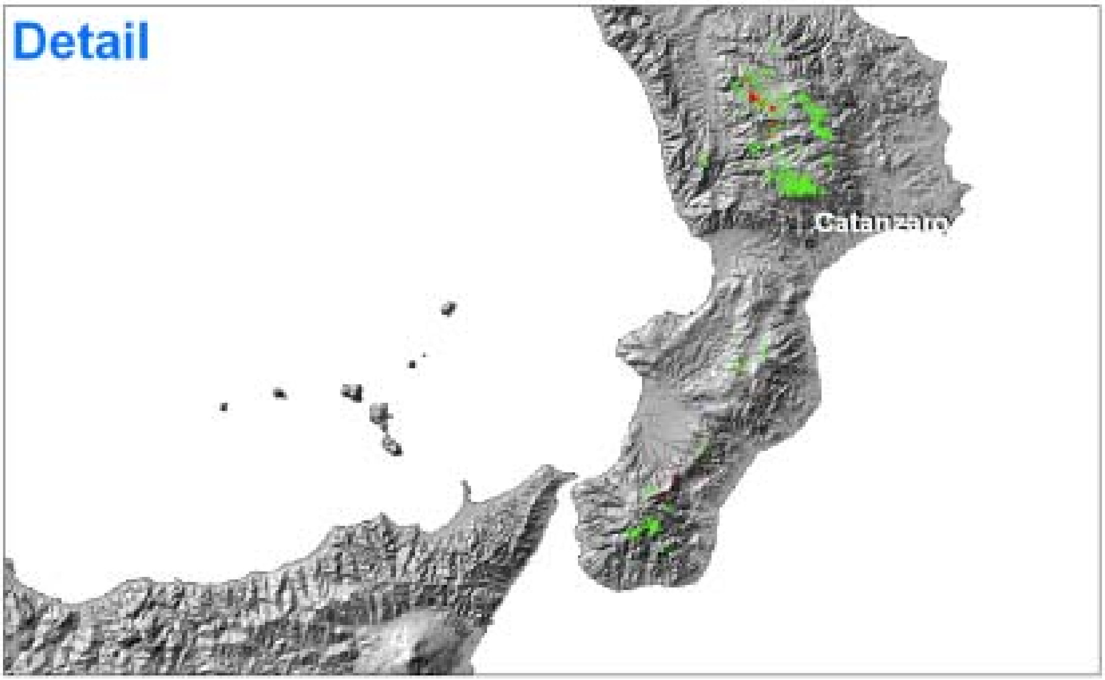
Southern Apennine Abies alba
Natura 2000 habitat type code **9510**
Palearctic habitat code (and Corine Biotopes)
Priority Habitat: **Yes**
Parent: Mediterranean and Macaronesian mountainous coniferous forests (9500)
Description
Relict *Abies alba* woods associated with the beech forests of the *Geranio versicolori-Fagion.*
Plants
Abies alba.
Geographic distribution
Southern Apennines (Molise, Basilicata, Calabria) Italy (Alpine, Meditterranean)
http://eunis.eea.europa.eu/habitats-factsheet.jsp?idHabitat=10232

ECOCHANGE rules

CLC:	**312** - Coniferous forest											
Annex I:	**9510** - Southern Apennine Abies alba											
Mapping rules:	Mediterranean mountains southern Apennines only. Over 800m? Abies alba.											
Indicator species:	Abies alba.											
GHC (BioHab):	- Forest phanerophytes/over70% conifer + Abies alba + further expert knowledge and indicators											
Field identification:	Dependant on one species therefore clear cut. But problem will be gradients with Fagus forests											
Occurrence:	No information.											
Direct threats:	Probably felling											
Climate change:	Could be threatened by increased summer drought											
Succession:	.likely to be climax											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

RESULT H9510. SOUTHERN APENNINE ABIES ALBA





Annex I Criteria used to classify the vegetation releves into the relevant Annex I habitat types for the various countries for which in-situ data were obtained.

Vegetation type	Britain	Netherlands	Belgium (Flanders)
Basic grassland	Comm. U1 - U21	vegetation class 15	--
Acid grasslands	Comm. CG1 - CG14	vegetation alliance 19AA	ph <= 4.4
4070 Pinus mugo	--	--	--
6150 Siliceous alpine and boreal grasslands	Comm. U7,U8,U9	--	--
6170 Alpine and subalpine calcareous grasslands	presence of Dryas octopetala	--	--
9410 Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)	--	--	--
9150 Medio-European limestone beech forests of the Cephalanthero-Fagion	--	--	--
6240 Sub-pannonic steppic grasslands	--	--	--
6250 Pannonic loess steppic grasslands	--	--	--
9510 Southern Apennine Abies alba	--	--	--
4060 Alpine and boreal heath	Comm. H16, H17, H19, H20, H21, H22	--	--
7110 Active raised bogs	Comm. M18, M20	Selection on AnnexI 7110	--
7130 Blanket bog	Comm. M17, M18, M19, M20	--	--
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	Brachypodium pinnatum >10% cover or Bromus erectus >10% cover	Selection on AnnexI 6210	--
9420 Alpine Larix decidua and/or Pinus cembra forest	--	--	--
6230 Species-rich Nardus grasslands	Comm. U5, U7 AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica	Selection on AnnexI 6230	--

Vegetation type	Austria	Tjechia	Slovakia
Basic grassland		predefined	Vegetation class 06 and 10
Acid grasslands	field ACIDSOIL' = "X"	predefined	Vegetation class 13
4070 Pinus mugo	preselected	Pinus mugo > 75% cover	Pinus mugo > 75% cover
6150 Siliceous alpine and boreal grasslands	Juncus trifidus > 5% cover or Carex bigelowii > 5% cover	--	Juncus trifidus > 5% cover or Carex bigelowii > 5% cover
6170 Alpine and subalpine calcareous grasslands	Dryas octopetala	--	Dryas octopetala and vegetation class 06
9410 Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)	--??	preselected	preselected
9150 Medio-European limestone beech forests of the Cephalanthero-Fagion	preselected	preselected	Syntaxon 27BD10
6240 Sub-pannonic steppic grasslands	Stipa pennata > 10% cover	preselected	preselected
6250 Pannonic loess steppic grasslands	--	preselected	--
9510 Southern Apennine Abies alba	--	--	--
4060 Alpine and boreal heath	Arctostaphyllos alpinus >20% cover or Rhododendron ferruginium >20% cover or Rhododendron hirsutum >20% cover	preselected	preselected
7110 Active raised bogs	Andromeda polifolia	Andromeda polifolia	Andromeda polifolia
7130 Blanket bog	--	--	--
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	Brachypodium pinnatum >10% cover or Bromus erectus >10% cover	Brachypodium pinnatum >10% cover or Bromus erectus >10% cover	Brachypodium pinnatum >10% cover or Bromus erectus >10% cover
9420 Alpine Larix decidua and/or Pinus cembra forest	??	--	preselected

6230 Species-rich Nardus grasslands	Nardus stricta > 5% cover AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica	Nardus stricta > 5% cover AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica	Nardus stricta > 5% cover AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica

Vegetation type	**Switzerland**	**Bulgaria**	**Romania**
Basic grassland	pH > = 7.0	field BASICROCK='limestone'	??
Acid grasslands	ph <= 4.4 and Nardus >= 25% cover	field BASICROCK='silicate'	??
4070 Pinus mugo	--	--	Pinus mugo > 75% cover
6150 Siliceous alpine and boreal grasslands	Juncus trifidus > 5% cover	--	Juncus trifidus > 5% cover
6170 Alpine and subalpine calcareous grasslands	Dryas octopetala and pH >= 7.0	--	Dryas octopetala > 5% cover
9410 Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)	--	--	Picea abies > 50% cover
9150 Medio-European limestone beech forests of the Cephalanthero-Fagion	--	--	Fagus sylvatica > 50% cover + Cephalanthera rubra preselected
6240 Sub-pannonic steppic grasslands	--	--	
6250 Pannonic loess steppic grasslands	--	--	--
9510 Southern Apennine Abies alba	--	--	--
4060 Alpine and boreal heath	--	--	--
7110 Active raised bogs	--	--	--
7130 Blanket bog	--	--	--
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	Brachypodium pinnatum >10% cover or Bromus erectus >10% cover	--	--
9420 Alpine Larix decidua and/or Pinus cembra forest	--	--	Pinus cembra > 20 cover or Larix decidua >20% cover
6230 Species-rich Nardus grasslands	Nardus stricta > 5% cover AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica	--	Nardus stricta > 5% cover AND one of the next 4 species: Gentiana pneumonanthe, Carex panicea, Carex ericetorum, Antennaria dioica

Annex II Knowledge rules for the relationship between CORINE Land Cover Classes and Annex 1 Habitats

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with comments from Doug Evans, Berien Elbersen, John Janssen, Gerard Hazeu and Rob Jongman.

Each of the Annex I habitats has the following description fields in this document:

1. Mapping rules: these mapping rules are constructed from the information provided in the Interpretation manual of European habitats on where the habitat occurs. This information is supplemented by field experience of the author and by discussions with phytosociologists in the Ecochange project. In due course literature could be consulted to confirm that the altitudinal ranges are correct. Consultation will also be held with Doug Evans of the Topic Centre in Paris to further check the descriptions.

2. Indicator species: the indicator species are in most cases a subset of the Annex I plant species. A subset has been made since the selected species are the most characteristic and stable species present within the habitat

3. GHC BioHab. These are General Habitat Classes (GHC) as defined within the BIOHAB project. The basis of the General Habitat Categories is the classification of plant Life forms produced by the Danish botanist Raunkiaer early in the 20th Century. These Life forms e.g. annuals or trees. They are based on the scientific hypothesis that habitat structure is related to the environment. The BioHab General Habitat Categories cover the Pan-European region (except Turkey) with 130 GHC's derived from 16 Life Forms (Bunce et al., 2008)

The Codes for the General Habitat Categories are in this document:
LHE = leafy hemicryptophytes(herbs), **CHE** = caespitose hemicryptophytes (grasses), **SUC** = succulents, **THE** = therophytes (annuals), **HEL** =helophytes (marsh plants) **CRY** = mosses, liverworts and lichens, **DCH** = espaliers below 5cm, **SCH**=dwarf scrub 5-30cm, **LPH** = low scrub,30-60cm, **MPH** = mid scrub 60cm-2.0 m, **TPH** = tall scrub2m-5m., **FPH** = forest over 5 m, **CON** = conifer, **DEC** = deciduous, **EVR** = evergreen, **NLE** = non leafy evergreen, **SPI** = spiny/summer deciduous

4. Field identification: comments on the probable ease of identification of the habitat in the field.

5. Occurrence: three categories are used: rare, where the habitat is present in isolated patches, usually small, common, where it is distributed widely but does not cover large areas in the landscape and abundant where it is not only widespread but is also dominant. These are qualified where necessary.

6. Direct threats: based on the knowledge of the vegetation and literature . The information could also be supplemented later by other experts.

7. Potential impacts of climate change: based on knowledge of the vegetation, literature and the change in Environmental Zones described by Metzger et al (2008).

8. Vegetation succession due to abandonment: conversion of the present composition into BioHab plant lifeform categories followed by an interpretation of likely successional changes together with possible timescales.

9. Distribution. This is the distribution of the specific habitat over the various Environmental Zones (Metzger et al., 2005). The codes, based on the BioHab handbook (Bunce et al 2005) are as follows for the Environmental Zones:
ALS = Alpine South, **BOR** = Boreal, **NEM** = Nemoral, **ATN** = Atlantic North, **ATC** = Atlantic Central, **ALS** = Alpine South, **PAN** = Pannonian, **CON** = Continental, **LUS** = Lusitanean, **MDM-** Mediterranean Mountains, **MDN** = Mediterranean North, **MDS** = Mediterranean South

Distribution (sites) has been obtained directly from the Natura 2000 database intersected with the Environmental Zones. Distribution (Bunce) is based on expert knowledge from Bob Bunce.

All knowledge rules below has been ordered in sequence of Annex I habitat types.

CLC:	**523** - Sea and ocean
Annex I:	**1110** - Sandbanks which are slightly covered by sea water all the time
Mapping rules:	Sea and ocean but with shallow coast lines in Atlantic Central / Atlantic North / Lusitanian Atlantic coast of Mediterranean North / Mediterranean South.
Indicator species:	Zostera marina, Potamogeton pectinatus.
GHC (BioHab):	Submerged hydrophytes + Zostera over 30% + Saline water.
Field identification:	Difficult when in deeper water – use evidence of material washed up on the shore.
Occurrence:	Highly localized, pollution impact means that distribution maps are unreliable.
Direct threats:	Pollution, sedimentation, disturbance.
Climate change:	Unlikely to be affected.
Succession:	None.
Countries:	Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Latvia, Portugal, Romania, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean
Annex I:	**1120** - Posidonia beds (Posidonion oceanicae)
Mapping rules:	Sea and ocean but with shallow coastlines only in the Mediterranean in Mediterranean North / Mediterranean South.
Indicator species:	Posidonia oceanica.
GHC (BioHab):	Submerged hydrophytes + Posidonia + saline water.
Field identification:	Difficult when in deeper water – use evidence of material washed up on the shore.
Occurrence:	Highly localized, pollution impact means that distribution maps are unreliable.
Direct threats:	Pollution, sedimentation, disturbance.
Climate change:	Unlikely to be affected.
Succession:	None.
Countries:	France, Greece, Italy, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**522** - Estuaries

Annex I:	**1130** - Estuaries
Mapping rules:	This is a landscape level class and is not defined by vegetation associations-it therefore needs a geographical definition. The description suggests that it includes only the actual substrate which is covered by tidal water. Therefore only in the main estuaries in Atlantic North / Atlantic Central but with specified site in Boreal / Nemoral in the Baltic.
Indicator species:	Ruppia maritima, Spartina maritima.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	*nem*	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean
Annex I:	**1130** - Estuaries
Mapping rules:	Sea and ocean but with shallow coastlines only in the Mediterranean in Mediterranean North / Mediterranean South.
Indicator species:	Ruppia maritima, Spartina maritima.
GHC (BioHab):	Landscape class whose general characteristics will be described in the key, but expert knowledge is also required.
Field identification:	Difficult because of lack of information, but main sites will be identified relatively easily – smaller units will have problems.
Occurrence:	Some large units, but small patches will be present on many Atlantic coast lines.
Direct threats:	Urbanisation and pollution.
Climate change:	Unlikely to be affected.
Succession:	None.
Countries:	Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Malta, Norway, Poland, Portugal, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	*nem*	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean

Annex I:	**1140** - Mudflats and sandflats not covered by seawater at low tide

Mapping rules:	Between high and low water mark + mud and / or sand.											
Indicator species:	-											
GHC (BioHab):	Tidal.											
Field identification:	Straight forward.											
Occurrence:	Occurs as large units in the main estuaries of Atlantic Europe. Otherwise fragmented small areas.											
Direct threats:	Urbanisation.											
Climate change:	None.											
Succession:	None.											
Countries:	Belgium, Denmark, Estonia, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**521** - Coastal lagoons
Annex I:	**1150** - Coastal lagoons

Mapping rules:	Coastal lagoons in CLC which will miss small patches.											
Indicator species:	Zostera spp., Ruppia maritima.											
GHC (BioHab):	Mainly Submerged hydrophytes with locally patches of Emergent hydrophytes + brackish to salt water + coastal shallow water or lagoons or ponds.											
Field identification:	Large units well defined, but identification of small patches will be difficult because of continua caused by leeching out of salt over time.											
Occurrence:	Some large areas, but locally small elements may also be present within matrices of salt marsh and coastal vegetation.											
Direct threats:	Urbanisation, removal of sea water coverage.											
Climate change:	Could increase with increased sea level.											
Succession:	Change to more dense coverage of non-maritime species.											
Countries:	Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean
Annex I:	**1160** - Large shallow inlets and bays

Mapping rules:	A landscape level class which will be difficult to separate from 1130 as it only differs in being dominated by freshwater. It is therefore unlikely that these two classes can be separated and a combined map would be indicative of their likely distribution by using the same ENZ;s.
Indicator species:	-
GHC (BioHab):	Sea + coastal indentations, but as a landscape class it will be identified before the GHC key.
Field identification:	Depends on the definition of large indentations, but it only present in the marine or tidal areas and not above mean high water mark.
Occurrence:	Probably some relatively large units, but the question remains over whether some small to medium units could also be included.
Direct threats:	Urbanization and pollution.
Climate change:	Only if sea level raises significantly.
Succession:	Unlikely unless extensive sedimentation occurs.
Countries:	Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Malta, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean
Annex I:	**1170** - Reefs

Mapping rules:	Marine only.
Indicator species:	-
GHC (BioHab):	Sea or Tidal or Sea / Tidal.
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Norway, Portugal, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**523** - Sea and ocean
Annex I:	**1180** - Submarine structures made by leaking gases

Mapping	Marine only.

rules:												
Indicator species:	-											
GHC (BioHab):	Sea.											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **1210** - Annual vegetation of drift lines

Mapping rules:	Occur along coast Alpine North / Boreal / Nemoral / Atlantic Central / Atlantic North / Continental / Lusitanian / Mediterranean. (North / Mediterranean South but discontinuous and only probabilistic. Coastal GIS line but discontinuous and likely to be absent from many coastlines especially those with cliffs, presence of 331 plus sand if possible and addition of line at high water mark would be reasonable. A narrow linear feature which could only be indicated?).											
Indicator species:	Cakile maritima, salsola kali, Glaucium flavum, Matthiola sinuata.											
GHC (BioHab):	Leafy hemicryptophytes / Ceaspitose hemicryptophytes, saline + sand or gravel + coast.											
Field identification:	Very restricted often degraded.											
Occurrence:	Fragmented discontinues line dependent upon local coastal condition.											
Direct threats:	Change in deposition patterns.											
Climate change:	Local patterns predominate - unlikely to be an important factor.											
Succession:	If deposition continues than Shrubby chamaephytes to Low phanerophytes to Mid phanerophytes + Tall phanerophytes + Forest phanerophytes alive, otherwise it is transient habitat anyway.											
Countries:	Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Malta, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **1220** - Perennial vegetation of stony banks

Mapping rules:	Boreal / Nemoral / Atlantic Central / Atlantic North coastal mask 1 km. Discontinuous. Coastal only. Probably included here although it is not sandy but pebbles. Of restricted localised occurrence and could be checked by looking at well known examples eg Chesil Beach and Dungeness. Coastal mask plus shingle if available.
Indicator species:	Crambe maritima, Crithmum maritimum.
GHC (BioHab):	Shrubby chamaephytes saline + pebbles.
Field identification:	Could be straightforward but a number of transitions are mentioned which could lead to problems.
Occurrence:	Often fragmented but could be in large pattern locally.
Direct threats:	Stone extraction / urbanization.
Climate change:	Could come drying out to the extent that some species die out.
Succession:	Shift to Ceaspitose hemicryptophytes and then to non saline Shrubby chamaephytes, Low phanerophytes and further colonization if not too exposed.
Countries:	Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**1230** - Vegetated sea cliffs of the Atlantic and Baltic coasts

Mapping rules:	Boreal / Nemoral / Atlantic North / Atlantic Central / Continental / Lusitanian / Mediterranean North (Atlantic coast rules) + coastal mask 100 m + local height differences.
Indicator species:	Brassica oleracea, Cochlearia officinalis, Asplenium marinum, Inula crithmoides.
GHC (BioHab):	Ceaspitose hemicryptophytes or Ceaspitose hemicryptophytes / Leafy hemicryptophytes locally Shrubby chamaephytes / Evergreen + coastal + defined quantities of saline tolerant species.
Field identification:	Straightforward as long as regional distribution maintained and the height of cliffs.
Occurrence:	Discontinues – but many long section interspersed because of bays / sand banks.
Direct threats:	Urbanisation otherwise protected, because of isolation.
Climate change:	Limited impact – changes in balance of species.
Succession:	Locally shrubs could colonize, but only in protected locations.
Countries:	Denmark, Estonia, Finland, France, Germany, Ireland, Latvia, Poland, Portugal, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**1240** - Vegetated sea cliffs of the Mediterranean coasts with endemic Limonium spp.

