

This is an extract from the following report:

Review of grassland habitats and development of distribution maps of heathland, scrub and tundra habitats of EUNIS habitats classification

Report EEA/NSV/15/005

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4 Description and distribution of the revised EUNIS heathland, scrub and tundra habitat types

4.1 Background

In the 2014 report (Schaminée et al. 2014), vegetation plots (phytosociological relevés) representing habitat types of heathlands, scrub or tundra were identified in the databases of the Braun-Blanquet project and EVA using a crosswalk between syntaxa (phytosociological alliances) and EUNIS habitat types (Schaminée et al. 2012, with later updates). This work was very important for identifying gaps in the data and subsequent targeted gap filling. It also made it possible to identify the preliminary lists of constant species for each of these types (Schaminée et al. 2014).

Here we present the next step of the analysis, which includes two significant improvements:

1) A computer expert system for heathland, scrub and tundra habitats was developed. It contains formal definitions of individual habitats and uses them to identify vegetation plots belonging to these habitats in the databases. Thus it (i) applies habitat classification consistently across Europe, unlike classification based on expert assignments to phytosociological alliances, which depend on subjective judgement of various experts; (ii) enables identification of vegetation plots that have not been labelled by the alliance names; (iii) can be used to classify any vegetation plot obtained in the future using the same criteria.

2) The lists of constant species were supplemented by the lists of diagnostic and dominant species. These three categories of indicator species have different meaning and together they provide a comprehensive characterization of the habitat's species diversity. Diagnostic species are species with occurrences concentrated in the habitat, being absent or rare in other habitats. As such they are good positive indicators of the habitat, but they do not need to occur in every location of the habitat. Constant species are species that frequently occur in the habitat, but they may include generalist species that are also frequent in other habitats. Dominant species are those that often reach high cover in the habitat, thus determining the habitat physiognomy. Species lists for all of these categories were computed based on the groups of vegetation plots classified by the expert system, using consistent numerical criteria.

4.2 Indicator species of the revised EUNIS heathland, scrub and tundra habitat types

The initial dataset used for the analysis was compiled from the EVA database and the Braun-Blanquet project database. This data set contained a total of 1,126,004 vegetation plots from Europe, including a small number of plots from adjacent regions such as Greenland, Siberia, Anatolia and the Mediterranean coast of North Africa. This dataset was imported to the JUICE 7.0 program (Tichý 2002), in which the subsequent analyses were performed. In this data set, plots identified as belonging to heathland, scrub and tundra habitat types were identified based on the assignments provided by Schaminée et al. (2014). New plots, especially those added to the source databases over the past year, were assigned to these habitat types based on the classification to the alliances by their original authors or expert judgement. These groups of plots belonging to respective habitat types were used as a basis for developing the formal definitions of habitat types for the expert system.

A database of European trees and shrubs developed in 2014 was further extended and revised and dwarf shrubs were added as a separate category. A refined ecological and morphological classification of these species was introduced.

Species groups were created using our expert judgement based on the lists of indicator species for EUNIS habitat types from Schaminée et al. (2014), descriptions of habitat types in European phytosociological literature, and lists of trees and shrubs. These species groups were defined in such a way that they can clearly separate the EUNIS habitat types based on their occurrence and total cover of their species. In general, some species groups included tree species, other groups included shrub species and yet others included the herb-layer species. Each group consisted of species of similar ecology and distribution.

These species groups were combined to create formal definitions of all habitat types of heathlands, scrub and tundra at EUNIS Level 3, with modifications proposed by Schaminée et al. (2014) and in the project of the Red List of European habitats. These formal definitions consist of formulas that combine covers of individual species, total covers of species groups, and numbers of co-occurring species of individual species groups using the logical operators AND, OR and AND NOT, following the proposals of Bruijnzeel (1997), and also relational operators GR (=greater than). Total covers of each species group were calculated assuming the random overlap of covers of their individual species based on the approach proposed by Chytrý et al. (2005) and formally described by Fischer (2015). Details of this procedure are described in Landucci et al. (2015). Some new software functions were not previously available and had to be developed by L. Tichý specifically for this project for the purpose of defining some types of scrub and dwarf scrub.

As an example, the formal definition of the habitat type F7.1 *Western Mediterranean spiny heath* is represented by the following logical formula:

(<#TC W-Mediterranean-coastal-spiny-shrubs GR25> AND <#TC W-Mediterranean-coastal-spiny-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs EXCEPT #TC W-Mediterranean-coastal-spiny-shrubs>) NOT <#TC Trees GR10>,

which means that the total cover (#TC) of the species group of the Western Mediterranean coastal spiny shrubs is greater than 25% (GR25) and at the same time the total cover of this group is greater than (GR) the total cover of other groups of shrub species (Shrubs, Dwarf shrubs and Garrigue-phrygana shrubs) and at the same time the total cover of trees is not greater than 10%.

A total of 52 definitions of habitat types was developed and included in the expert system (Appendix E). Some of them were defined more narrowly than the EUNIS habitat types used in the final output. These narrower definitions make it possible to create finer classification whenever needed, but the habitat types they define are perfectly nested within the target EUNIS habitat types. This means that EUNIS habitat types can be defined by simply merging the narrower units of the expert system. In contrast, some habitat types defined mainly by geographic criteria, but having very similar species composition in different areas, had a common definition, namely the arctic-alpine and boreo-mountain-temperate types.