Mapping rules:	Mediterranean North / Mediterranean South. Coastal mask 100 m + rocky – accuracy depends on Limonium spp.											
Indicator species:	Crithmum maritimum, Asplenium marinum, Daucus carota ssp azorica.											
GHC (BioHab):	Leafy hemicryptophytes on Leafy hemicryptophytes / Ceaspitose hemicryptophytes or Shrubby chamaephytes + coastal cliffs + rocky saline species varies, but always present.											
Field identification:	Includes rocky shores as well as cliffs so rather variable – also depends on how strictly the presence of endemic Limonium species is applied.											
Occurrence:	Some long sections but often fragmented and discontinuous.											
Direct threats:	Urbanization, but usually protected because of isolation.											
Climate change:	Limited impact, except to change the balance in species.											
Succession:	High temperatures and inherent drought probably restrict colonization.											
Countries:	Bulgaria, France, Greece, Italy, Malta, Portugal, Slovenia, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **1250** - Vegetated sea cliffs with endemic flora of the Macaronesian coasts

Mapping rules:	Macaronesia only.											
Indicator species:	Crithmum maritimum, Limonium spp..											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **421** - Salt marshes

Annex I: **1310** - Salicornia and other annuals colonising mud and sand

Mapping rules:	Atlantic North / Atlantic Central / Continental / Lusitanian / Mediterranean North / Mediterranean South / km coastal marsh + (bare mud if possible).
Indicator species:	Salicornia spp, Suaeda maritima, Sagina maritima, Sagina nodosa, Cochlearia danica.
GHC	Therophytes or Leafy hemicryptophytes / Therophytes or Leafy hemicryptophytes / Ceaspitose

(BioHab):	hemicryptophytes or Shrubby chamaephytes high salinity.
Field identification:	Staright forward except for areas which have below 30% vegetated cover.
Occurrence:	Will occur in large units but also in small patches between mature salt marshes.
Direct threats:	Urbanisation, cutting off from the sea.
Climate change:	Only changes of sea level likely to be important.
Succession:	Slow but could be Shrubby chamaephytes to Low phanerophytes if siltation takes place.
Countries:	Belgium, Bulgaria, Denmark, Estonia, France, Germany, Greece, Ireland, Italy, Latvia, Malta, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	*mds*

CLC:	**421** - Salt marshes
Annex I:	**1320** - Spartina swards (Spartinion maritimae)
Mapping rules:	Atlantic North / Atlantic Central + coastal mask 1 km.
Indicator species:	Spartina maritima.
GHC (BioHab):	Ceaspitose hemicryptophytes + spartina maritimae coverage > 30% SPV < 70%, otherwise SPV / BAR.
Field identification:	Straightforward although gradient under salt marsh development after initial colonization.
Occurrence:	Mainly in large patches but also in small fragments.
Direct threats:	Enclosure from sea and conversion in to agriculture.
Climate change:	Change in sea level could lead to eventual loss.
Succession:	Only to Shrubby chamaephytes and the Low phanerophytes if siltation continues and then eventually to Mid phanerophytes / Tall phanerophytes and Forest phanerophytes and a long period following loss of salt.
Countries:	Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, Slovenia, Spain, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	*mds*

CLC:	**421** - Salt marshes
Annex I:	**1330** - Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
Mapping rules:	Atlantic North / Atlantic Central / BOS / Nemoral / Continental + coastal marsh + saline soils.
Indicator species:	Spergularia marina, Potentilla anserina.
GHC (BioHab):	Ceaspitose hemicryptophytes or Ceaspitose hemicryptophytes / Leafy hemicryptophytes strongly saline.

Field identification:	Contains quite a wide range of different salt marsh associations could be broadly interpreted.
Occurrence:	Often in large units but can also be in small patches + linear strips. The main areas will therefore be identified.
Direct threats:	Urbanization + enclosure from sea.
Climate change:	Changes in sea level could alter balance between species.
Succession:	Depends on siltation rate and loss of salt Shrubby chamaephytes (10) ==> Low phanerophytes 10 Mid phanerophytes 10 Tall phanerophytes 10 Forest phanerophytes 10.
Countries:	Belgium, Denmark, France, Germany, Ireland, Netherlands, Poland, Portugal, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*

CLC: **411** - Inland marshes

Annex I: **1340** - Inland salt meadows

Mapping rules:	Too small and fragmented to predict unless the distribution of inland saline soils areas is available.
Indicator species:	Aster tripolium, Atriplex hastata, Puccinellia distans, Salicornia spp. Spergularia salina.
GHC (BioHab):	Ceaspitose hemicryptophytes or Ceaspitose hemicryptophytes / Leafy hemicryptophytes + moist strongly saline soils.
Field identification:	Gradient with slightly salty areas leads to difficulties.
Occurrence:	Occurrent in small dispersed patches.
Direct threats:	Gradual loss of salt and conversion to agriculture.
Climate change:	Could maintain the salt level and maintain the class.
Succession:	Depends on loss of salt but Shrubby chamaephytes 10 Low phanerophytes 10 maybe Mid phanerophytes 10.
Countries:	Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Poland, Slovakia, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **421** - Salt marshes

Annex I: **1410** - Mediterranean salt meadows (Juncetalia maritimi)

Mapping rules:	Lusitanian (?), Mediterranean North / Mediterranean South, coastal marsh < 1 km. Inland only possible on saline soils.
Indicator species:	Juncus maritimus, Aster tripolium.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes saline , also Shrubby chamaephytes saline.
Field	Inland well-defined clear cut, but transitions with low shores and also intergrades with salt marshes on

identification: the coast.

Occurrence: Fragmented inland larger patches often linear by coast.

Direct threats: Irrigation to remove salt and shifts to agriculture and urbanization.

Climate change: Could cause drying out and loss of species.

Succession: Could be by salt tolerant low shrubs but slow because of salinity - Ceaspitose hemicryptophytes / Leafy hemicryptophytes ==> Shrubby chamaephytes 10 ==>Low phanerophytes 10 probably no further.

Countries: Bulgaria, France, Greece, Ireland, Italy, Malta, Portugal, Romania, Slovenia, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **421** - Salt marshes

Annex I: **1420** - Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)

Mapping rules: Lusitanian + Medit. North + Medit. South + Mean high water mark + Saline muds.

Indicator species: Sarcocornetea fruticosi, Inula critmoides, Sarcocornia perennis.

GHC (BioHab): Shrubby chamaephytes / Evergreen or Low phanerophytes / Evergreen + saline soils + indicator species.

Field identification: Straight forward.

Occurrence: Locally possible some large areas, but often small patches of linear features.

Direct threats: Urbanization and leeching out of salt.

Climate change: Level rise may inundate this type of habitat.

Succession: Unlikely in present circumstances because of high salinity.

Countries: France, Greece, Ireland, Italy, Malta, Portugal, Slovenia, Spain, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **421** - Salt marshes

Annex I: **1430** - Halo-nitrophilous scrubs (Pegano-Salsoletea)

Mapping rules: Probably only Medit. South, but otherwise impossible to map because of requirement to access nitrophilous status. Indicators maybe available.

Indicator species: Peganum harmala, Atriplex halimus, Atriplex glauca.

GHC (BioHab): Low phanerophytes / Evergreen or Mid phanerophytes / Evergreen + dry eutropic + indicators.

Field identification: Probably straight forward with experience.

Occurrence: Probably in small patches, but difficult without expert knowledge.

Direct threats: Conversion to green house arigulture.

Climate May only alter balance of species to more xeric assemblies.

change:												
Succession:	Unlikely, because of high salinity.											
Countries:	France, Greece, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**421** - Salt marshes											
Annex I:	**1510** - Mediterranean salt steppes (Limonietalia)											
Mapping rules:	No rules yet.											
Indicator species:	Limonium spp., Lygeum spartum, Salicornia patula.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	France, Greece, Italy, Malta, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**

CLC:	**331** - Beaches, sand, dunes											
Annex I:	**1610** - Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation											
Mapping rules:	This is a landscape class but mainly belongs here but also 332 and 423 a re also included. Best solution is a mask of Baltic islets separate from CLC.											
Indicator species:	Calluna vulgaris, Empetrum nigrum, Honkenya peploides, Juniperus communis.											
GHC (BioHab):	SPV / Terrestrial and / or Therophytes and / or Leafy hemicryptophytes and / or Ceaspitose hemicryptophytes / Leafy hemicryptophytes.											
Field identification:	Identifiable as a landscape type clear description required.											
Occurrence:	Probably quite large units.											
Direct threats:	Urbanisation.											
Climate change:	Sea level rise.											
Succession:	-											
Countries:	Finland, Sweden.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **1620** - Boreal baltic islets and small islands

Mapping rules:	Needs to be separated fro 1610 by rocky coasts otherwise distribution the same.
Indicator species:	Agrostis stolonifera, Allium schoenoprasum, Cochleria danica, Juniperus communis, Silene viscosa.
GHC (BioHab):	Needs clear landscape description in the landscape.
Field identification:	Clear if adequate description provided of the key.
Occurrence:	Probably quite large while present.
Direct threats:	Urbanisation.
Climate change:	Sea level rise.
Succession:	-
Countries:	Estonia, Finland, Sweden.

Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **1640** - Boreal Baltic sandy beaches with perennial vegetation

Mapping rules:	Coastal beaches on the Finnish and Baltic coasts.
Indicator species:	Ammophila arenaria, Atriplex littoralis, Cakile maritima.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Estonia, Finland, Latvia, Sweden.

Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I:	**2110** - Embryonic shifting dunes
Mapping rules:	Coastal only. Boreal / Nemoral / Atlantic North / Atlantic Central / Lusitanian / Mediterranean North / Mediterranean South.
Indicator species:	Elymus farctus, Pancratium maritimum.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**2120** - Shifting dunes along the shoreline with Ammophila arenaria (white dunes)
Mapping rules:	All coasts with dunes but a band of variable width-maybe not wide enough to be mapped by CLC and prediction will therefore be unreliable. Coastal only. Boreal / Nemoral / Atlantic North / Atlantic Central / Lusitanian / Mediterranean North / Mediterranean South.
Indicator species:	Ammophila arenaria, Euphorbia paralias.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes

Annex I:	**2130** - Fixed coastal dunes with herbaceous vegetation (grey dunes)
Mapping rules:	Coastlines of Atlantic Central / Atlantic North / Boreal / Nemoral , Mediterranean South / Mediterranean North, Atlantic coast only,. Coastal only. Boreal / Nemoral / Atlantic North / Atlantic Central / Lusitanian / Mediterranean North / Mediterranean South.
Indicator species:	Gentiana campestris, Ononis repens, Carex arenaria, Salix repens.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**2140** - Decalcified fixed dunes with Empetrum nigrum
Mapping rules:	Technically moors and heathlands 322 but likely to be in patches in dune systems which are too small to map with in CLC.Atlantic Central / Atlantic North / Boreal / Nemoral but indicative only.
Indicator species:	Carex arenaria, Empetrum nigrum.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Denmark, Estonia, Finland, Germany, Ireland, Latvia, Netherlands, Poland, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**2150** - Atlantic decalcified fixed dunes (Calluno-Ulicetea)

Mapping rules:	As 2140 but only Atlantic Central / Atlantic North in France / Belgium and Britain.											
Indicator species:	Calluna vulgaris, Carex arenaria.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	France, Germany, Ireland, Netherlands, Portugal, Spain, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **21A0** - Machairs (* in Ireland)

Mapping rules:	This class is a landscape unit as it includes complexes of other recognised habitats. The separation of Irish machairs as a priority habitat from Scottish examples is historical. Whilst machair is mainly dunes it also includes cultivated land, grassland, rock and even small groups of buildings and salt marsh intergrades with dune. Romeo et al comment that it can also include 242 Complex cultivation patterns and 211 Non-irrigated arable land and also possibly 321 natural grasslands. As with several other classes it would be useful to examine examples of specific sites and check what has been included. West coast of Ireland and Scotland Atlantic North and Atlantic central plus dunes although not all dunes are within Machair.											
Indicator species:	-											
GHC (BioHab):	Identifiable from location and local knowledge as it is landscape complex / includeg grasslands,herb rich grasslands,dunes,salt marshes and small arable plots and crofts.											
Field identification:	Maps available of Irish sites and possibly Scottish-problems will be in drawing inland boundaries. Former are Priority the latter not.											
Occurrence:	Often present as quite large units-small patches not present as complexes required.											
Direct threats:	Agricultural fragmentation and decline of traditional farm practices.											
Climate change:	Adjacent to Atlantic therefore buffered against change.											
Succession:	Depends on seed availability but could shift to srrub classes if grazing stops or reduces.											
Countries:	Ireland, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **2210** - Crucianellion maritimae fixed beach dunes

Mapping rules:	Coastal only. Mediterranean North / Mediterranean South.											
Indicator species:	Crucianella maritima, Ephedra distachya, Silene nicaeensis.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	France, Italy, Malta, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **331** - Beaches, sand, dunes

Annex I: **2220** - Dunes with Euphorbia terracina

Mapping rules:	Coastal only. Mediterranean North / Mediterranean South.											
Indicator species:	Euphorbia terracina, Ephedra distachya, Silene nicaeensis.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Greece, Malta.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **2230** - Malcolmietalia dune grasslands

Mapping rules:	Coastal only. ? Mediterranean South?. + sand dunes -only possible to indicate region.
Indicator species:	Malcolmia lacera, Anthyllis hamosa.

GHC (BioHab):	Leafy hemicryptophyte / Therophyte + coastall dunes + local knowledge + indicator species.
Field identification:	Likely to be well defined but needs more details of character.
Occurrence:	Probaly small patches and also likely to be rare.
Direct threats:	Urbanisation.
Climate change:	No information.
Succession:	No information.
Countries:	France, Greece, Italy, Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**2240** - Brachypodietalia dune grasslands with annuals

Mapping rules:	Coastal only. Mediterranean North / Mediterranean South. + coastal dunes + calcareous soils but fragmented and possible to define potential region only.
Indicator species:	Brachypodium spp..
GHC (BioHab):	Caespitose hemicryptophytes / Therophytes + coastal dnes + further expert knowledge.
Field identification:	Depends on how welll described the class is in the phytosociological literature.
Occurrence:	Probably fragmented and localised.
Direct threats:	Urbanisation, grazing.
Climate change:	Already xerophilous.
Succession:	Unlikely.
Countries:	France, Italy, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**2250** - Coastal dunes with Juniperus spp.

Mapping rules:	LCC322, Mediterranean North / Mediterranean South but only Iberia. Plus coastal mask of 500m and / or adjacent to dunes 331. Romeo also comment that it could also be within Coniferous forest 312 but this is likely to be mostly 2270.
Indicator species:	Juniperus turbinata spp. Turbinata, J. macrocarpa, J. navicularis, J. communis, J. oxycedrus.
GHC (BioHab):	-

Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Denmark, France, Greece, Italy, Portugal, Spain, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)

Annex I: **2260** - Cisto-Lavenduletalia dune sclerophyllous scrubs

Mapping rules:	232 Mediterranean North / Mediterranean South plus coastal mask of 500m and / or adjacent to dunes 331.											
Indicator species:	-											
GHC (BioHab):	Low phanerophytes / Evergreen or Shrubby chamaephytes / Evergreen + dry sandy soils + key species + expert knowledge.											
Field identification:	Inadequate information.											
Occurrence:	Prbabbly in small patches.											
Direct threats:	Urbanisation, fire.											
Climate change:	Could be threathened by increased drought.											
Succession:	Probably stable.											
Countries:	France, Greece, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)

Annex I: **2270** - Wooded dunes with Pinus pinea and/or Pinus pinaster

Mapping rules:	Medit. mountains / Medit. South plus coastal mask of 1000 m and / or adjacent to dunes 331 + Pinus pinea and or Pinus pinaster.
Indicator species:	Pinus pinea, Pinus pinaster (?).
GHC (BioHab):	Forest phanerophytes / Conifers + Pinus pinea30-100% and or Pinus pinaster 30-100% + long established + sand dunes.
Field identification:	Straightforward but problem is with definition of long established.
Occurrence:	Usually extensive stands where present.
Direct threats:	Fire,urbanization,felling.
Climate	Close to coast so buffered.

change:												
Succession:	Stable.											
Countries:	France, Greece, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**322** - Moors and heath lands											
Annex I:	**2310** - Dry sand heaths with Calluna and Genista											
Mapping rules:	Romeo suggests 322 but many areas will be limited in extent and may be included into dune systems within the 25 ha unit. Examples need to be checked. May include inland dunes as well so all dune systems in Boreal / Nemoral / Atlantic North / Atlantic Central but probably so rare in Continental as not to be included here.											
Indicator species:	Calluna vulgaris, Genista anglica.											
GHC (BioHab):	Low phanerophytes / Evergreen + moist sands + key indicators + expert knowledge.											
Field identification:	Integrades with many more widespread.											
Occurrence:	Localised, probably small patches.											
Direct threats:	Overgrazing, urbanization, clearance for agriculture.											
Climate change:	Buffered by adjacency of ocean.											
Succession:	Depends on seed source Mid phanerophytes / 10 only Tall phanerophytes / Forest phanerophytes if Betula nearby.											
Countries:	Belgium, Denmark, Germany, Netherlands.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	**CON**	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**322** - Moors and heath lands
Annex I:	**2320** - Dry sand heaths with Calluna and Empetrum nigrum
Mapping rules:	Romeo suggests 322 but many areas will be limited in extent and may be included into dune systems within the 25 ha unit. Examples need to be checked. May include inland dunes as well so all dune systems in Boreal / Nemoral / Atlantic North / Atlantic Central but probably so rare in Continental as not to be included here. 4010. Alpine North below 700m Atlantic North below 900m and all British Check!!). Atlantic Central all British otherwise only within 80 km of coast. Acid peaty podsols, peats and rankers.
Indicator species:	Calluna vulgaris, Empetrum nigrum.
GHC (BioHab):	Low phanerophytes / Evergreen with patches of Shrubby chamaephytes / Evergreen + moist acid sands + indicator + expert knowledge.
Field identification:	Difficult to separate from some other heathlands.

Occurrence:	Now restricted to small patches.
Direct threats:	Abandonment or over-grazing drainage or fertilizing.
Climate change:	Region well buffered and increased rain unlikely to affect,.
Succession:	Colonisation status: Shrubby chamaephytes but rate depends on exposure and soil types. Less exposed drier soils Low phanerophytes 10, Mid phanerophytes 10, Tall phanerophytes 20 probably no further except in sheltered places and limited by seed availability. Exposed and wet soils Low phanerophytes 15 Mid phanerophytes 15 and probably no further.
Countries:	Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Netherlands, Sweden.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**2330** - Inland dunes with open Corynephorus and Agrostis grasslands

Mapping rules:	Nemoral Atlantic Central / Atlantic North / Pannonian / Continental. Inland siliceous.dunes. Biopress-may be mixed with 321.
Indicator species:	Corynephorus canescens, Carex arenaria.
GHC (BioHab):	Caespitose hemicryptophytes / therophytes + scrub below30% + inland dunes + dry sandy soils + expert knowledge.
Field identification:	Probaly well defined but could intergrade with scrub.
Occurrence:	Rare and localised.
Direct threats:	Colonisation by scrub and tree planting.
Climate change:	Could put some species under pressure and change composition.
Succession:	Depends on isolation but coule be colonized by scrub-further information required.
Countries:	Belgium, Czech Republic, Denmark, Estonia, France, Germany, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**2340** - Pannonic inland dunes

Mapping rules:	Pannonian. Inland dunes. Related to 6260. Biopress –may be mixed with 321.
Indicator species:	Thymus serpyllum, Cerastrium semidecandrum, Spergularia morisonii, Alyssum montanum spp., Cynodon dactlylon.
GHC (BioHab):	-
Field	-

identification:	
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Bulgaria, Hungary, Romania, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies
Annex I:	**3110** - Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)
Mapping rules:	All zones except Mediterranean South acid soils but from the biogeographic reference list has probably been interpreted beyond sand plains.
Indicator species:	Isoetes lacustris, Isoetus echinospora, Lobelia dortmanna, Deschampsia setacea.
GHC (BioHab):	-
Field identification:	Straightforward for the vegetation. Association but the degree of extension makes it more difficult.
Occurrence:	The description also includes sparse reed beds and helophytic vegetation so the class probably covers more than the strict vegetation association which is quite specific.
Direct threats:	Drainage, eutrophication and nitrogen deposition.
Climate change:	Susceptible to drying out under higher temperatures.
Succession:	Colonisation status: Helophytes / Emergent hydrophytes or Aquatic on drying will change rapidly to Ceaspitose hemicryptophytes / LKHE and then progressively into scrub categories.
Countries:	Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Russia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies
Annex I:	**3120** - Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean with Isoetes spp.
Mapping rules:	Lusitanian / MEDN below 1200m.
Indicator species:	Isoetes velata, Isoetes setacea, Serapias spp..
GHC (BioHab):	-
Field identification:	-

Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	France, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies											
Annex I:	**3130** - Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea											
Mapping rules:	Alpine South / Boreal below 300m Nemoral / Atlantic Central / Atlantic North below 400m Continental / Alpine South / Pannonian below 1000m, Mediterranean mountains over 700m. 3140 Alpine North / Boreal / Nemoral below 300m Atlantic Central / Atlantic North below 400m Continental / Pannonian / Alpine South below 700m.											
Indicator species:	Littorella uniflora, Pilularia globulifera, Juncus bulbosus ssp. Bulbosus, Sparganium minimum.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.											
Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies
Annex I:	**3150** - Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation
Mapping rules:	Alpine North / Boreal / Nemoral / Atlantic North / Atlantic Central below 300m Alpine South / Continental below 700m Mediterranean mountains 400-1500m.
Indicator species:	Hydrocharis morsus-ranae, Utricularia australis.
GHC (BioHab):	-
Field identification:	-

Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies
Annex I:	**3160** - Natural dystrophic lakes and ponds

Mapping rules:	Alpine North / Boreal / Nemoral below 400m Atlantic North / Atlantic Central below 500m Alpine South / Continental below 700m.
Indicator species:	Utricularia minor, Rhynchospora alba, Nuphar lutea, Nuphar pumila, Nymphaea candida.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**512** - Water bodies
Annex I:	**3170** - Mediterranean temporary ponds

Mapping rules:	Mediterranean mountains / Mediterranean North below 600m Mediterranean South below 1000m.
Indicator species:	-
GHC (BioHab):	-
Field identification:	-
Occurrence:	-

Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	France, Greece, Italy, Malta, Portugal, Spain, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **512** - Water bodies

Annex I: **3180** - Turloughs

Mapping rules:	Atlantic Central below 200m.											
Indicator species:	-											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Estonia, Germany, Ireland, Slovenia, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **512** - Water bodies

Annex I: **3190** - Lakes of gypsum karst

Mapping rules:	Mediterranean mountains / Mediterranean North below 600m Mediterranean South below100m. Gypsum soils.
Indicator species:	-
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Latvia, Lithuania.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **512** - Water bodies
Annex I: **31A0** - Transylvanian hot-spring lotus beds

Mapping rules: Petea lake Romania only.
Indicator species: -
GHC (BioHab): -
Field identification: -
Occurrence: -
Direct threats: -
Climate change: -
Succession: -
Countries: Romania.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **511** - Water courses
Annex I: **3210** - Fennoscandian natural rivers

Mapping rules: Boreal / Nemoral.
Digital outline of large rivers plus buffer of 100m.
Abundant where present.
Indicator species: -
GHC (BioHab): -
Field identification: -
Occurrence: -
Direct threats: -
Climate change: -
Succession: -
Countries: Finland, Norway, Sweden.

Distribution (sites):	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**511** - Water courses
Annex I:	**3220** - Alpine rivers and the herbaceous vegetation along their banks
Mapping rules:	Alpine North / Boreal over 700m maybe with outliers lower down Alpine South / Continental 1000-3000m. Lines of rivers only, only so could use physiographic map to indicate abundance.
Indicator species:	-
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Finland, France, Germany, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

Distribution (sites):	**ALN**	**BOR**	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**511** - Water courses
Annex I:	**3230** - Alpine rivers and their ligneous vegetation with Myricaria germanica
Mapping rules:	As 3220 but with distribution of Myricaria-could make them mutually exclusive.
Indicator species:	Myricaria germanica, Salix daphnoides, Salix nigricans.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Czech Republic, Finland, France, Germany, Italy, Poland, Romania, Slovakia, Slovenia, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**511** - Water courses

Annex I:	**3240** - Alpine rivers and their ligneous vegetation with Salix elaeagnos
Mapping rules:	As 3220 but with distribution of Salix elaeagnos and other shrubby but not dwarf Salix species.
Indicator species:	Salix elaeagnos, Salix purpurea ssp. Gracilis.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, France, Germany, Greece, Italy, Poland, Romania, Slovakia, Slovenia, Spain.
Distribution (sites):	*aln* *bor* *nem* *atn* **ALS** **CON** *atc* *pan* **LUS** **MDM** **MDN** *mds*
Distribution (Bunce):	*aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC:	**511** - Water courses
Annex I:	**3250** - Constantly flowing Mediterranean rivers with Glaucium flavum
Mapping rules:	As 3220 with distribution of Glaucium flavum.
Indicator species:	Myricaria germanica, Glaucium flavum.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	France, Greece, Italy, Portugal, Spain.
Distribution (sites):	*aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* **MDM** **MDN** **MDS**
Distribution (Bunce):	*aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC:	**511** - Water courses
Annex I:	**3260** - Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
Mapping rules:	Alpine North / Boreal / Nemoral below 600m Atlantic Central / Atlantic North / Lusitanian below 800m Continental / Pannonian / Alpine South below1200 m Mediterranean mountains all Mediterranean North

	over 200 m Mediterranean South over 400 m. Lines of rivers could be used but this class is likely to be rare especially in the Mediterranean. Calcareous rocks would also be used but may be overridden by local conditions.
Indicator species:	Ranunculus fluitans, Ranunculus aquatilis, Callitriche spp. Zannichellia palustris.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**511** - Water courses
Annex I:	**3270** - Rivers with muddy banks with Chenopodion rubri p.p.and Bidention p.p. vegetation
Mapping rules:	Alpine North / Boreal / Nemoral below 600m Atlantic Central / Atlantic North / Lusitanian below 800m Continental / Pannonian / Alpine South below1200 Mediterranean mountains all Mediterranean North over 200 m Mediterranean South over 400 m. Lines of rivers could be used but this class is likely to be rare especially in the Mediterranean. Calcareous rocks would also be used but may be overridden by local conditions. As 3260 but with larger rivers.
Indicator species:	Chenopodium rubrum, Bidens frondosa, Polygonum lapathifolium.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**511** - Water courses

Annex I:	**3280** - Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba
Mapping rules:	Mediterranean North / Mediterranean South all. Populus alba plus large rivers.
Indicator species:	Paspalum paspaloides, Cyperus fuscus.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	France, Greece, Italy, Portugal, Romania, Spain.
Distribution (sites):	*aln bor nem atn als con atc pan lus* **MDM MDN MDS**
Distribution (Bunce):	*aln bor nem atn als con atc pan lus mdm mdn mds*

CLC:	**511** - Water courses
Annex I:	**3290** - Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion
Mapping rules:	Mediterranean mountains below 700m Mediterranean North / Mediterranean South all but only indicative as it is likely to have a sporadic distribution.
Indicator species:	Polygonum amphibium, Ranuncilus fluitans, Potamogeton natans.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	France, Greece, Italy, Portugal, Spain.
Distribution (sites):	*aln bor nem atn als con atc pan lus* **MDM MDN MDS**
Distribution (Bunce):	*aln bor nem atn als con atc pan lus mdm mdn mds*

CLC:	**322** - Moors and heath lands
Annex I:	**4020** - Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix
Mapping rules:	Atlantic Central all within 80 km of coast, Lusitanian below 800 m. Podsols / peaty gleys.

Indicator species:	Erica ciliaris, Ulex minor var. lusitanicus.
GHC (BioHab):	Shrubby chamaephytes / Evergreen + wet peat soils + jey indicators + expert knowledge.
Field identification:	Quite straightforward if Erica ciliaris is the main indicator.
Occurrence:	Probably fragmented but locally common.
Direct threats:	Abandonment, overgrazing, drainage, fertilization.
Climate change:	In the south of its range may be influenced by higher temperatures casing drying out. In the north could expand but unlikely as suitable sites unlikely to be available.
Succession:	Colonisation: status Shrubby chamaephytes Low phanerophytes 10, Mid phanerophytes 10 Tall phanerophytes 10 Forest phanerophytes 15 dependent upon exposure and soil wetness where the process will be slower.
Countries:	France, Portugal, Spain, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	*mds*

CLC:	**322** - Moors and heath lands
Annex I:	**4030** - European dry heaths

Mapping rules:	Alpine North / Boreal below 700 m Nemoral / Continental / Atlantic Central all Atlantic North below 500m Alpine South over 1500 m Mediterranean mountains over 1800 m below 700m Lusitanian below 800 m.
Indicator species:	Caluna vulgaris, Genista anglica, Erica cinerea.
GHC (BioHab):	Low phanerophytes / Evergreen or Shrubby chamaephytes / Evergreen + moist acid soils + wide range of conditions + better definition.
Field identification:	A broad category including many classes that is likely to be open to a wide range of regional interpretations. The use of the term xerophile in the description does not fit well with the associations listed.
Occurrence:	Some extensive areas covering whole landscapes.
Direct threats:	Overgrazing, burning (which may maintain the class) fertilization / ploughing, nitrogen deposition.
Climate change:	Impact likely to be highly variable because of the wide range of conditions covered but soil type may restrict changes to the proportions of species present rather than major shifts.
Succession:	Colonisation: status Shrubby chamaephytes / Low phanerophytes depending on altitude ,grazing pressure exposure and burning all of which are likely to affect colonization. Many exposed high altitude locations may go no further than Low phanerophytes or Mid phanerophytes. Otherwise Mid phanerophytes 10 Tall phanerophytes 10 Forest phanerophytes 15.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*

CLC:	**322** - Moors and heath lands
Annex I:	**4040** - Dry Atlantic coastal heaths with Erica vagans

Mapping rules:	Lusitanian / Atlantic Central within 20 km of coast. Podsols.											
Indicator species:	Erica vagans, Ulex europaeus.											
GHC (BioHab):	SCeaspitose hemicryptophytes / Evergreen + moist acid soils + Erica vagens and other indicators.											
Field identification:	One association only so no problems.											
Occurrence:	Probably small + fragmented.											
Direct threats:	Drainage fertilization but not usually grazed.											
Climate change:	As for 4030.											
Succession:	Colonisation status: Shrubby chamaephytes Low phanerophytes 10 if Ulex present which can result in a terminated succession otherwise more slowly Mid phanerophytes 10 and dependent upon seed sources potentially and finally Tall phanerophytes 10 but probably not to Forest phanerophytes.											
Countries:	France, Spain, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*

CLC: **322** - Moors and heath lands
Annex I: **4050** - Endemic macaronesian heaths

Mapping rules:	Macaronesia only.											
Indicator species:	Daboecia azorica, Erica arborea, Teline canarienis.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	Not included.											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **322** - Moors and heath lands
Annex I: **4060** - Alpine and Boreal heaths

Mapping rules:	Alpine North / Boreal over 800m Atlantic North over 900 m small patches on exposed coastal areas in the north) Alpine South over 1800 m.

	No soils as highly variable, although skeletal soils eg rankers predominate.
Indicator species:	-
GHC (BioHab):	Shrubby chamaephytes / Evergreen but locally Dwarf chamaephytes / Evergreen / Winter deciduous + Moist acid soils + upto 30% bare ground / rocks + key indicators. Also Low phanerophytes / Conifers Mid phanerophytes / Evergreen.
Field identification:	Although highly variable because this class has a well recognisable landscape context and consistent life form structure it will probably be readily identified.
Occurrence:	Occurs in large areas in the centre of its range – small patches on edge.
Direct threats:	At low altitudes overgrazing locally although in some areas grazing may have halted scrub invasion. decline in grazing can therefore lead to quite rapid changes. Reindeer grazing can cause erosion in Scandinavia.
Climate change:	The increased temperatures likely in many of these mountains will favour scrub expansion at lower levels as shown by Kienast. However the class may well be able to move higher except where it is caused by extreme exposure.
Succession:	Colonisation: status Shrubby chamaephytes or L PH or even Mid phanerophytes in some situations. May remain as Shrubby chamaephytes in extreme situations and especially in the Scandinavian mountains at mid altitudes Low phanerophytes to Mid phanerophytes 10 and Tall phanerophytes 15 at low altitudes Low phanerophytes to Mid phanerophytes 10 Tall phanerophytes 15 possibly Forest phanerophytes 20.
Countries:	Austria, Bulgaria, Czech Republic, Finland, France, Germany, Greece, Ireland, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**322** - Moors and heath lands
Annex I:	**4070** - Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)

Mapping rules:	Alpine South over 1800 m plus distribution of Pinus mugo.
Indicator species:	Pinus mugo, Rhodendendron chamaecistus, Rhodondendron hirsutum.
GHC (BioHab):	Mid phanerophytes / Evergreen / Conifers + moist acid soils + montane situation + indicators.
Field identification:	:straightforward if a minimal cover of 30% is assumed.
Occurrence:	Often in large units but loccaly in small patches.
Direct threats:	Burning and clearance for grazing.
Climate change:	Likely to expand upwards with higher temperatures.
Succession:	Colonisation: climax in most cases.
Countries:	Austria, Bulgaria, Czech Republic, France, Germany, Italy, Poland, Romania, Slovakia, Slovenia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**322** - Moors and heath lands
Annex I:	**4080** - Sub-Arctic Salix spp. scrub

Mapping rules:	Alpine North over 1100m Atlantic North over 900 m Boreal over 1000m Alpine South over 1800m.
Indicator species:	Salix lapponum, Salix myrsinites.
GHC (BioHab):	Dwarf chamaephytes / Winter deciduous or Shrubby chamaephytes / Winter deciduous locally Low phanerophytes / Winter deciduous + moist acid soils + exposed mountain situations + Salix species.
Field identification:	Present in well defined mountain environments with a readily recognized structure.
Occurrence:	In the centre of its range can dominate landscapes – elsewhere more restricted.
Direct threats:	Mostly above the gazing level except for reindeer which can have a major impact.
Climate change:	Higher temperatures may encourage other scrub species to invade at lower altitudes and at higher levels earlier snow melt may encourage its expansion upwards.
Succession:	Colonisation: status: mostly Low phanerophytes but sometimes Shrubby chamaephytes-climax under present conditions so unlikely to change.
Countries:	Bulgaria, Czech Republic, Finland, France, Italy, Poland, Romania, Slovakia, Sweden, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **322** - Moors and heath lands

Annex I: **4090** - Endemic oro-Mediterranean heaths with gorse

Mapping rules:	Lusitanian 700 m-1200 m, Mediterranean mountains over 600m , Mediterranean South over 1500 m Alpine South Pyrenees / Cantabria only 800 m-1500 m.
Indicator species:	-
GHC (BioHab):	-Low phanerophytes / Non-leafy evergreens or Low phanerophytes / Evergreen locally on exposed situations Shrubby chamaephytes + rocky soils + hedgehog heaths + indicators + local knowledge.
Field identification:	Includes a wide range of types with local knowledge likely to be important in getting uniform descriptions.
Occurrence:	Originally potential confusion with spiny cushions.
Direct threats:	May well be climax in many situations or caused by over-grazing in others. Even so the Burning or cutting for grazing could be important in some areas that have less extreme climates.
Climate change:	Many areas of this class are likely to experience greatly increased temperatures but their response is unpredictable without detailed local knowledge.
Succession:	Shrubby chamaephytes / Low phanerophytes Summer deciduous and / or spiny cushion -probably stable maybe increasing in height if grazing stops. Depends also on the cover of spiny species-may just get denser.
Countries:	Bulgaria, France, Greece, Italy, Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	*mdm*	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)

Annex I: **40A0** - Subcontinental peri-Pannonic scrub

Mapping rules:	Pannonian below 900m Alpine South (Carpathians only) below 900 m.											
Indicator species:	-											
GHC (BioHab):	Low phanerophytes / Winter deciduous + xeric variable soils + in mosaics with Ceaspitose hemicryptophytes / Leafy hemicryptophytes + key species + expert knowledge.											
Field identification:	In one restricted region and a specific class therefore straightforward if 30% rule for scrub cover is used.											
Occurrence:	Probabbly small patches with integrades.											
Direct threats:	Unknown-more information needed but already adapted tom dry conditions.											
Climate change:	Could be favoured by more drought conditions.											
Succession:	Colonisation: status: Low phanerophytes / Winter deciduous possibly climax but has probably developed from grasslands 6210 and 6190 maybe after removal of grazing maybe moves to Mid phanerophytes and Tall phanerophytes but probably no further because of dryness.											
Countries:	Bulgaria, Czech Republic, Germany, Hungary, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)

Annex I: **5110** - Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)

Mapping rules:	Alpine South, south facing slopes below 800 m Mediterranean North 200-800m Continental warm south facing shallow soils but in small patches Mediterranean mountains probably only small patches best predicted by distribution of Buxus. Calcareous soils.											
Indicator species:	Buxus sempervirens, Prunus mahaleb.											
GHC (BioHab):	Mid phanerophytes / Evergreen + Tall phanerophytes / Evergreen + variable soils + Buxus + expert knowledge, with some Mid phanerophytes / Winter deciduous.											
Field identification:	Probably clear if Buxus alone indicative.											
Occurrence:	Widespread locally.											
Direct threats:	Burning and clearance for grazing but unlikely because on steep slopes.											
Climate change:	Could lead to more fires and Buxus may be susceptible to hotter conditions as it is often in foothills.											
Succession:	Colonisation: status Mid phanerophytes / Tall phanerophytes Evergreen difficult to predict as it vis a succession phase towards Pinus or Quercus forests but from description unlikely to take place because on such shallow soils.											
Countries:	Belgium, France, Germany, Greece, Italy, Luxembourg, Portugal, Spain, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)

Annex I: **5120** - Mountain Cytisus purgans formations

Mapping rules:	Mediterranean mountains over 700 m Lusitanian 700-1500m. Skeletal soils.
Indicator species:	Cytisus purgans.
GHC (BioHab):	Low phanerophytes / Non-leafy evergreens or Mid phanerophytes / Non-leafy evergreens + shallow acidic soils + Mountain situations + Cutisus purgens + expert knowledge.
Field identification:	Straightforward with 30% rule for canopy cover.
Occurrence:	Locally occurs in large areas.
Direct threats:	Burning and clearance for agriculture or forestry.
Climate change:	Covers a wide range of altitudes so may be resistant to the likely increase in temperatures.
Succession:	Colonisation: status Low phanerophytes / Mid phanerophytes Non-leafy evergreens probably will develop no further as the stands are often very dense and the result of colonization of grassland following grazing recession. There is also often a lack of tree seed .
Countries:	France, Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	*mdm*	*mdn*	*mds*

CLC:	**323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)
Annex I:	**5130** - Juniperus communis formations on heaths or calcareous grasslands

Mapping rules:	Includes a wide range of conditions and the distribution of Juniperus communis and the suggested zones below could indicate its likely extent. Alpine North below 500m Atlantic North below 400m Boreal below 500m Nemoral / Atlantic Central / Pannonian all Continental / Lusitanian / Alpine South below 800 m Mediterranean North 500-1000m Mediterranean mountains over 800 m. Threats: clearance for agriculture.
Indicator species:	Juniperus communis.
GHC (BioHab):	Low phanerophytes / Conifers or Mid phanerophytes / Conifers + moist acid calcareous soils + Juniperus + local knowledge.
Field identification:	Straightforward with 30% cover of Juniperus / but integrades with grasslands.
Occurrence:	Locally common but not usually in large areas.
Direct threats:	Burning clearance for grazing.
Climate change:	Covers a wide range and can probably adapt although species composition may change with increased drought which could also encourage fire.
Succession:	Colonisation: status: Low phanerophytes / Mid phanerophytes / depending upon length of establishment- likely to move to Tall or Forest phanerophytes with composition depending on local conditions.
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)
Annex I: **5140** - Cistus palhinhae formations on maritime wet heaths

Mapping rules:	Cistus palinhae only in Mediterranean North S. Portugal and 5km from coast.											
Indicator species:	Cistus palhinhae.											
GHC (BioHab):	Shrubby chamaephytes / Evergreen + moist acid soils + Cistus palinlae + endemics.											
Field identification:	Very restricted to one area. So probably clear if Cistus is indicator.											
Occurrence:	Localised probably fragmented.											
Direct threats:	Urbanisation, fire.											
Climate change:	Could effect the endemics through drier soils.											
Succession:	Probably in exposed areas therefore limited.											
Countries:	Portugal.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)
Annex I: **5210** - Arborescent matorral with Juniperus spp.

Mapping rules:	Mediterranean mountains below 500m Mediterranean North below 800m Mediterranean South all.											
Indicator species:	Juniperus oxycedrus, J. phoenicea, J. exelsea.											
GHC (BioHab):	Mid phanerophytes / Conifers or Tall phanerophytes / Conifers + dry or xeric soils + Juniperus species + expert knowledge.											
Field identification:	Difficult because of the likely varying proportions of Juniperus species would have to be determined and communis is included overlapping with 5130 in MDM and MDN.											
Occurrence:	Some large units in favourable locations.											
Direct threats:	Fire and increased grazing the latter unlikely at present.											
Climate change:	Likely to increase the chance of fire.											
Succession:	Colonisation status: Mid phanerophytes / Tall phanerophytes depending on species and age. Likely to be climax in many situations otherwise shift to Forest phanerophytes Evergreen.											
Countries:	Bulgaria, France, Greece, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*

CLC: **323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)
Annex I: **5230** - Arborescent matorral with Laurus nobilis

Mapping Lusitanian / Medit. South + distribution of Laurus nobilis, otherwise badly defined.

rules:											
Indicator species:	Laurus nobilis, Quercus ilex.										
GHC (BioHab):	Mid phanerophytes / Tall phanerophytes / Evergreen + Laurus nobilis + further expert knowledge.										
Field identification:	More information required.										
Occurrence:	More information required.										
Direct threats:	-										
Climate change:	-										
Succession:	-										
Countries:	Greece, Italy, Malta, Portugal, Spain.										
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6110** - Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi

Mapping rules:	May not appear as grassland as it has many herbs but also because it occurs in small patches below the 25 ha unit. skeletal calcareous soils. Boreal / Nemoral below 100m Alpine South / Continental below300m.											
Indicator species:	Alyssum alyssoides, Hornungia petraea.											
GHC (BioHab):	Therophytes / Succulent chamaephytes + bare sand + dry calcareous soils + expert knowledge + indicator speceis.											
Field identification:	Specialized and local therefore recognisable.											
Occurrence:	Probably in small patches, could be common locally.											
Direct threats:	Colonization by shrubs.											
Climate change:	More xeric conditions will restrict colonization but unlikely to expand because other adjacent vegetation is likely to be with high cover.											
Succession:	Colonisation: Therophytes / Succulent chamaephytes-to Ceaspitose hemicryptophytes -10 years, Shrubby chamaephytes 10 years Low phanerophytes 5-10 years Mid phanerophytes 5-10 years Tall phanerophytes 5 years but probably not into Forest phanerophytes because of shallow dry soils.											
Countries:	Austria, Belgium, Bulgaria, Czech Republic, France, Germany, Greece, Hungary, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6120** - Xeric sand calcareous grasslands

Mapping rules:	Calcareous and sandy soils. Same altitude bands as 6110.

Indicator species:	Alyssum montanum ssp germelinii, Astragalus arenarius, Dianthus deltoides, Gypsophila fastigiata, Helichrysum arenarium, Koelerion glauca.											
GHC (BioHab):	Leafy hemicryptophytes / Therophytes + bare sand + dry neutral / calcareous + expert knowledge + indicator species.											
Field identification:	Specialised and very local.											
Occurrence:	Probably small patches. Probably rare.											
Direct threats:	Colonisation by shrubs / irrigation for agriculture.											
Climate change:	Would favour more xeic species.											
Succession:	Colonisation as 6110.											
Countries:	Belgium, Denmark, France, Germany, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Slovakia, Sweden.											
Distribution (sites):	*aln*	*bor*	**NEM**	*atn*	*als*	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6130** - Calaminarian grasslands of the Violetalia calaminariae

Mapping rules:	Likely to be present along linear or in point features specifically related to heavy metals and therefore probably not predictable except from expert knowledge or probabilities within certain regions.											
Indicator species:	Viola calamineria, Thlaspi caeulescens, Cochleria alpina, Festuca ovina, Minuartia verna.											
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + heavy metal ridge soils _ + indicator species + expert knowledge.											
Field identification:	A site specific class which should be readily recognised.											
Occurrence:	In small patches, very localized.											
Direct threats:	Taller scrub development unlikely because of the high toxic levels but low shrubs possible.											
Climate change:	Prbably limited impact.											
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Shrubby chamaephytes 10 and probably no further.											
Countries:	Austria, Belgium, France, Germany, Ireland, Italy, Netherlands, Slovenia, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6140** - Siliceous Pyrenean Festuca eskia grasslands

Mapping rules:	Pyrenees and Cantabrian mountains (from local knowledge, not in description). Over 1000 m but check Festuca eskia distribution in the Flora Europea.
Indicator species:	Festuca eskia, Arnica montana, Ranunculus pyrenaeus.

GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + acid soils + over 1000m + indicator species + local knowledge.
Field identification:	Clear if Festuca eskia is the only indicator but needs checking with local experts.
Occurrence:	-
Direct threats:	Decline in grazing pressure and spread of Genista and Cytisus species.
Climate change:	Probably stable as on north facing slopes but could be more susceptible to shrub invasion.
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Ceaspitose hemicryptophytes 10 years Shrubby chamaephytes 5-10 years dependent on altitude Low phanerophytes 5 Mid phanerophytes 5 but probably no further as halted succession. due to altitude.
Countries:	France, Spain.
Distribution (sites):	*aln* *bor* *nem* *atn* **ALS** *con* *atc* *pan* *lus* *mdm* *mdn* *mds*
Distribution (Bunce):	*aln* *bor* *nem* *atn* **ALS** *con* *atc* *pan* **LUS** *mdm* *mdn* *mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6150** - Siliceous alpine and boreal grasslands
Mapping rules:	Acid rocks / soils. Look at adjacency of 332 and 333. Alpine South over 1500m. / Alpine north / Boreal over 700m, Atlantic North over 900m.
Indicator species:	Juncus trifidus, Carex bigelowii.
GHC (BioHab):	Ceaspitose hemicryptophytes / Cryptogames + some dwarf chamaephytes + shallow acidic soils + mud bare rock + indicator species.
Field identification:	Needs instructions to separate from related vegetation, but reasily identifiable.
Occurrence:	Except in Atlantic North occurs in large units above the critical altitude.
Direct threats:	Overgrazing.
Climate change:	Will allow tree / shrub growth to higher altitudes.
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Cryptogames –Dwarf chamaephytes 5-10 years Shrubby chamaephytes 5-10 years maybe to Low phanerophytes5-10 years.
Countries:	Austria, Bulgaria, Czech Republic, Finland, France, Germany, Italy, Poland, Romania, Slovakia, Slovenia, Sweden, United Kingdom.
Distribution (sites):	**ALN** **BOR** *nem* **ATN** **ALS** **CON** *atc* *pan* *lus* *mdm* *mdn* *mds*
Distribution (Bunce):	**ALN** **BOR** *nem* **ATN** **ALS** **CON** *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6160** - Oro-Iberian Festuca indigesta grasslands
Mapping rules:	Acid soils / rocks. Lusitanian / Mediterranean mountains over1800 m. / Alpine South (Pyrenees only over 1800m). Look up distribution of Festuca indigesta.

Indicator species:	Festuca indigesta.
GHC (BioHab):	Ceaspitose hemicryptophytes + expert knowledge + species indicators + Festuca indigesta.
Field identification:	Needs further information.
Occurrence:	Needs further information.
Direct threats:	Probably dependent on grazing but further information required from the literature.
Climate change:	Further information needed on character.
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Leafy hemicryptophytes if not grazed .Probably slow scrub expansion and limited development because of altitude and exposure. Shrubby chamaephytes 10 Low phanerophytes 15.
Countries:	Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6170** - Alpine and subalpine calcareous grasslands

Mapping rules:	Calcareous soils / rocks probably mainly skeletal but also deeper soils given in the description. Alpine North / Boreal over 700m, Atlantic North over 800m, Lusitanian / Mediterranean mountains over 2000m, Alpine South / Continental over1000m.
Indicator species:	Dryas octopetala, Gentiana nivalis, Draba aizoides.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + moist calcareous soils + open ground upto 3-% + montane situations + indicator species.
Field identification:	Contains many vegetation classes and experience probably needed for exact allocation.
Occurrence:	Occurs in large units in the centre of its distributions – small patches towards the edge.
Direct threats:	Decline or cessation in grazing. Rate of change determines rate of development.
Climate change:	May move higher but threatened at lower levels by increased tree / shrub growth.
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Ceaspitose hemicryptophytes if not grazed Shrubby chamaephytes 5-10 Low phanerophytes 5-10 Tall phanerophytes 5-10 but only with climate change otherwise only Low phanerophytes.
Countries:	Austria, Bulgaria, France, Germany, Greece, Italy, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	**ALN**	*bor*	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6180** - Macaronesian mesophile grasslands

Mapping rules:	Macaronesia only.
Indicator species:	Holcus rigidus, Festuca jubata, Cardamine caldeirarum, Dryopteris azorica.
GHC (BioHab):	No information required.
Field identification:	No information required.
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6190** - Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)

Mapping rules:	Rendzinas. Pannonian 150-900 m.
Indicator species:	-
GHC (BioHab):	Leafy hemicryptophytes / Ceaspitose hemicryptophytes + dry calcareous + rare and threatened Pannonic species + expert knowledge.
Field identification:	A specific vegetation type with precise definition.
Occurrence:	-
Direct threats:	Decline in grazing. Probably fragmented in small patches.
Climate change:	Could lead to expansion into mesic grasslands.
Succession:	Colonisation. Status Ceaspitose hemicryptophytes / Leafy hemicryptophytes without grazing Ceaspitose hemicryptophytes -Shrubby chamaephytes 10-15 dependent on dispersion of seed Low phanerophytes 5 Mid phanerophytes 5 maybe no further because of shallow soils.
Countries:	Czech Republic, Hungary, Romania, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6210** - Semi-natural dry grasslands and scrubland facies on calcareous substrates(Festuco-Brometalia) (* important orchid sites)

Mapping	Calcareous soils.

rules:	Boreal / Nemoral Below 200m Atlantic North below 300m All Atlantic Central Continental / Alpine South below 700m Mediterranean mountains below1400m.
Indicator species:	Arabis hirsuta, Dianthus carthusianorum, Ophrys apifera, Orchis mascula, Bromus erecta, Adonis vernalis.
GHC (BioHab):	Leafy hemicryptophytes / Ceaspitose hemicryptophytes + dry calcareous soils + indication.
Field identification:	Difficult as many vegetation associations are included-instructions as to local conditions therefore needed for regional surveyors. Also a definition of important orchid sites is required.
Occurrence:	Could be large patches locally but often fragmented.
Direct threats:	Decline in grazing.
Climate change:	Could expand into mesic grasslands on south facing slopes but rate likely to be slow because of closed swards.
Succession:	Colonisation. Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes to Ceaspitose hemicryptophytes 5 without grazing Shrubby chamaephytes 10 Low phanerophytes 5 Mid phanerophytes 5 Tall phanerophytes 10 Forest phanerophytes 10.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.
Distribution (sites):	*aln* **BOR** **NEM** **ATN** **ALS** **CON** **ATC** **PAN** **LUS** **MDM** **MDN** *mds*
Distribution (Bunce):	*aln* **BOR** **NEM** **ATN** *als* **CON** **ATC** **PAN** **LUS** **MDM** *mdn* *mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6220** - Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea

Mapping rules:	Although included in grasslands the signal could be confused with fallow and sparsely vegetated depending on the proportion of bare ground. Calcareous soils. Mediterranean mountains below 800 m Mediterranean North below1200m Mediterranean South below1600 m.
Indicator species:	Brachypodium distachym, Brachypodium retusum.
GHC (BioHab):	Ceaspitose hemicryptophytes / Therophytes + xeric + calcareous + critical species + expert knowledge.
Field identification:	Difficult because a range of vegetation types are included-further instructions required.
Occurrence:	Prbably rare and fragmented because specific local conditions required.
Direct threats:	This class probably depends on regular disturbance whether of heavy grazing or cultivation. Any changes in the status quo could lead to colonization or if more intense to more bare ground.
Climate change:	The probable drier conditions could lead to expansion into more stable grasslands.
Succession:	Colonisation. Depends on the start point and local factors such as xeric conditions and seed availability. Status is likely to be Ceaspitose hemicryptophytes / Therophytes .For total abandonment the rate could be:. Dry: Shrubby chamaephytes 10 Low phanerophytes 10 Mid phanerophytes 10 Tall phanerophytes20 Forest phanerophytes 10. Xeric Shrubby chamaephytes 15 Low phanerophytes 15 Mid phanerophytes 10 Tall phanerophytes 10.
Countries:	Bulgaria, France, Greece, Italy, Malta, Portugal, Spain.
Distribution (sites):	*aln* *bor* *nem* *atn* **ALS** *con* *atc* **PAN** **LUS** **MDM** **MDN** **MDS**

Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6230** - Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

Mapping rules: Making rules for this class is difficult because it depends on interpretation of the term species rich. If it is assumed that the extensive generally species poor Nardus grasslands of the Atlantic zone are included then it is widespread. More species rich grasslands with Nardus are rare in GB but are rather common at quite high elevations in the Alps. The comment in the text suggests that irreversibly degraded grasslands should be excluded which probably means many of those in GB. The rules below cover the whole range but mean that very different frequencies are likely to be involved.
Siliceous soils / rocks Alpine North / Boreal below 700m Nemoral / Atlantic Central all altitudes Atlantic North below 900 m, Continental / Alpine South / Pannonian over 700 m but under 2000m, Lusitanian over 1000 m, Mediterranean mountains over 1500 m.

Indicator species: Antennaria dioica, Galium saxatile.

GHC (BioHab): Ceaspitose hemicryptophytes / Leafy hemicryptophytes + moist neutral / acidic soils + Nardus + wide range of speceis.

Field identification: Depends on the definition of species rich but the associations are well defined.

Occurrence: Often occurs in large units in the centre of its range, smaller patches elsewhere.

Direct threats: Mostly maintained by grazing but some of the higher sites may be above the tree line.

Climate change: The class covers a high of altitude so probably robust although tree / shrub colonization at higher levels would be favoured if grazing declines. The proportion of montane species may also decline as more competitive species are likely to expand.

Succession: Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes- Nardus will expand with less grazing and will therefore change to Ceaspitose hemicryptophytes , further development depends on altitude, low altitudes will end up as Forest phanerophytes ,mid Tall phanerophytes high Shrubby chamaephytes.

Countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **6240** - Sub-pannonic steppic grasslands

Mapping rules: Pannonian and eastern Continental classes below 500 m clays / sands / gravels.
South facing.

Indicator species: Alyssum alyssoides, Astragalus austriacus, Iris humilis ssp. Arenaria, Stipa capillata.

GHC (BioHab): Ceaspitose hemicryptophytes / Leafy hemicryptophytes + xeric soils + variable soil structure + species + expert judgement.

Field identification: Straightforward because detailed description of a restricted vegetation type included.

Occurrence: Probably in small fragmented.

Direct threats:	Some are more or less climax others depend on grazing but probably mostly the former so limited threats except for fertilization.
Climate change:	Could expand under the likely drier conditions but adjacent land may be cultivated so expansion unlikely.
Succession:	Status: probably Ceaspitose hemicryptophytes / Leafy hemicryptophytes with a representation of Shrubby chamaephytes which may expand without any management but otherwise stable.
Countries:	Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Italy, Romania, Slovakia.
Distribution (sites):	*aln* *bor* *nem* *atn* **ALS** **CON** *atc* **PAN** *lus* *mdm* *mdn* *mds*
Distribution (Bunce):	*aln* *bor* *nem* *atn* *als* **CON** *atc* **PAN** *lus* *mdm* *mdn* *mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6250** - Pannonic loess steppic grasslands
Mapping rules:	Pannonian below 500 m. Loess soils.
Indicator species:	Artyemesia pontica, Ornithogalum pannonicum, Achillea pannonica.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + xeric loess soils + critical species + expert knowledge.
Field identification:	As 6240.
Occurrence:	Small fragmented units.
Direct threats:	Information on management needs to be checked.
Climate change:	Could expand into other grasslands but likely to be slow because of surrounding cultivated land.
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes may be susceptible to expansion of Shrubby chamaephytes and Low phanerophytes and eventually Mid phanerophytes but restricted by xeric conditions.
Countries:	Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovakia.
Distribution (sites):	*aln* *bor* *nem* *atn* *als* *con* *atc* **PAN** *lus* *mdm* *mdn* *mds*
Distribution (Bunce):	*aln* *bor* *nem* *atn* *als* *con* *atc* **PAN** *lus* *mdm* *mdn* *mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6260** - Pannonic sand steppes
Mapping rules:	Pannonian below 500 m but distribution given in France and Italy so maybe Continental or even Mediterranean North at low altitudes –literature needs to be checked. Sands / inland dunes?.
Indicator species:	Helychrysum arenarium, Dianthus serotinus, Alyssum montanum ssp. Gmelinii, Cynodon dactylon.
GHC (BioHab):	Leafy hemicryptophytes / Therophytes + xeric inland sands + critical species + expert knowledge.
Field identification:	Probably straightforward because it is restricted to a small area of sand.
Occurrence:	No information.

Direct threats:	May depend on disturbance but more likely to be an early stage in succession therefore seral development may be the main potential influence.											
Climate change:	Already very dry-may be kept open by increased drought.											
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes with some Shrubby chamaephytes which may expand slowly 15 and lead to Low phanerophytes afterranother10.											
Countries:	Austria, Bulgaria, Czech Republic, Hungary, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)											
Annex I:	**6270** - Fennoscandian lowland species-rich dry to mesic grasslands											
Mapping rules:	Boreal / Nemoral below 200 m. Siliceous soils.											
Indicator species:	Botrychium spp., Dianthus deltoides, Gentianella campestris, Primula veris.											
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + moist / dry acid soils + grazing / mowing + indicator species.											
Field identification:	Distribution probably well known locally and in medium sized units.											
Occurrence:	Restriced and now probably rare.											
Direct threats:	Decline in agriculture and grazing.											
Climate change:	Region has unpredictable changes therefore stable.											
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes-Ceaspitose hemicryptophytes 5 Shrubby chamaephytes-10 Low phanerophytes 10 Mid phanerophytes 5 Tall phanerophytes 5 Forest phanerophytes 10.											
Countries:	Estonia, Finland, Latvia, Sweden.											
Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6280** - Nordic alvar and precambrian calcareous flatrocks
Mapping rules:	Nemoral / Boreal below 200m and probably a coastal mask of 20 km. Pre-Cambrian / Silurian calcareous rocks.
Indicator species:	Asperula tinctoria, Potentilla tabernaemontani, Saxifraga tridactylites, Hornungia petraea.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + bare calcareous rocks + invading sands + expert judgement.
Field identification:	Well defined – could be considered as a landscape class as it is on one geomorphological situation.
Occurrence:	Locally dominant in large units.
Direct threats:	Seral development combined with lack of grazing.

Climate change:	Region has unpredictable changes therefore likely to have no effect.											
Succession:	Colonisation: status Leafy hemicryptophytes / Ceaspitose hemicryptophytes with patches of Therophytes Process could be Shrubby chamaephytes 10 Mid phanerophytes 10 Tall phanerophytes 10 Forest phanerophytes 10 but probably still with patches of Ceaspitose hemicryptophytes.											
Countries:	Estonia, Finland, Sweden.											
Distribution (sites):	*aln*	*bor*	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)											
Annex I:	**62A0** - Eastern sub-mediteranean dry grasslands (Scorzoneratalia villosae)											
Mapping rules:	Mediterranean North and Mediterranean South east of Italy to the Balkans below 300m.											
Indicator species:	-											
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + xeric + key species.											
Field identification:	Rather general description-needs more information.											
Occurrence:	No information.											
Direct threats:	Further literature search needed on character.											
Climate change:	A region with likely further extension of xeric conditions so could expand.											
Succession:	Colonisation: status Ceaspitose hemicryptophytes / Leafy hemicryptophytes but no information on management but unlikely to go beyond Low phanerophytes because of xeric conditions.											
Countries:	Bulgaria, Croatia, Greece, Italy, Slovenia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**62B0** - Serpentinophilous grassland of Cyprus
Mapping rules:	Only in Troodos mountains and Akamas peninsula,Cyprus. Serpentine soils. No other information but such vegetation on such soils is usually stable.
Indicator species:	-
GHC (BioHab):	-
Field identification:	More information needed.
Occurrence:	-
Direct threats:	-
Climate	-

change:												
Succession:	-											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**244** - Agro-forestry areas											
Annex I:	**6310** - Dehesas with evergreen Quercus spp.											
Mapping rules:	The description makes it clear that this class only occurs in the Iberian peninsula and also takes the strict definition of only evergreen Quercus species. In practice there has been problems because of the difference in interpretation between Spain and Portugal leading to confusion with sclerophyllous scrub. Therefore the rule is: Mediterranean mountains / Mediterranean North / Mediterranean South in the Iberian peninsula. There will be an altitudinal limit but that will not be needed as the class is mapped directly.											
Indicator species:	Quercus suber, Quercus ilex, Quercus rotundifolia.											
GHC (BioHab):	-											
Field identification:	Straightforward if the 30% cover is used together with evergreen oak species.											
Occurrence:	-											
Direct threats:	Lack of maintenance of tree pruning, removal of trees and conversion to arable / pasture farming without trees, abandonment of agriculture.											
Climate change:	In the south hotter summers are leading to the death of Quercus trees.											
Succession:	Colonisation status: invasion of scrub categories between the trees is often quite rapid following abandonment as small shrubs are often present . The trees often do not manage to regenerate as the matorral of Cistus spp. is too dense.											
Countries:	France, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6410** - Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)
Mapping rules:	Wet calcareous peaty clays but variability in soil type makes it difficult makes it difficult to predict and it is also likely to be found in small patches. Remove Alpine North classes 2 and but the rest of Alpine North under 300m Boreal below 300m Nemoral / Atlantic Central below 200m Continental below 300m.
Indicator species:	Molininia caerulea, Potentilla erecta.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + wet peaty / clay soils + Mainia + critical species.
Field identification:	A well known and defined class but separation from some related vegetation may be difficult.

Occurrence:	Now rare and dispersed patches.
Direct threats:	Abandonment. Drainage. Agricultural intensification.
Climate change:	Likely to be robust because of high soil moisture retention but could shift into drier types.
Succession:	Colonisation Leafy hemicryptophytes / Ceaspitose hemicryptophytes to Ceaspitose hemicryptophytes 5 Low phanerophytes 10 Mid phanerophytes 10 Tall phanerophytes 5 Forest phanerophytes 10.
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6420** - Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion
Mapping rules:	Wet soils but likely to be in small patches due to local conditions and therefore difficult to locate plus dunes on Black sea coast but likely to be in small patches. Mediterranean mountains / Mediterranean North below 500m Mediterranean South over 700m.
Indicator species:	Scirpus holoschoenus, Molinia caerulea, Orchis laxiflora.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes but dominated by grasses + moist neutral soils + critical species.
Field identification:	Likely to be clearly defined.
Occurrence:	Probably fragmented.
Direct threats:	Abandonment. Drainage. Fertilisation.
Climate change:	As it is in a region of likely increased temperatures it is threatened by drying out.
Succession:	Currents status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes –to Ceaspitose hemicryptophytes 5 years with no management Shrubby chamaephytes 10 Low phanerophytes 5 Mid phanerophytes 5 Tall phanerophytes 5 Forest phanerophytes 5.
Countries:	Bulgaria, France, Greece, Italy, Portugal, Romania, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6430** - Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
Mapping rules:	Very localized and usually occurring in narrow bands by major rivers or in small patches by smaller streams or on forest edges which are difficult to predict therefore the major rivers only are likely to be indicative of likely extent. Otherwise wet alluvial soils.

	Alpine North / Boreal below 500m Nemoral all, likely to be very rare and difficult to identify in Atlantic Central / Atlantic North, so omit, Pannonian below 500 m Continental / Alpine South seems to be sub-alpine therefore 800 m-1800 m m probably rare in Lusitanian too.
Indicator species:	-
GHC (BioHab):	Leafy hemicryptophytes + seasonally eutrophic wet alluvial soils + water courses + indicator species.
Field identification:	Roles need to separate from related vegetation types.
Occurrence:	Probably in restricted linear elements and patches streamsides.
Direct threats:	Probably variable in origin and needing further literature work but likely to be affected by drainage and tree / shrub colonization.
Climate change:	As it is adjacent to rivers and water courses will be stable.
Succession:	Status: Leafy hemicryptophytes-Shrubby chamaephytes 5-Low phanerophytes 5- Mid phanerophytes-5,Tall phanerophytes-5.Forest phanerophytes-5 because of high nutrients and moisture although the wetter soils may be slower.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6440** - Alluvial meadows of river valleys of the Cnidion dubii
Mapping rules:	Boreal / Nemoral below 300 m m Atlantic Central / Pannonian below 500 m m, probably 800 m-1400 m Alpine South / Continental but needs more information Also occurs in small patches on transitions so will be infrequent so the map will be indicative only. Brown earths.
Indicator species:	Cnidium dubium, Viola persicifolia.
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + wet seasonally flooded alluvial soils + river valleys.
Field identification:	Depends upon how many indicators need to be present – often degraded.
Occurrence:	Linear feature but now restricted.
Direct threats:	More information needed.
Climate change:	Probabbly robust as by major rivers.
Succession:	More information needed.
Countries:	Austria, Bulgaria, Czech Republic, France, Germany, Hungary, Poland, Romania, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)

Annex I:	**6460** - Peat grasslands of Troodos

Mapping rules:	Troodos mountains in Cyprus only. Peat soils.
Indicator species:	-
GHC (BioHab):	Ceaspitose hemicryptophytes + moist basic peat soil + indicator species + expert knowledge.
Field identification:	More information needed.
Occurrence:	More information needed.
Direct threats:	More information needed.
Climate change:	More information needed.
Succession:	Colonisation status Ceaspitose hemicryptophytes / Leafy hemicryptophytes but otherwise more information needed.
Countries:	

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6510** - Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)

Mapping rules:	Alpine North / Boreal-below 400 m, Nemoral / Atlantic Central all altitudes, Atlantic North below 250 m, Alpine South / Continental 700-900 m, Pannonian below 800m, Lusitanian below 1000m, Mediterranean mountains below 1400 m, Mediterranean North over 1000m. Brown earth soils.
Indicator species:	-
GHC (BioHab):	Ceaspitose hemicryptophytes / Leafy hemicryptophytes + moist neutral soils + lowland situations + indicators.
Field identification:	Problems with intergrades with degraded examples but well defined with good literature.
Occurrence:	Now fragmented in a few small fields widely dispersed.
Direct threats:	Largely destroyed by fertilizer and slurry application and silage cuts. Very sensitive to any changes but now unlikely to be abandoned except in Central Europe.
Climate change:	Likely to be minimal because on mesic sites although drying out could be a problem on steeper south facing slopes.
Succession:	Colonisation: Likely to depend on seed availability but following abandonment likely to be quite fast. Because of high soil fertility :status Ceaspitose hemicryptophytes / Leafy hemicryptophytes – Ceaspitose hemicryptophytes -5- Shrubby chamaephytes 10-Mid phanerophytes 10,-Tall phanerophytes-5,Forest phanerophytes 5.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**321 (231)** - Natural grasslands (Pastures)
Annex I:	**6520** - Mountain hay meadows

Mapping rules:	This class is included as a particularity of class 321 but its distribution needs to be examined. The inclusion of dwarf pines (particularity of class 322) and rock formations-class 333 could lead to confusions as no figures are given for the percentage required but “ forming a compact canopy probably means a high cover of pine whereas 333 is over 10% rock. :Boreal / Alpine North 400-700 m but probably now no longer harvested except in protected areas Alpine South / Continental 700-1200 m, Lusitanian 700-1000m Mediterranean mountains 800-1100.
Indicator species:	Trisetum flavescens, Astrantia major, Silene vulgaris, Trollius europaeus.
GHC (BioHab):	Ceaspitose hemicryptophytes?Leafy hemicryptophytes but high proportion of Leafy hemicryptophytes + moist neutral soils + upland situation + indicators.
Field identification:	Well described and widely understood. Brown earth soils.
Occurrence:	Widespread in Alpine South but scarce everywhere else.
Direct threats:	Abandonment of hay cutting but also aftermath grazing.
Climate change:	Could lead to increase in altitude but limited by suitable soils.
Succession:	Status: Ceaspitose hemicryptophytes / Leafy hemicryptophytes-Leafy hemicryptophytes 5-, Shrubby chamaephytes-10. Low phanerophytes-5, Mid phanerophytes -10, Tall phanerophytes-10 and maybe never to Forest phanerophytes except at lower altitudes. 6530- CLC 244 is intended to record this class but may well also include some other formations-details provided under that heading.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**412** - Peat bogs
Annex I:	**7110** - Active raised bogs

Mapping rules:	Atlantic Central / Atlantic North / Boreal / Nemoral below 300m.
Indicator species:	Andromeda polifolia, Vaccinium oxycoccos, Drosera anglica, Drosera intermedia.
GHC (BioHab):	Complexes of Cryptogames / Aquatic / Dwarf chamaephytes / Ceaspitose hemicryptophytes qualified with bog.
Field identification:	Difficult to separate from 7120 – Sphagnum dominated areas indicate quality habitat.
Occurrence:	Usually in discrete units but in the Atlantic zones difficult to separate from other bogs.
Direct threats:	Drainage, peat cutting.
Climate change:	Increases the rate of drying out and colonization by scrub and loss of Sphagnum species.
Succession:	Colonization by Low phanerophytes / Mid phanerophytes and eventually Tall phanerophytes. drying out and destruction of the bog surface.
Countries:	Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland,

	Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**412** - Peat bogs
Annex I:	**7120** - Degraded raised bogs still capable of natural regeneration
Mapping rules:	Atlantic Central / Atlantic North / Boreal / Nemoral below 300m.
Indicator species:	-
GHC (BioHab):	As 7110 but with less open water.
Field identification:	Lack of Sphagnum cover plus absence of dome structure and rand vegetation (scrub around the edge of the bog).
Occurrence:	-
Direct threats:	Conversion to agriculture through drainage and fertilizer.
Climate change:	Probably already drier than 7110, but further drying would lead to conversion to acid grassland.
Succession:	Progressive drying could lead to colonization by scrub and eventually forest Ceaspitose hemicryptophytes ==> Shrubby chamaephytes ==> Low phanerophytes ==> Mid phanerophytes ==>Tall phanerophytes==>Forest phanerophytes.
Countries:	Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Sweden, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**412** - Peat bogs
Annex I:	**7130** - Blanket bogs (* if active bog)
Mapping rules:	Atlantic Central / Atlantic North above 300m.
Indicator species:	Drosera rotundifolia, Eriophorum vaginatum, Empetrum nigrum, Rubus chamaemorus.
GHC (BioHab):	Leafy hemicryptophytes, but usually with under 30% Low phanerophytes / Evergreen.
Field identification:	Several key species enable identification notably Rubus chamaemorus and Eriophorum vaginatum.
Occurrence:	Large units where present.
Direct threats:	Overgrazing and conversion to agriculture; drainage.
Climate change:	Will lead to drying out and colonization by grasses.
Succession:	At low altitudes could be colonized by Low phanerophytes / Mid phanerophytes but only if climate change reduces the water saturation.

Countries:	France, Ireland, Spain, Sweden, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **412** - Peat bogs
Annex I: **7140** - Transition mires and quaking bogs

Mapping rules:	Probably the only way is to extract 7130 and 7110 and leave the remainder as 7140.											
Indicator species:	Scheuchzeria palustris(?), Carex rostrata, Menyanthes trifoliata.											
GHC (BioHab):	Very difficult to define without further work and specific site description.											
Field identification:	A difficult class with many intergrades with other bog classes. Further work needed to define this class adequately.											
Occurrence:	Large units were present. Specific site descriptions often available.											
Direct threats:	Drainage.											
Climate change:	Leads to drying out and conversion to grassland types.											
Succession:	Contains so many variations that it is impossible to generalize.											
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.											
Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **412** - Peat bogs
Annex I: **7150** - Depressions on peat substrates of the Rhynchosporion

Mapping rules:	Localized and at a small scale, only possible to use distribution of peat bogs with low probability. Usually present below 300 m.											
Indicator species:	-											
GHC (BioHab):	Ceaspitose hemicryptophytes / very acid / standing water / + key species.											
Field identification:	A well defined vegetation class with several specific indicators.											
Occurrence:	Small fragmented pattern in specific situation.											
Direct threats:	Drainage.											
Climate change:	High temperature will cause drying out.											
Succession:	Only if drainage and drying out takes place.											
Countries:	Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, United Kingdom.											
Distribution	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*

(sites):												
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**411** - Inland marshes
Annex I:	**7160** - Fennoscandian mineral-rich springs and springfens
Mapping rules:	Boreal / Nemoral very localized and small scale. Impossible to predict.
Indicator species:	-
GHC (BioHab):	Needs interpretation of relevant phytosociological associations.
Field identification:	Several specific associations but quite variable + depended upon phytosociological experience.
Occurrence:	Localized and fragmented associations.
Direct threats:	Drainage and eutrophication.
Climate change:	Drying out and invasion of non fennoscandian species.
Succession:	Build up of humus and colonization by Shrubby chamaephytes ->Mid phanerophytes->Tall phanerophytes->Forest phanerophytes.
Countries:	Estonia, Finland, Latvia, Lithuania, Sweden.

Distribution (sites):	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**411** - Inland marshes
Annex I:	**7210** - Calcareous fens with Cladium mariscus and species of the Caricion davallianae
Mapping rules:	Adjacent to water bodies but also wetlands – difficult to identify.
Indicator species:	Cladium mariscus, Schoenus nigrans, Salix repens.
GHC (BioHab):	Complexes of grassland and shrubs – needs examination.
Field identification:	Contains a range of associations – usually phytosociological associations to develop the key.
Occurrence:	Highly localized, usually fragmented.
Direct threats:	Drainage and conversion to agriculture.
Climate change:	Leads to drying out and trend towards grassland.
Succession:	Succession can be rapid, but depends on status of the vegetation. And is therefore difficult to generalize, but possibly Low phanerophytes ==>Mid phanerophytes==> Tall phanerophytes==>Forest phanerophytes.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution	*aln*	*bor*	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**

(sites):												
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **411** - Inland marshes

Annex I: **7220** - Petrifying springs with tufa formation (Cratoneurion)

Mapping rules:	Point features - not possible to predict.
Indicator species:	-
GHC (BioHab):	Ceaspitose hemicryptophytes / Cryptogames, highly calcareous and tufa present.
Field identification:	Specific character readily identified.
Occurrence:	Dispersed and fragmented but may be locally common on particular substrates.
Direct threats:	Drainage.
Climate change:	Leads to drying out.
Succession:	Only if drying out takes place.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **411** - Inland marshes

Annex I: **7230** - Alkaline fens

Mapping rules:	Alkaline peat soils / wet Alpine North / Boreal: below 200 m, Nemoral: all, Atlantic North: below 250m, Atlantic Central: all, Continental / Alpine South / Lusitanian: below 1500 m. (MED too rare to predict).
Indicator species:	-
GHC (BioHab):	Leafy hemicryptophytes / Cryptogames wet alkaline peat + expert knowledge from phytosociology.
Field identification:	Rich fens clearly defined. Problem is with transitions to poor fens.
Occurrence:	Quite often in small patches – only large units reliable.
Direct threats:	Drainage + conversion to agriculture.
Climate change:	Will cause drying out and shift to scrub.
Succession:	Ceaspitose hemicryptophytes / Cryptogames – Ceaspitose hemicryptophytes depending on drying out – Shrubby chamaephytes (5-10 y) ==> Low phanerophytes (5-10 Y) ==> Mid phanerophytes (5-10 Y) ==> Tall phanerophytes (5-10 Y). Probably no further because of high water level.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**411** - Inland marshes
Annex I:	**7240** - Alpine pioneer formations of Caricion bicoloris-atrofuscae

Mapping rules:	Acid / peats / sands, Alpine North / Boreal on 500m, Atlantic North on 900 m Continental / Alpine South on 2000 m.
Indicator species:	Carex atrofusa, Carex bicolor, Juncus triglumis.
GHC (BioHab):	Ceaspitose hemicryptophytes / wet / acid + phytosociological units + solifluction terraces.
Field identification:	Readily identifiable, except small transitional patches will be often present.
Occurrence:	In the centre of distribution occurs in large areas, but on the edge of e.g. Atlantic North (ATN) only in small patches.
Direct threats:	See below under climate change, because grazing is minimal.
Climate change:	Probably changing due to decline in perma-frost and high temperatures.
Succession:	Only if temperatures rise and then strongly: Ceaspitose hemicryptophytes ==> Shrubby chamaephytes (10 Y) ==>Low phanerophytes (10 y) probably no further.
Countries:	Austria, Finland, France, Germany, Italy, Romania, Spain, Sweden, United Kingdom.

Distribution (sites):	**ALN**	*bor*	*nem*	**ATN**	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**412** - Peat bogs
Annex I:	**7310** - Aapa mires

Mapping rules:	Only Northern classes of Alpine North (Alpine North) and Boreal.
Indicator species:	Saxifraga hirculus.
GHC (BioHab):	Mosaics of Ceaspitose hemicryptophytes / Cryptogames / Shrubby chamaephytes / Aquatic.
Field identification:	Could be difficult to separate from 7320, depending on height of palsa mires labelled with bog code + guideline only in ALN / BOR classes.
Occurrence:	In large units.
Direct threats:	Drainage and afforestation.
Climate change:	Could lead to drying out and colonization by shrubs / trees.
Succession:	If drying + drainage : Low phanerophytes ==> Mid phanerophytes ==>Tall phanerophytes.
Countries:	Finland, Sweden.

Distribution (sites):	**ALN**	**BOR**	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

(Bunce):

CLC:	**412** - Peat bogs
Annex I:	**7320** - Palsa mires

Mapping rules:	Only Northern classes of Alpine North (Alpine North) and Boreal.											
Indicator species:	Eriophorum russeolum, Betula nana, Vaccinium microcarpum.											
GHC (BioHab):	Mosaic of Ceaspitose hemicryptophytes / Cryptogames / Shrubby chamaephytes / Aquatic labelled with bog code + guideline only in ALN / BOR northern classes + palsa mounds over 2 m.											
Field identification:	Could be difficult to separate from 7310 but OK if palsa-height over 2m is included.											
Occurrence:	In large units.											
Direct threats:	Unlikely to be threatened, except by climate change – see below.											
Climate change:	Loss of permafrost could lead to breakdown of palsa and conversion to other bog types.											
Succession:	Unlikely to be beyond Low phanerophytes or Mid phanerophytes even in the long term.											
Countries:	Finland, Sweden.											
Distribution (sites):	**ALN**	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8110** - Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsetalia ladani)

Mapping rules:	Alpine North (Alpine North) > 800 m, Atlantic North > 900 m, Continental / Alpine South > 2000 m + Acidic soils.											
Indicator species:	Androsacae alpina, Oxyria digyna, Saxifraga bryoides, Cryptogramma crispa, Anthyrium alpestre.											
GHC (BioHab):	Herbaceous chamaephytes or Ceaspitose hemicryptophytes or Ceaspitose hemicryptophytes / Leafy hemicryptophytes, Locally Leafy hemicryptophytes + acidic scree + may be areas < 30 m2.											
Field identification:	Quite well defined but could grade into other scree associations.											
Occurrence:	In the centre of the range in the Alps and Scandinavia widespread. On the edge of its range e.g., in ALN, fragmented in small patches.											
Direct threats:	See climate change.											
Climate change:	Would move upwards with climate change and disappear at lower levels.											
Succession:	Only by Shrubby chamaephytes / Low phanerophytes under climate change and with the slow.											
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Ireland, Italy, Poland, Romania, Slovakia, Spain, Sweden, United Kingdom.											
Distribution (sites):	**ALN**	**BOR**	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8120** - Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)

Mapping rules:	Alpine North (Alpine North) above 800 m, Atlantic North above 450 m, Continental / Alpine South above 2000 m.											
Indicator species:	Campanula cenisia, Saxifraga biflora, Thlaspi rotundifolium, Hutchinsia alpina, Galium villarsi.											
GHC (BioHab):	Leafy hemicryptophytes on Ceaspitose hemicryptophytes / Leafy hemicryptophytes or locally Leafy hemicryptophytes, but locally with some Herbaceous chamaephytes.											
Field identification:	Quite well defined although some units may have quite small amounts of bare rock.											
Occurrence:	In the centre of the range if Alps + Scandinavia may be extensive, elsewhere in small fragmented patches.											
Direct threats:	Colonization by shrubs.											
Climate change:	Could lead to increase in altitude and distinction at lower levels due to sands colonization.											
Succession:	Shrubby chamaephytes / Low phanerophytes under climate change. Rate varies according to soil depth and exposure.											
Countries:	Austria, Bulgaria, France, Germany, Ireland, Italy, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.											
Distribution (sites):	**ALN**	*bor*	*nem*	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8130** - Western Mediterranean and thermophilous screes

Mapping rules:	Continental / Alpine South 300 m-1200 m south facing, Mediterranean mountains / Mediterranean North above 500m + screes + calcareous.											
Indicator species:	-											
GHC (BioHab):	Leafy hemicryptophytes or Leafy hemicryptophytes / Ceaspitose hemicryptophytes.											
Field identification:	Contains many vegetation associations - therefore a complex class with a requirement for phytosociological guidance.											
Occurrence:	Could be some large areas but often small patches.											
Direct threats:	None foreseen, except see climate change.											
Climate change:	Could get too dry to support the current cover and shift to high temperature species.											
Succession:	Unlikely because high temperature and shallow soils.											
Countries:	Austria, France, Italy, Portugal, Spain, Switzerland.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8140** - Eastern Mediterranean screes

Mapping rules:	Mediterranean North / Mediterranean mountains above 500m + Greece only (but could also be elsewhere?).											
Indicator species:	Drypis spinosa, Ranunculus brevifolius, Senecio thapsoides, Arenaria serpentini.											
GHC (BioHab):	Leafy hemicryptophytes + screes + expert knowledge.											
Field identification:	Limited information available, but two vegetations units only.											
Occurrence:	Likely to be fragmented and in small localized patches.											
Direct threats:	None foreseen except climate change.											
Climate change:	Could get too dry to support the current flora and shift to more thermophylous species.											
Succession:	Unlikely because high temperature and shallow soils.											
Countries:	Greece.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **332 (333)** - Bare rocks (Sparsely vegetated areas)

Annex I: **8150** - Medio-European upland siliceous screes

Mapping rules:	Acid / calcareous rocks Alpine North / Boreal 600 m-1000m Atlantic North / Atlantic Central over 700m Continental / Alpine South 900-1500m.											
Indicator species:	Epilobium collinum, Galeopsis segetum, Cryptogramma crispa.											
GHC (BioHab):	-											
Field identification:	-											
Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Austria, Czech Republic, France, Germany, Hungary, Luxembourg, Poland, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **332 (333)** - Bare rocks (Sparsely vegetated areas)

Annex I: **8160** - Medio-European calcareous scree of hill and montane levels

Mapping rules:	Alpine South 400 m-2500 m. Continental 400 m-2500 m.
Indicator species:	Dryopteris robertiania, Rumex scutatus, Petasites paraduxus.

GHC (BioHab):	Leafy hemicryptophytes / Ceaspitose hemicryptophytes + calcareous scree + expert knowledge.
Field identification:	Limited information means that it will be difficult to separate from 8130 – further consultation needed.
Occurrence:	Likely to be fragmented and in small patches.
Direct threats:	None foreseen, except see below.
Climate change:	Increase temperatures could lead to shift to more thermophyllous types.
Succession:	Unlikely under present condition because of shallow soils.
Countries:	Austria, Belgium, Czech Republic, France, Germany, Hungary, Italy, Luxembourg, Poland, Romania, Slovakia, Slovenia, Switzerland.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8210** - Calcareous rocky slopes with chasmophytic vegetation

Mapping rules:	Mediterranean North / Alpine South below 800m. Mediterranean mountains / limestone roads.
Indicator species:	Ramonda myconi, Potentilla caulescentis, Cystopteris fragilis, Asplenium thrichomanes, Asplenium viride, Woodsia glabella.
GHC (BioHab):	Leafy hemicryptophytes or Leafy hemicryptophytes / Ceaspitose hemicryptophytes + Highly calcareous + high percentage of bare rocks.
Field identification:	Difficult because of the range of habitants overlap with limestone pavements / consult with experts.
Occurrence:	Likely to be fragmented and in small patches.
Direct threats:	Successional developments in lowlands, but none on steep cliffs.
Climate change:	Variable according to aspect and altitude.
Succession:	Variable but mainly stable, except limestone pavements where shifts to Shrubby chamaephytes Low phanerophytes Mid phanerophytes Tall phanerophytes and Forest phanerophytes would occur according local conditions.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8230** - Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii

Mapping rules:	As 8220.
Indicator species:	-

GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, Poland, Portugal, Romania, Slovakia, Spain, Sweden.

Distribution (sites):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8240** - Limestone pavements

Mapping rules:	Carboniferous limestone: Atlantic North may occur elsewhere but rare comparable karstic habitats occur in Mediterranean mountains / Alpine South / Mediterranean North and Mediterranean South at no specific altitudinal levels. 8310.Below ground-not relevant.
Indicator species:	Gymnocarpium robertianum, Dryopteris villarii.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Estonia, France, Ireland, Italy, Portugal, Slovenia, Sweden, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**332 (333)** - Bare rocks (Sparsely vegetated areas)
Annex I:	**8320** - Fields of lava and natural excavations

Mapping rules:	Adjacent to active volcanoes only.
Indicator species:	-
GHC (BioHab):	-

Field identification: -

Occurrence: -

Direct threats: -

Climate change: -

Succession: -

Countries: Greece, Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9010** - Western Taïga

Mapping rules: This class contains a wide range of variation and although the description in the manual implies that only old forests are included recently burnt areas are also covered. Also whilst some broadleaved trees may be preset consultation with general descriptions of taiga suggest that it is mainly coniferous and does not extend into the nemoral zone but is in the high mountains of Norway and Sweden. The rules therefore define where the class can potentially occur but whether an individual unit is actually priority habitat status is more difficult to determine.
Alpine North / Boreal (western sector)500-800 Boreal eastern sector throughout.(based on distribution map of the biome).

Indicator species: -

GHC (BioHab): Forest phanerophytes Conifers + Pinus and or Picea + dry acid soils + definition of old forest + local exoert knowledge.

Field identification: Difficult because it covers such a wide range of classes. Can only be done be biogeagraphic region together with old forest.

Occurrence: Widespread and dominant over large areas but also fragmented in places.

Direct threats: Fire windblow felling.

Climate change: Will favour dry species.

Succession: Climax.

Countries: Estonia, Finland, Latvia, Lithuania, Sweden.

Distribution (sites):	**ALN**	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9020** - Fennoscandian hemiboreal natural old broad-leaved deciduous forests (Quercus, Tilia, Acer, Fraxinus or Ulmus) rich in epiphytes

Mapping rules: Boreal below 500m Nemoral all + Brown earth soils + Presence of Ulmus and Quercus.

Indicator species: Anemone nemorosa, Dentaria bulbifera, Hepatica nobilis, Mercurialis perennis.

GHC Forest phanerophytes / Winter deciduous + mixtures of nQuercus / Tilia / Acer / Fraxinus and Ulmus +

(BioHab):	evidence of continuity bof forest cover + dead wood + epiphytes.
Field identification:	Priority status may depend on amount of dead wood otherwise restricted range of variation and well defined.
Occurrence:	Restricted and local.
Direct threats:	Felling.
Climate change:	Long lived trees in good conditions therefore limited impact.
Succession:	Climax.
Countries:	Estonia, Finland, Latvia, Lithuania, Sweden.

Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9030** - Natural forests of primary succession stages of landupheaval coast

Mapping rules:	10 km mask on the Baltic coast in Boreal / Nemoral. All CLC forest categories to be included .Consultation required as to the extent of the mask.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Winter deciduous + expert information.
Field identification:	Includes a combination of a specific geomorphological formation and range of forest types.
Occurrence:	Restricted to a specific geographical region.
Direct threats:	Felling, wind blow, conversion to conifers.
Climate change:	Probably stable.
Succession:	Balance between species may change but otherwise mature forest type.
Countries:	Finland, Sweden.

Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9040** - Nordic subalpine/subarctic forests with Betula pubescens ssp. Czerepanovii

Mapping rules:	Alpine North / Boreal (western sector) 400-800 Boreal eastern sector northern classes only.
Indicator species:	Betula pubescens ssp. czerepanovii, Empetrum hermaphroditum, Vaccinium myrtillus, Aconitum lycoctonum.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Betula pubescens ssp czerrpanovii over 70% + variable ground vegetation + expert knowledge.
Field identification:	Its occurrence depends on the Betula subspecies.
Occurrence:	Probably widespread but depends on how specific the class is to the subspecies of Betula.
Direct threats:	Windblow,caterpillar infestation, felling.

Climate change: Maybe expand north but be under pressure at southern edge of its range.
Succession: Climax.
Countries: Finland, Sweden.
Distribution (sites): **ALN** **BOR** *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*
Distribution (Bunce): **ALN** **BOR** *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **9050** - Fennoscandian herb-rich forests with Picea abies

Mapping rules: Brown soils Alpine North / Boreal below 300 Nemoral all + Picea abies.
Indicator species: Picea abies, Actaea spicata, Geranium sylvaticum, Paris quadrifolia, Matteuccia struthiopteris.
GHC (BioHab): Forest phanerophytes / Conifers maybe som Forest phanerophytes / Winter deciduous present Picea abies over30% + brown forest soils + rich ground flora.
Field identification: . Depends on identification of specific herbaceous assemblages but as the class is common probably not difficult.,several vegetation types present and problem with deciduous tree presence.
Occurrence: Widespread covering large areas.
Direct threats: , Windblow,felling.
Climate change: Minimal.
Succession: Climax.
Countries: Estonia, Finland, Latvia, Lithuania, Sweden.
Distribution (sites): **ALN** **BOR** **NEM** *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*
Distribution (Bunce): **ALN** **BOR** **NEM** *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **9060** - Coniferous forests on, or connected to, glaciofluvial eskers

Mapping rules: Find if there is a map of eskers Boreal below 300 Nemoral all.
Indicator species: Antennaria dioeca, Pteridium aquilinum, Pinus sylvestris.
GHC (BioHab): Forest phanerophytes / Conifers maybe with some Forest phanerophytes / Winter deciduous + Pinus sylvestris 30-100 and or Picea abies 30-100 + moist freely drained neutral soils + rich herb layer + eastern species.
Field identification: Contains only two associations so is probably clear in conjunction with eskers.
Occurrence: Restricted to a specific geomorphological formation which is extensive in the lowlands of the zone.
Direct threats: Felling.
Climate change: Robust species composition therefore limited but mor eatern species possible.
Succession: Climax.

Countries:	Estonia, Finland, Latvia, Sweden.											
Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **321 (231)** - Natural grasslands (Pastures)

Annex I: **9070** - Fennoscandian wooded pastures

Mapping rules:	Brown soils + Alpine North / Boreal / Nemoral upto 700m.											
Indicator species:	-											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + ,mixtures of Fraxinus / Tilia / Betula with at least 30% cover Pinus and Picea may also be present + evidence od domestic stock grazing or former use.											
Field identification:	Most examples probably well known with a clear structure although now often in the process of change.											
Occurrence:	Scattered small units often now ungrazed - therefore difficult to detect-therefore regional distribution needs to be known.											
Direct threats:	Colonisation by Picea and Pinus, loss of grazing and conversion to forest structure.											
Climate change:	Probaly stable because of ling lived trees.											
Succession:	Canopy closure and shift to frest.											
Countries:	Estonia, Finland, Lithuania, Sweden.											
Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9080** - Fennoscandian deciduous swamp woods

Mapping rules:	Boreal below 300 Nemoral all + Wet peats.											
Indicator species:	Fraxinus excelsior, Alnus glutinosa, Alnus icana, Lycopus europaeus, Lysimachia thyrsiflora.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + more than 30% of Alnus,Betula or Salix + wet soils + eutrophic.											
Field identification:	Well defined restricted range of associations plus recognizable local conditions.											
Occurrence:	Probably locally covering large areas on suitable soils but otherwise small patches by rivers.											
Direct threats:	Drainage, canalisation of rivers.											
Climate change:	Likely to be buffered by presence of major rivers.											
Succession:	Climax unless change in local conditions.											
Countries:	Estonia, Finland, Latvia, Lithuania, Poland, Sweden.											
Distribution (sites):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution	**ALN**	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

(Bunce):

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9110** - Luzulo-Fagetum beech forests
Mapping rules:	Nemoral South Sweden only Atlant. Central / Continental below 200 Alpine South 300-1400 Medit. mountains 800-1500 but only in north + Acid brown earth soils + Distribution of Fagus.
Indicator species:	Fagus sylvatica, Luzula luzuloides, Pteridium aquilinum, Vaccinium myrtillus.
GHC (BioHab):	Forest phanerophytes / Winter deciduous more than 70% Fagus + moist acid soils + one association but probably extended to other types.
Field identification:	One recognisable association dependent on Luzula albida but probably now includes other acidic beech forests.
Occurrence:	Often present as large blocks of continuous forest.
Direct threats:	Felling, conversion to conifer.
Climate change:	Fagus could be affected by drought at edges of its range with sunbsequent shift to Quercus petraea in the long term.
Succession:	Climax over large areas.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9120** - Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)
Mapping rules:	Atlant. North southern classes only and within 100km of coast Atlant. Central within 100km of coast + Acid brown soils + Fagus.
Indicator species:	Fagus sylvatica, Ilex aquifolium (?), Taxus baccata, Deschampsia flexuosa, Pteridium aquilinum, Vaccinium myrtillus.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus over 70% + Ilex and or Taxus + most acid soils + local guidance.
Field identification:	Alright for vegetation scientists otherwise difficult to separate from 9110.
Occurrence:	Scattered and difficult to separate from 9110.
Direct threats:	Felling, conversion to conifer.
Climate change:	Drought would lead to gradual loss of fagus and shift vto Quercus.
Succession:	Climax.
Countries:	Belgium, Denmark, France, Germany, Lithuania, Luxembourg, Netherlands, Spain, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	*pan*	**LUS**	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9130** - Asperulo-Fagetum beech forests

Mapping rules:	Probably best to omit the western examples as they are fragmented and difficult to identify-the core distribution will be given by the following rules. Alpine South / Continental 400 m-1200 m Pannonian over 400 m. Basic / calcareous soils. Distribution of Fagus.
Indicator species:	Fagus sylvatica, Anemone nemorosa, Lamium galeobdolon, Dentaria spp..
GHC (BioHab):	-
Field identification:	Seems to cover a wide range of vegetation-could therefore be difficult to identify.
Occurrence:	Fragmented in the west but includes large patches in the centre of its distribution.
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Luxembourg, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, United Kingdom.

Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9140** - Medio-European subalpine beech woods with Acer and Rumex arifolius

Mapping rules:	Alpine South / Continental 700-1200.
Indicator species:	Fagus sylvatica, Acer pseudoplatanus, Rumex acrifolius.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus 30-70 + Acer psedoplatanus 30-70 + expert local knowledge.
Field identification:	Difficult to separate from 9130 and 9110 and limited descriptive information.
Occurrence:	Not enough information but probably restricted.
Direct threats:	Felling, conversion to conifer.
Climate change:	Inadequate information but could expand upwards.
Succession:	Climax.
Countries:	Austria, Czech Republic, France, Germany, Greece, Italy, Poland, Slovakia, Spain, Switzerland.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)

Annex I:	**9150** - Medio-European limestone beech forests of the Cephalanthero-Fagion											
Mapping rules:	Atlant. Central all Alpine South / Continental 400-1200 + Calcareous soils + Fagus.											
Indicator species:	Fagus sylvatica, Carex digita, Cephalantera spp., Neotttia nidus-avis.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus over 70% + shallow dry calcareous soils + steep slopes + ground flora species.											
Field identification:	A well defined category but grades into 9130.											
Occurrence:	Widespread in large patches but often replaced by Picea abies in the Alps.											
Direct threats:	Felling withy deeper soils conversion to conifer.											
Climate change:	Thermophilic species will be favoured.											
Succession:	Climax.											
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Lithuania, Luxembourg, Poland, Romania, Slovakia, Spain, Switzerland.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**9160** - Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli											
Mapping rules:	Atlant. Central all Continental below 800 Alpine North / Boreal too restricted to predict but look at possibility of species + Brown earth soils + Quercus robur (mainly but can also be petraea but not often) + Carpinus.											
Indicator species:	Quercus robur, Quercus petraea, Carpinus betulus, Stellaria holostea, Ranunculus nemorosus.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous Quercus petraea and or Quercus robur and Carpinus all 30-70% + moist neutral soils.											
Field identification:	Grades into other oak forests and can be on former beech forests.											
Occurrence:	Locally extensive and also widespread.											
Direct threats:	Felling, conversion to agriculture.											
Climate change:	Probably stable but long term changes in tree composition possible.											
Succession:	Climax.											
Countries:	Austria, Belgium, Denmark, France, Germany, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Spain, Sweden, United Kingdom.											
Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	**NEM**	*atn*	*als*	**CON**	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9170** - Galio-Carpinetum oak-hornbeam forests

Mapping rules:	Continental below 400 + Distribution of Quercus petraea and Carpinus.											
Indicator species:	Quercus petraea, Carpinus betulus, Sorbus torminalis, Convallaria majalis.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus petraea + Carpinus + Tilia all 30-70 % + dry neutral soils.											
Field identification:	One association only so should be clear although dominance of tree species could be variable.											
Occurrence:	Restricted but probably locally dominant.											
Direct threats:	Felling.											
Climate change:	Probably stable.											
Succession:	Climax.											
Countries:	Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Italy, Poland, Romania, Slovakia, Sweden.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	**ATC**	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**9180** - Tilio-Acerion forests of slopes, screes and ravines											
Mapping rules:	Alpine South 400-1200 Atlant. North below 200 Atlant. North / Boreal / Nemoral likely to be rare. Steep slopes-adjacent to scree in description but does not seem to fit British types + shallow soils.											
Indicator species:	Acer pseudoplatanus, Tilia cordata (?).											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + m Acer pseu + Tilia + Fraxinus all 30-70% + moist neutral soils + shallow rock soils + steep slopes.											
Field identification:	,Depends on local knowledge of the relevant associations.											
Occurrence:	Localised but difficult to assess because of high variability of situations.											
Direct threats:	Often protected by inaccessibility.											
Climate change:	Probably stable.											
Succession:	Climax.											
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.											
Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9190** - Old acidophilous oak woods with Quercus robur on sandy plains
Mapping rules:	Atlant. Central / Nemoral / Boreal / Continental + 100km from coast of Estonia to theNetherlands + Podzols + Quercus robur / Betula.

Indicator species:	Quercus robur.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous Quercus robur / Betula 30-70 % + old forests + Acid moist podzols.											
Field identification:	Well defined and one association.											
Occurrence:	Probably localized and not common.											
Direct threats:	Felling.											
Climate change:	Shift to Quercus petraea and drier herb layer species.											
Succession:	Climax.											
Countries:	Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, Lithuania, Netherlands, Poland, Slovakia, Sweden, United Kingdom.											
Distribution (sites):	*aln*	*bor*	**NEM**	**ATN**	*als*	**CON**	**ATC**	**PAN**	**LUS**	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	**BOR**	**NEM**	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **91A0** - Old sessile oak woods with Ilex and Blechnum in British Isles

Mapping rules:	Atlant. North / Atlant. Central 100 km from west coast of GB + Acid brown earths.											
Indicator species:	Ilex aquifolium, Arbutus unedo, Quercus petraea.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous Quercus petraea over 70% + old forests + moist acid soils + rich herb layer of mosses and ferns.											
Field identification:	Well defined.											
Occurrence:	Localized but cover large areas where present.											
Direct threats:	Overgrazing restricting regeneration,felling.											
Climate change:	Likely to affect the richness of the Atlantic moss flora. Successiuon Clima.											
Succession:	-											
Countries:	France, Ireland, United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **91B0** - Thermophilous Fraxinus angustifolia woods

Mapping rules:	Medit. North all Medit. mountains below 1200 Medit. South probably too rare to predict but check + + distribution of F.angustifolia.
Indicator species:	Fraxinus angustifolia, Quercus pubescens, Quercus pyrenaica.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fraxinus angustifolia over 70% + moist neutral soils + usually grazed by domestic stock.

	Occurremce. Localised usually small patches often linear.											
Field identification:	Well defined.											
Occurrence:	. Localised usually small patches often linear.											
Direct threats:	Felling conversion to agriculture.											
Climate change:	Susceptible to increased drought leading to loss of canopy.											
Succession:	Ground layer could change from grass to scrub if grazing abandoned.											
Countries:	France, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)											
Annex I:	**91C0** - Caledonian forest											
Mapping rules:	North of the Highland fault in Scotland only + native distribution of Pinus sylvestris.											
Indicator species:	Pinus sylvestris.											
GHC (BioHab):	Forest phanerophytes / Conifers + Pinus sylvestris over 30% + distribution literature.											
Field identification:	Straightforward.											
Occurrence:	A few large sites otherwise fragmented.											
Direct threats:	Felling but mostly protected.											
Climate change:	Will favour drier species.											
Succession:	Canopy will close if deer excluded otherwise climax.											
Countries:	United Kingdom.											
Distribution (sites):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	**ATN**	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**91D0** - Bog woodland
Mapping rules:	Should also include mixed forests- pure deciduous likely to be much less common and therefore exclude unless good soil information is available. Alpine North / Boreal / Nemoral probably exclude Atlant. Central / Atlant. North / Continental / Medit. mountains as rare and fragmented in these zones + Wet acid peat soils.
Indicator species:	Betula pubescens, Picea abies, Pinus sylvestris.
GHC (BioHab):	Forest phanerophytes / Conifers and Forest phanerophytes / Winter deciduous Picea Pinus sylvestris and also Alnus and Betula possible also mixed but the critical parameter is water saturated acid peat soils + very acid wet species assemblages.

Field identification:	Conatins many vegetation units and is not well defined.
Occurrence:	Probably widespread in the core zones although often forming linear features,small patches outside core zone in specific combinations of local conditions.
Direct threats:	Drainage felling.
Climate change:	Could lead to lower water tables ad drying out.
Succession:	Close to climax.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.
Distribution (sites):	**ALN** **BOR** **NEM** **ATN** **ALS** **CON** **ATC** *pan* *lus* **MDM** *mdn* *mds*
Distribution (Bunce):	**ALN** **BOR** **NEM** *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91E0** - Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Pandion, Alnion incanae, Salicion albae)
Mapping rules:	Alpine North / Boreal / Atlant. North below300 Nemoral / Atlant. Central / Pannonian all Continental / Lusitanian / Alpine South below 400 + large rivers + alluvial soils.
Indicator species:	Alnus incanae, Populus nigra, Salix alba, Cirsium oleraceum, Filipendula ulmaria, Rumex sanguineus.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fraxinus / Alnus / Populus or Salix species + alluvial soils + regular flooding.
Field identification:	Although containing a range of vegetation classes and canopy types is probably distinctive because of the local conditions.
Occurrence:	Likely to be fragmented and mainly in small patches.
Direct threats:	Drainage and felling.
Climate change:	Drying out and lowering water table.
Succession:	Climax but susceptible to local changes.
Countries:	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.
Distribution (sites):	**ALN** **BOR** **NEM** **ATN** **ALS** **CON** **ATC** **PAN** **LUS** **MDM** **MDN** **MDS**
Distribution (Bunce):	**ALN** **BOR** **NEM** **ATN** **ALS** **CON** **ATC** **PAN** **LUS** *mdm* *mdn* *mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91F0** - Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)
Mapping rules:	Atlant. North / Atlant. Central / Continental below 300m 500m buffer by large river.
Indicator species:	Quercus robur, Ulmus laevis, Ulmus minor, Ulmus glabra, Fraxinus exelsior, Tamus communis, Phalaris arundinacea.
GHC	Forest phanerophytes / Winter deciduous + mixtures of Quercus robur,Ulmus minor and Fraxinus

(BioHab):	species + tall herb ground vegetation + alluvial wet soils + adjacent to large rivers.
Field identification:	Well defined although evidence of temporary flooding may not always be available.
Occurrence:	Locally extensive stands usually linear.
Direct threats:	Drainage fragmentation by felling.
Climate change:	Likely to be stable as by large rivers.
Succession:	Climax but may get denser canopies.
Countries:	Austria, Belgium, Bulgaria, Czech Republic, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden.

Distribution (sites):	*aln*	**BOR**	**NEM**	**ATN**	*als*	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	**ALN**	**BOR**	**NEM**	**ATN**	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91G0** - Pannonic woods with Quercus petraea and Carpinus betulus

Mapping rules:	Pannonian below 500, + Quercus petraea and Carpinus + mixed soils.
Indicator species:	Quercus petraea, Carpinus betulus.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus petraea 30-70- and Carpinus 30-70 + local Pannonian species + local knowledge.
Field identification:	Well defined.
Occurrence:	Localized and fragmented.
Direct threats:	Felling, conversion to conifer.
Climate change:	Colonisation by thermophilic species eg Quercus pubescens.
Succession:	Climax unless threatened by climate change.
Countries:	Austria, Bulgaria, Czech Republic, Germany, Hungary, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91H0** - Pannonian woods with Quercus pubescens

Mapping rules:	Pannonian below 500 + Quercus pubescens + shallow calcareous soils.
Indicator species:	Quercus pubescens, Fraxinus ornus, Sorbus domestica, Cornus mas.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus pubescens over 30% + dry calcareous soils + local knowledge.
Field identification:	Well defined but local knowledge also required.
Occurrence:	Localized and fragmented.

Direct threats:	Felling, fire.											
Climate change:	Thermophilic on edge of range therefore possibly stable.											
Succession:	Climax unless disturbance.											
Countries:	Austria, Bulgaria, Czech Republic, Hungary, Italy, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**91I0** - Euro-Siberian steppic woods with Quercus spp.											
Mapping rules:	Eastern Continental classes only + Quercus spp + Loess soil.											
Indicator species:	Quercus cerris, Quercus pubescens, Tanacetum corybosum, Vincetoxicum hirundinaria.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous o0ver 30% Quercus cerris and orQuercus petraea or pubescens + expert knowledge.											
Field identification:	Clear because of distinctive species but complicated by the degree of invasion by Robinia.											
Occurrence:	Very fragmented but more information required.											
Direct threats:	Invasion by Robinia, felling, fire.											
Climate change:	Could alter balance of species with thermophiles increasing.											
Succession:	Climax but see threats.											
Countries:	Austria, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**91J0** - Taxus baccata woods of the British Isles
Mapping rules:	Too rare to predict but only in GB lowlands below 200 m. Atlantic central only.
Indicator species:	Taxus baccata.
GHC (BioHab):	Forest phanerophytes / Conifers over 70% Taxus.
Field identification:	Direct.
Occurrence:	-
Direct threats:	Felling for veneers but often protected.
Climate change:	Robust long lived trees resistant to change.
Succession:	Climax.
Countries:	Ireland, United Kingdom.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	**ATC**	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91K0** - Illyrian Fagus sylvatica forests (Aremonio-Fagion)
Mapping rules:	Alpine South over 300 Balkans only + Fagus + Dolomitic limestone. + Maybe outliers in SE Alps and Pannonian.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus over 70% + moist calcareaous soil.
Field identification:	Probably difficult because intergrades with 9130 9140 and 9150.
Occurrence:	No information.
Direct threats:	Felling.
Climate change:	Increased drought coulod affect density of Fagus.
Succession:	Climax.
Countries:	Hungary, Italy, Romania, Slovenia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	**PAN**	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**91L0** - Illyrian oak-hornbeam forests (Erythronio-carpinion)
Mapping rules:	Alpine South Balkans over 300 Pannonian over 300 outlier in N Appennines + Quercus species + Carpinus + Neutral / acidic brown earths.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Winter deciduous Quercus robur + Quercus petraea + Quercus cerris + Carpinus all between 30 and 70% + dry neutral soils.
Field identification:	Could be difficult as they are quoted as intermediates between 9170 and 91GO.
Occurrence:	No information.
Direct threats:	Felling. fire.
Climate change:	Would change balance to more thermophilic species.
Succession:	Climax.
Countries:	Hungary, Italy, Romania, Slovenia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	**PAN**	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**91M0** - Pannonian-Balkanic turkey oak –sessile oak forests											
Mapping rules:	Alpine South northern Balkans only 300-600 Pannonian southern only 300-600 + Brown soils.											
Indicator species:	-											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus petraea + Quercus cerris both 30-70% + dry neutral and acidic soils.											
Field identification:	Rather ill defined with limited information.											
Occurrence:	No information.											
Direct threats:	Felling and fire.											
Climate change:	Would favour shift to more thermophilic species.											
Succession:	Climax.											
Countries:	Austria, Bulgaria, Hungary, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)											
Annex I:	**91N0** - Pannonic inland sand dune thicket (Junipero-Populetum albae)											
Mapping rules:	Pannonian below 500m + sands.											
Indicator species:	-											
GHC (BioHab):	Forest or Tall scrub over 30% but below 70% + mixed conifer / decicuous + Juniperus and populus + sand or dunes.											
Field identification:	Seems well defined if assumption of over 30% tree cover is correct.											
Occurrence:	Probably localized and fragmented.											
Direct threats:	Felling, fire conversion to agriculture.											
Climate change:	Could increase fire risk and favor xeric species in ground vegetation.											
Succession:	-											
Countries:	Hungary, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**331** - Beaches, sand, dunes
Annex I:	**91N0** - Pannonic inland sand dune thicket (Junipero-Populetum albae)

Mapping rules:	Pannonian. Populus / Juniperus.
Indicator species:	-
GHC (BioHab):	-
Field identification:	Likely to be distinctive.
Occurrence:	Probably fragmented and small patches.
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	Hungary, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **91P0** - Holy Cross fir forest (Abietetum polonicum)

Mapping rules:	Alpine South Poland only + distribution ofAbies polonicum.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Conifer over 30 % + Abies polonicum.
Field identification:	Relies on presence of a single species.
Occurrence:	One location only.
Direct threats:	Felling.
Climate change:	No information.
Succession:	No information.
Countries:	Poland.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **91Q0** - Western Carpathian calcicolous Pinus sylvestris forests

Mapping rules:	Alpine South and Continental (eastern only) over 1200m,Western Carpathians only + Calcareous soils + Pinus sylvestris.
Indicator species:	-
GHC	Forest phanerophytes / Conifers + Pinus sylvestris over 70% + dry calcareous soils + distin=ctive

(BioHab):	ground layer.											
Field identification:	Not well defined only general description provided, more information needed.											
Occurrence:	Only in small isolated patches difficult to predict and more information needed.											
Direct threats:	Fire, felling.											
Climate change:	Could be under pressure as only small patches.											
Succession:	Presumably climax.											
Countries:	Poland, Romania, Slovakia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)											
Annex I:	**91R0** - Dinaric dolomite Scots pine forests (Genisto januensis-Pinetum)											
Mapping rules:	Alpine South 900 m-1200 m, Balkans only. Dolomitic limestone. Pinus sylvestris. Related to 91KO and higher than 9530.											
Indicator species:	-											
GHC (BioHab):	Forest Phanerophytes + conifer over70% + Pinus sylvestris + dolomite rendzina soils + expert knowledge + key continental species.											
Field identification:	Restricted distribution limited description –by context only.											
Occurrence:	No information.											
Direct threats:	Felling,fire.											
Climate change:	Increased fire risk and potential loss of relict species and could cause loss of Fagus.											
Succession:	Climax.											
Countries:	Slovenia.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**91T0** - Central European lichen scots pine forests
Mapping rules:	Continental, Northeast + central / below 800m, plus sandy acid soils + Pinus sylvestris.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / conifers over 70% / Pinus sylvestris / sandy podsoils + lichen.
Field identification:	Well defined vegetation association.

Occurrence:	Probably present in large units.											
Direct threats:	Felling but maybe expanding through land abandonment.											
Climate change:	Pinus sylvestris has wide tolerance, but ground flora may shift to more xeric species.											
Succession:	Climax.											
Countries:	Czech Republic, Germany, Lithuania, Poland.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **91U0** - Sarmatic steppe pine forest

Mapping rules:	Pannonian 300 m Eastern Continental below 300 m but indicative only. Pinus sylvestris.											
Indicator species:	-											
GHC (BioHab):	Forest phanerphytes + conifer 0ver 70% + Pinus sylvestris + expert knowledge and key species.											
Field identification:	One association only and sounds distinctive but more details required.											
Occurrence:	No information.											
Direct threats:	Felling, fire.											
Climate change:	Could increase fire risk and cause loss of relict species.											
Succession:	Climax.											
Countries:	Germany.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	**CON**	*atc*	**PAN**	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)
Annex I: **91V0** - Dacian Beech forests (Symphyto-Fagion)

Mapping rules:	Alpine South eastern only 800-1400? (Dacian is not well defined) + Fagus.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Winter deciduous + more than 70% Fagus + local expert knowledge.
Field identification:	One association only but more details required.
Occurrence:	No information.
Direct threats:	Felling, conversion to conifer.
Climate change:	Drought could affect Fagus- if so shift to Quercus.
Succession:	Climax unless disturbance.

Countries:	Romania.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9210** - Apennine beech forests with Taxus and Ilex

Mapping rules:	Medit. mountains Apennines only 700-900 + Fagus.
Indicator species:	Fagus sylvatica, Taxus baccata, Ilex aquifolium.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Fagus over 70% + Ilex and / or Taxus.
Field identification:	Several exact locations mentioned but otherwise depends on combination of Taxus / Fagus / Ilex.
Occurrence:	Fragmented but could be common locally.
Direct threats:	Felling, conversion to conifer.
Climate change:	Drought could lead to loss of Fagus and succession.
Succession:	Climax unless disturbed.
Countries:	Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9220** - Apennine beech forests with Abies alba and beech forests with Abies nebrodensis

Mapping rules:	Mediterranean mountains Apennines only 800 m-1000 m?. Fagus / Abies alba / Abies nebrodensis.
Indicator species:	Fagus sylvatica, Abies alba, Abies nebrodensis, Daphne laureola.
GHC (BioHab):	Forest phanerophytes / 40-60% conifer,40-60% winter deciduous + Fagus over 30% and Abies over 30% + expert knowledge.
Field identification:	Several sites mentioned and if the three species are indicative then clear cut.
Occurrence:	Fragmented but could be locally common.
Direct threats:	Felling.
Climate change:	Increased drought could influence Fagus and change species balance.
Succession:	Climax.
Countries:	Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9220** - Apennine beech forests with Abies alba and beech forests with Abies nebrodensis
Mapping rules:	Mediterranean mountains Apennines only 800 m-1000 m?. Fagus / Abies alba / Abies nebrodensis.
Indicator species:	Fagus sylvatica, Abies alba, Abies nebrodensis, Daphne laureola.
GHC (BioHab):	Forest phanerophytes / 40-60% conifer,40-60% winter deciduous + Fagus over 30% and Abies over 30% + expert knowledge.
Field identification:	Several sites mentioned and if the three species are indicative then clear cut.
Occurrence:	Fragmented but could be locally common.
Direct threats:	Felling.
Climate change:	Increased drought could influence Fagus and change species balance.
Succession:	Climax.
Countries:	Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9230** - Galicio-Portuguese oak woods with Quercus robur and Quercus pyrenaica
Mapping rules:	Medit. mountains over 400 Iberian peninsula only but outlier in SW France + Quercus pyrenaica.
Indicator species:	Quercus robur, Quercus pyrenaica.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus pyrenaica + dry and moist acid soils.
Field identification:	Covers a wide range of vegetation classes but if Quercus pyrenaica alone is indicative then clear cut.
Occurrence:	Extensive stands where it occurs but also often in small patches in grazed areas.
Direct threats:	Felling,overgrazing.
Climate change:	May favour expansion of sclerophyllous species.
Succession:	.
Countries:	France, Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9240** - Quercus faginea and Quercus canariensis Iberian woods

Mapping rules:	Possibly Medit. mountains 400-1500 otherwise distribution of Quercus faginea and Quercus canariensis.
Indicator species:	Quercus faginea, Quercus canariensis.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Q> faginea + Quercus canariensis + moist acid soils + further expert information.
Field identification:	Depends on the quantity of cover of the tree species to determine the class but limited information available.
Occurrence:	Fragmented and likely to be in small stands.
Direct threats:	Felling and fire.
Climate change:	Increased drought could lead to loss of canopy and drie ground conditions.
Succession:	Climax.
Countries:	Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9250** - Quercus trojana woods

Mapping rules:	Medit. South + presence of Quercus trojana only maybe outliers in southern classes of Medit. North.
Indicator species:	Quercus trojana.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus trojana over 70% + dry soils + expert local information.
Field identification:	Depends on the one species but no details on % cover.
Occurrence:	No information.
Direct threats:	Felling,fire.
Climate change:	Increased dessication may lead to loss of canopy and mincrease in xeric species.
Succession:	Climax.
Countries:	Greece, Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **9260** - Castanea sativa woods

Mapping rules:	Medit. North / Medit. mountains + Castanea sativa but distribution needs to include non-native stands.
Indicator species:	Castanea sativa.
GHC	FEH / Winter deciduous probably over 70 % + moist acid soils + local knowledge.

(BioHab):												
Field identification:	Depends on the one species but no information on required % cover or definition of old.											
Occurrence:	Occurs in usually small stands in the Iberian peninsula and France but may be more extensive where native.											
Direct threats:	Felling fungal and insect diseases.											
Climate change:	Could be affected by increased drought.											
Succession:	Managed woods will change rapidly if abandoned ground vegetation will change without grazing.											
Countries:	Austria, Bulgaria, France, Greece, Italy, Portugal, Romania, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**9270** - Hellenic beech forests with Abies borisii-regis											
Mapping rules:	Mediterranean Mountains over700m? Greece only. Fagus / Abies borisii-regis.											
Indicator species:	Fagus sylvatica, Abies borisii-regis.											
GHC (BioHab):	Forest phanerophytes / conifer 40-60, deciduous 40-60 + Fagus over 30 and Abies over 10? + expert knowledge + endemic species.											
Field identification:	Depends on presence of two species-clear cut if these are indicative.											
Occurrence:	No information.											
Direct threats:	Probably felling.											
Climate change:	Increasded temperatures likely to affect Fagus as it is on the edge of its distribution also endemics likely to be threatened.											
Succession:	Probably climax.											
Countries:	Bulgaria, Greece.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9270** - Hellenic beech forests with Abies borisii-regis
Mapping rules:	Mediterranean Mountains over700m? Greece only. Fagus / Abies borisii-regis.
Indicator species:	Fagus sylvatica, Abies borisii-regis.
GHC (BioHab):	Forest phanerophytes / conifer 40-60, deciduous 40-60 + Fagus over 30 and Abies over 10? + expert knowledge + endemic species.
Field identification:	Depends on presence of two species-clear cut if these are indicative.
Occurrence:	No information.

Direct threats:	Probably felling.
Climate change:	Increasded temperatures likely to affect Fagus as it is on the edge of its distribution also endemics likely to be threatened.
Succession:	Probably climax.
Countries:	Bulgaria, Greece.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9280** - Quercus frainetto woods

Mapping rules:	Medit. mountains below 700 Medit. South + distribution of Quercus frainetto only but Fagus may also be involved-needs checking.
Indicator species:	Fagus sylvatica, Quercus frainetto.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus frainetto and Fagus 30-70 % but needs furtherexpert information.
Field identification:	May depend on the one species but no information on required % or if mixed with Fagus.
Occurrence:	No information.
Direct threats:	Felling.
Climate change:	Fagus likely to be stressed by drought as it is at the edge of its range.
Succession:	Climax.
Countries:	Greece, Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9290** - Cupressus forests (Acero-Cupression)

Mapping rules:	Cupressus species alone-Mediterranean mountains over1000 m Balkans only.
Indicator species:	Cupressus atlantica, Cupressus sempervirens.
GHC (BioHab):	Forest phanerpphytes / conifer 0ver 70% + Cupressus species over 30% + further expert knowledge.
Field identification:	Depends on the % of Cupressus cover which is indicative.
Occurrence:	No information.
Direct threats:	Possibly fire and felling.
Climate change:	Long lived trees probably robust but ground vegetation may be different.
Succession:	No information.
Countries:	Greece.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **92A0** - Salix alba and Populus alba galleries

Mapping rules:	Medit. North / Medit. South / Medit. mountains Plus major rivers which will only identify the main stands. Those by smaller rivers will be too small anyway to be identified.
Indicator species:	Salix alba, Populus alba.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Populus species as well as Alnus and Salix over 30 % + adjacent to major rivers + further expert information.
Field identification:	Well defined and different from surrounding vegetation therefore distinctive.
Occurrence:	Likely to be localized but may be in significant linear stands where present Could be confused with poplar plantations.
Direct threats:	Felling drainage.
Climate change:	Could lead to infrequent river flow and lowering of the water table.
Succession:	Climax.
Countries:	Bulgaria, France, Greece, Italy, Malta, Portugal, Romania, Slovenia, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	**ATC**	**PAN**	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I: **92B0** - Riparian formations on intermittent Mediterranean water courses with Rhododendron ponticum, Salix and others

Mapping rules:	Medit. South Presence of Rhododendron ponticum.
Indicator species:	Rhodondendron ponticum ssp. Baeticum, Betula parvibracteata.
GHC (BioHab):	Mid phanerophytes / Tall phanerophytes / Evergreen + R. ponticum + endemics + moist soils + steep-sided valleys + local expert information.
Field identification:	Clear cut if the one species is solely indicative.
Occurrence:	Likely to be rare and in small patches or linear features.
Direct threats:	Clearance and fire.
Climate change:	Likely to be a sensitive system to desertification.
Succession:	Possibly a local climax in nan extreme situation.
Countries:	Portugal, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

(Bunce):

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**92C0** - Platanus orientalis and Liquidambar orientalis woods (Plantanion orientalis)
Mapping rules:	Medit. South in Greece the Balkans and Sicily. + Presence of Platanus orientalis and Liqudamber orientalis. Although riparian these forests can be by temporary watercourses so cannot be identified by rivers.
Indicator species:	Platanus orientalis, Liquidambar orientalis, Ranunculus ficaria, Helleborus cyclophyllus, Pteridium aquilinum.
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Platanus and Liquidamber 30-70% + m moist neutral soils + distinctiuve ground flora assemblagies.
Field identification:	Extensive description should allow exact definition but question remains about the number of species required to identify the class.
Occurrence:	Along linear elements-may be below the 25 ha unit of CLC.
Direct threats:	Felling.
Climate change:	Increased drought could lead to drying out of soils and expansion of sclerophylls.
Succession:	Climax.
Countries:	Bulgaria, Greece, Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**92D0** - Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)
Mapping rules:	Medit. South below 30.
Indicator species:	Nerium oleander, Tamarix spp..
GHC (BioHab):	Mid phanerophytes / Evergreen + water courses + further expert knowledge.
Field identification:	Distinctive vegetation linked to a clear geomorphological feature.
Occurrence:	Indicative only as in narrow linear patches.
Direct threats:	Fire urbanization.
Climate change:	Increased dessication could change flora.
Succession:	Probably close to climax for the local conditions.
Countries:	France, Greece, Italy, Malta, Portugal, Romania, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC: **311 (313)** - Broad-leaved forest (Mixed forest)

Annex I:	**9310** - Aegean Quercus brachyphylla forests

Mapping rules:	Medit. South below 500 + Quercus brachyphylla + Aegean margins only.											
Indicator species:	Quercus brachaphylla.											
GHC (BioHab):	Forest phanerophytes / Winter deciduous + expert knowledge.											
Field identification:	No information apart from the one species.											
Occurrence:	No information.											
Direct threats:	Fire.											
Climate change:	Increased temperatures will favour sclerophylls.											
Succession:	Climax.											
Countries:	Greece.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9320** - Olea and Ceratonia forests

Mapping rules:	Medit. South below 400? + distribution of Olea and Ceratonia.											
Indicator species:	Olea europaea ssp. Sylvestris, Ceratonia siliqua.											
GHC (BioHab):	Tall phanerophytes / Evergreen + 30-70)lea + 30-70 n% Ceratonia + xeric soils + indicator species.											
Field identification:	Usually well defined according to the named species.											
Occurrence:	Often mixed in a matrix with sclerophyllous scrub and also often in small patches. Unlikely to be identified accurately within CLC-indicative therefore of region of occurrence only. Also possible confusion with overgrown olive groves.											
Direct threats:	Fire.											
Climate change:	Could well lead to expansion.											
Succession:	May procede to Forest phanerophytes / Winter deciduousin favourable sites.											
Countries:	France, Greece, Italy, Malta, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9330** - Quercus suber forests

Mapping	Medit. North / Medit. South + distribution of Quercus suber + Acid soils.

rules:												
Indicator species:	Quercus suber.											
GHC (BioHab):	Forest phanerophytes / Evergreen + dry acid soils + May have some Quercus faginea and Quercus pyrenaica.											
Field identification:	Generally Quercus suber occurs in pure stands which can be readily identified-the % cover needs to be specified as there is potential overlap with denser areas of Dehesas and Montados.											
Occurrence:	Extensive stands where it occurs but likely to be confused with Dehesas / Montados ,as well as sclerophyllous scrub.											
Direct threats:	Fire lack of management Felling.											
Climate change:	Already affecting the trees in dryier areas.											
Succession:	Infilling with scrub between trees and shift to Quercus ilex.											
Countries:	France, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**9340** - Quercus ilex and Quercus rotundifolia forests											
Mapping rules:	Medit. mountains below900 / Medit. North / Medit. South Plus Quercus ilex and Quercus rotundifolia + dry soils. Otherwise difficult to specify due to local, patterns.											
Indicator species:	Quercus ilex, Quercus rotundifolia.											
GHC (BioHab):	Forest phanerophytes / Evergreen + Quercus ilex and Quercus rotundifolia over 70 %(canopy cover over 5m only) + dry soils.											
Field identification:	Although the species are readily identified the problem is with the % cover that is required to form forest. ,Height is also important.											
Occurrence:	Locally in large patches but often transitional to sclerophyllous scrub with many combinations of height and density according to the successional state of the area concerned.											
Direct threats:	Fire, felling.											
Climate change:	Limited impact but will increase xeric species in the ground vegetation. Succcession: Climax but many standsare open and canopies will close reducing ground cover species.											
Succession:	-											
Countries:	France, Greece, Italy, Malta, Portugal, Slovenia, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9350** - Quercus macrolepis forests
Mapping rules:	Medit. South Greece only + Quercus macrolepis.
Indicator	Quercus macrolepsis.

species:	
GHC (BioHab):	Forest phanerophytes / Winter deciduous but may also be Forest phanerophytes / Evergreen depending on season + Quercus macrolepis over 70% + expert knowledge.
Field identification:	Probably if the species is over 70% then it could be considered dominant but needs checking.
Occurrence:	No information.
Direct threats:	Fire felling.
Climate change:	Could favour increasing sclerophylls and xeric species.
Succession:	Climax.
Countries:	Greece, Italy.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9360** - Macaronesian laurel forests (Laurus, Ocotea)
Mapping rules:	Macaronesia only.
Indicator species:	Laurus azoricae, Hedera canariensis, Prunus lusitanica.
GHC (BioHab):	-
Field identification:	-
Occurrence:	-
Direct threats:	-
Climate change:	-
Succession:	-
Countries:	

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)
Annex I:	**9370** - Palm groves of Phoenix
Mapping rules:	Crete and the Canaries only with distribution of the two species.
Indicator species:	Phoenix canariensis, Phoenix theophrasti.
GHC (BioHab):	-
Field identification:	-

Occurrence:	-											
Direct threats:	-											
Climate change:	-											
Succession:	-											
Countries:	Greece.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**9380** - Forests of Ilex aquifolium											
Mapping rules:	Too rare to be predicted.											
Indicator species:	Ilex acuifolium.											
GHC (BioHab):	Forest phanerophytes / Evergreen + Ilex aquifolium over 70% + occasionally Taxus present.											
Field identification:	Straightforward because of Ilex over 70% otherwise % needs specifying.											
Occurrence:	Dispersed small very rare patches.											
Direct threats:	Felling overgrazing.											
Climate change:	Only at southern edge of the range dessiction may kill trees.											
Succession:	In old age the trees may die and be replaced by other species.											
Countries:	France, Greece, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**323 (324)** - Sclerophyllous vegetation (Transitional woodland-scrub)
Annex I:	**9390** - Scrub and low forest vegetation with Quercus alnifolia
Mapping rules:	Quercus alniflora Troodos mountains only.
Indicator species:	-
GHC (BioHab):	Forest phanerophytes / Winter deciduous + Quercus alniflora only ? over 30% m + expert information.
Field identification:	Clear if presence of species only required.
Occurrence:	No information.
Direct threats:	No information.
Climate change:	No information.
Succession:	No information.

Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**311 (313)** - Broad-leaved forest (Mixed forest)											
Annex I:	**93A0** - Woodlands with Quercus infectoria (Anagyro foetidae-Quercetum infectoriae)											
Mapping rules:	Quercus infectoria Troodos mountains only 600-1100 + dry limestone soils.											
Indicator species:	-											
GHC (BioHab):	Forest phanerophytes / Winter deciduous? + Quercusinfectoria ovr 30%? + dry limestone solils + expert information on local species.											
Field identification:	Clear if presence of species only.											
Occurrence:	No information but likely to be.											
Direct threats:	Unknown.											
Climate change:	But could lead to sccerophyll invasion.											
Succession:	Suggestion in description that it may be susceptible to colonization by other species.											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)											
Annex I:	**9410** - Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)											
Mapping rules:	Alpine South / Continental 800 m-1700 m ?. Mediterranean Mountains but north of Pyreneees only.											
Indicator species:	Picea abies, Picea orientalis.											
GHC (BioHab):	Forest phanerophytes / conifer over 70% + moist acid soils + key species.											
Field identification:	Well defined species patterns but depends whether converted Fagus / and / or plantation forests are included.											
Occurrence:	Extensive forests often artificially pure spruce from forest practice. Also many converted Fagus forests.											
Direct threats:	Felling.											
Climate change:	Could threaten spruce dominance by encouraging disease at lower altitudes.											
Succession:	Climax but structure will change with age.											
Countries:	Austria, Bulgaria, Czech Republic, France, Germany, Greece, Italy, Poland, Romania, Slovakia, Slovenia, Switzerland.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution	*aln*	*bor*	*nem*	*atn*	**ALS**	**CON**	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

(Bunce):

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9420** - Alpine Larix decidua and/or Pinus cembra forests
Mapping rules:	Alpine South 1000-1700 m?. Mediterranean mountains over 100m but north of Pyrenees only plus native distribution of. Larix / P.cembra.
Indicator species:	Larix decidua, Pinus cembra, Vaccinium myrtillus.
GHC (BioHab):	Forest phanerophyte / Conifer over 70% / + Larix or P.cembra but only native stands + moist acid soils + species indicators.
Field identification:	Usually present as more or less pure stands so readily identifiable.
Occurrence:	Often present as altitudinal bands and relatively small patches. May be confused with deciduous forest in CLC and may be also below the minimum mappable unit.
Direct threats:	Felling and conversion to grazing land or spruce.
Climate change:	Could exert pressure on tree health at lower altitudes but also increase altitude range.
Succession:	Probaly climax but proportions of species may change with age.
Countries:	Austria, France, Germany, Italy, Poland, Romania, Slovakia.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9430** - Pinus uncinata forests (* if on gypsum or limestone)
Mapping rules:	Alpine South 100 m-1700 m?. Variable soil type but priority if limestone or gypsum. Pinus uncinata.
Indicator species:	Pinus uncinata, Lycopodium annotium, Huperzia selago, Arctostaphylos alpina, Rodondendrum ferrugineum.
GHC (BioHab):	Forest phanerophyte / conifer over 70% / Pinus uncinata over 70% / variable soils but Priority habitat if gypsum or limestone + indicator species.
Field identification:	Clear if only dependant on P.uncinata but % problems with other tree species.
Occurrence:	Localized probably rather patchy and intergrades with 9420 could be a problem of open stands being below the % forest recognized by CLC.
Direct threats:	Felling and / or conversion to grazing land.
Climate change:	Could increase altitudinal range.
Succession:	Probably climax.
Countries:	Austria, France, Italy, Spain.

Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9510** - Southern Apennine Abies alba

Mapping rules:	Mediterranean mountains southern Apennines only. Over 800m?. Abies alba.											
Indicator species:	Abies alba.											
GHC (BioHab):	Forest phanerophytes / over70% conifer + Abies alba + further expert knowledge and indicators.											
Field identification:	Dependant on one species therefore clear cut. But problem will be gradients with Fagus forests.											
Occurrence:	No information.											
Direct threats:	Probably felling.											
Climate change:	Could be threatened by increased summer drought.											
Succession:	Likely to be climax.											
Countries:	Italy.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9520** - Abies pinsapo forests

Mapping rules:	Mediterranean South but Abies pinsapo only.											
Indicator species:	Abies pinsapo.											
GHC (BioHab):	Probaly not 30% tree cover of Abies remainder of cover is various scrub categories.											
Field identification:	One species only in one site.											
Occurrence:	One site only in Southern Spain –the trees are so open that they are not likely to be identified as forest, but rather as sclerophyllous scrub.											
Direct threats:	Fire but protected from felling.											
Climate change:	Probably resistant to further desiccation as long lived tree.											
Succession:	Vitually no tree regeneration therefore only change in scrub structure.											
Countries:	Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*

CLC:	**312 (313)** - Coniferous forest (Mixed forest)
Annex I:	**9530** - (Sub-)Mediterranean pine forests with endemic black pines

Mapping rules:	Mediterranean mountains over 900 m. ? / Mediterranean north over 1000m ?. / maybe Alpine South in Balkans over 1000 m.											
Indicator species:	Pinus nigra.											
GHC (BioHab):	Forest phanerphyte / Conifer over 70% + Pinus laricio or Pinus nigra + dolomite rock + expert knowledge of species distribution and character of native forest.											
Field identification:	Not likely to be difficult, dependent upon specific tree species that usually grow separately from other trees. . But difficult to separate the many plantations of P.nigra.											
Occurrence:	Localised but probably extensive where present.											
Direct threats:	Felling,fire.											
Climate change:	Probaly resistant to change but depends on extent of temperature increase.											
Succession:	Climax but more open stands may fill in with denser scrub stands.											
Countries:	Austria, Bulgaria, France, Greece, Italy, Romania, Slovenia, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	**ALS**	*con*	*atc*	*pan*	*lus*	**MDM**	*mdn*	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)

Annex I: **9540** - Mediterranean pine forests with endemic Mesogean pines

Mapping rules:	Lusitanian / Mediterranean North / Mediterranean South / Mediterranean mountains below 800 m.											
Indicator species:	Pinus pinaster ssp. Pinaster, P. halepensis, P. pityusa, P. stankewiczii, P. eldarica, P. brutia.											
GHC (BioHab):	Forest phanerophyte / Conifer over 70% + thermophilic scrub species-long established plantations included but artificial plantations not.											
Field identification:	Rules needed to accurately define this class. But the problem is likely to be intergrads with Q.ilex and age of stands and what constitutes a natural structure.											
Occurrence:	One of the most extensive forest classes in Annexe 1 covering large areas. Confusion with planted stands of P. radiata in LUS and plantations of P.nigra in MDM in Spain.											
Direct threats:	Fire,felling.											
Climate change:	Ground vegetation likely to be increasingly dominated by xeric species but trees probably resistant.											
Succession:	Climax but proportions of canopy species may change but wide variation makes estimation difficult.											
Countries:	France, Greece, Italy, Malta, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	**MDM**	**MDN**	**MDS**
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)

Annex I: **9550** - Canarian endemic pine forests

Mapping rules:	Canaries only.
Indicator	Pinus canariensis.

species:
GHC (BioHab): -
Field identification: -
Occurrence: -
Direct threats: -
Climate change: -
Succession: -
Countries:
Distribution (sites): *aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*
Distribution (Bunce): *aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* *mdn* *mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **9560** - Endemic forests with Juniperus spp.

Mapping rules: Mediterranean South / Mediterranean mountains 300 m-1200 m ?. Mediterranean Juniperus spp.
Indicator species: Juniperus brevifolia, J. cedrus, J. drupacea, J. exelsa, J. foetidissima, J. oxycedrus, J. phoenicera, J. thurefera.
GHC (BioHab): Tall phanerphytes with mixtures of mid-phanerophytes / conifers but with other scrub fcies between trees + Juniperus species + Expert knowledge.
Field identification: Difficult because of % mixtures with other species and land covers.
Occurrence: Likely to occur in small patches but locally common and a very widespread class although not commonly a dominant cover class.
Direct threats: Fire clearance for grazing.
Climate change: Increased fire risk and extreme xeric species in ground vegetation.
Succession: Locall could be colonized by pines but many areas too dry.
Countries: Bulgaria, France, Greece, Italy, Portugal, Spain.
Distribution (sites): *aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* **MDM** **MDN** *mds*
Distribution (Bunce): *aln* *bor* *nem* *atn* *als* *con* *atc* *pan* *lus* *mdm* **MDN** *mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)
Annex I: **9580** - Mediterranean Taxus baccata woods

Mapping rules: Too fragmented and rare to predict. . But present in Mediterranean mountains over 700m ?.
Indicator species: Taxus baccata.
GHC (BioHab): Forest phanerphytes / Conifer over 70% + Taxus baccata and sometimes Ilex aquifolium.
Field Depends on definition of required % of Taxus.

identification:												
Occurrence:	Probably fragmented and rare.											
Direct threats:	Felling.											
Climate change:	Could alter ground vegetation but Taxus long lived and persistent.											
Succession:	Unlikely but no information as ti status.											
Countries:	France, Italy, Portugal, Spain.											
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	**MDM**	**MDN**	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	**LUS**	*mdm*	**MDN**	*mds*

CLC: **312 (313)** - Coniferous forest (Mixed forest)

Annex I: **9590** - Cedrus brevifolia forests (Cedrosetum brevifoliae)

Mapping rules:	Cedrus brevifolia. Troodos mountains.											
Indicator species:	-											
GHC (BioHab):	Forest phanerophytes / over 70% conifer + Cedrus brevifolia + mountain summits + expert knowledge.											
Field identification:	Clear if the presence of Cedrus only is indicative. But furter information needed from literature and / or expert knowledge.											
Occurrence:	No information.											
Direct threats:	No information.											
Climate change:	No information.											
Succession:	No information.											
Countries:												
Distribution (sites):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
Distribution (Bunce):	*aln*	*bor*	*nem*	*atn*	*als*	*con*	*atc*	*pan*	*lus*	*mdm*	*mdn*	*mds*