The species composition of all 1,126,004 vegetation plots was compared with all the formal definitions. This procedure was computationally very intensive, taking several days on a cloud computer. As a result, plots belonging to some of the 52 habitat types of heathlands, scrub or tundra were identified. These plots were checked for species composition, mapped, and based on the results, formal definitions were adjusted and errors in the input database were corrected. This procedure was repeated several times until an optimal solution was achieved. At the end 40,885 plots were classified to heathland, scrub or tundra habitat types.

The group of plots assigned to EUNIS habitat types were used to prepare distribution maps. The plots assigned by a common definition to groups representing more than one geographically conceived habitat type were subsequently separated to these habitat types based on the occurrence in Ecoregions as defined by Olson et al. (2001). Coastal scrub habitat types belonging to the habitat group B of EUNIS were defined by intersecting plot assignment to scrub habitat types and occurrence on coastal dunes, defined according to the coastal dune area of the Map of the Natural Vegetation of Europe (Bohn et al. 2000-2004) with a buffer of 1 km.

Three groups of indicator species were defined for each EUNIS habitat type based on the groups of vegetation plots assigned to this type using the

procedure described in the previous chapter. These groups included diagnostic, constant and dominant species.

An important issue that had to be solved before computing indicator species was the geographical stratification of the vegetation-plot dataset (Knollová et al. 2005). This was needed in order to remove the effect of geographically unbalanced sampling effort across Europe, which meant that some relatively small areas had a high concentration vegetation plots, while other (often large) areas were represented by few or no plots, even though the habitat type most probably occurs there.

For the purpose of the stratified resampling the data set was divided into two parts – plots classified as heathland, scrub and tundra habitat types and plots of other types. Aquatic vegetation plots and vegetation plots from Greenland, North Africa and Asia east of 60° E were deleted prior to the stratification. Geographical stratification of the classified part of the data set was performed in a grid of 3 x 5 minutes. If a cell of this grid contained more than 1 plot belonging to the same habitat type, one plot was selected randomly and the other plots were deleted. Geographical stratification of the unclassified part of the data set (plots with geographical coordinates) started with its random division to 10 subsets with equal number of plots. Within each subset, one randomly selected plot from each grid cell of 3 x 5 minutes (approximately 5.5 x 6 km at 50° N) was included in the stratified file, while others were deleted. In this way, up to 10 times more unclassified plots were selected from each grid cell, which is justified by the fact that unclassified plots belonged to many habitat types, while for the classified plots selection was always made from a single habitat type.

As a result of stratified resampling, a dataset was prepared that contained 11,727 plots belonging to heathland, scrub and tundra habitat types and 279,741 plots belonging to other habitat types. The number of plots was much smaller than the total number of plots of these habitats available, but the advantage of this dataset was that it was more representative. Plots of the other types had to be retained in the dataset to provide a background for calculating the degree of concentration of species occurrences within the target vegetation type in the computation of diagnostic species. For computation of indicator species of coastal dune scrub habitats, a separate file had to be created, because the coastal dune habitats were represented by the same plots as some scrub habitats of group F. A total of 894 plots belonging to coastal dune scrub and 242,236 plots of other habitats were included in this dataset.

Diagnostic species were determined based on the degree of concentration of their occurrences in groups of plots representing each EUNIS habitat type. This degree of concentration was calculated using the phi coefficient of association (Sokal & Rohlf 1995) standardized for the identical number of relevés across all groups, which was arbitrarily set to 1% of the total data set (Tichý & Chytrý 2006). The species with a value of phi for the particular habitat higher than

0.15 were considered as diagnostic for this habitat type. However, for some habitat types represented by a low number of plots in the stratified dataset, the concentration of species occurrence within the type may not have been statistically significant. Therefore statistical significance of the species-habitat type association was tested using the Fisher's exact test (Sokal & Rohlf 1995) and if this association was not significant at $P < 0.05$, the species was excluded from the list of diagnostic species (Tichý & Chytrý 2006).

Constant species were defined as those with constancy (= percentage occurrence frequency) in the target habitat type at least 10%.

Dominant species were defined as those that occurred with a cover higher than 25% in at least 5% of vegetation plots. This means that a species is considered as dominant even if it does not belong to the highest vegetation layer, and a single plot can have more than one dominant species, or no dominant species if vegetation is very sparse or if cover values of all species are lower than 25%.

Records of species identified only to the genus level and records of epiphytic lichens were removed from the lists of indicator species.

The resulting lists of indicator species for EUNIS heathlands, scrub and tundra habitat types, including diagnostic, constant and dominant species, are presented in Appendix F. After excluding a few habitat types for which no or less than 10 vegetation plots were available, indicator species were defined for the following 41 types:

B1.5a	Atlantic and Baltic coastal <i>Empetrum</i> heath
B1.5b	Atlantic coastal <i>Calluna</i> and <i>Ulex</i> heath
B1.6a	Atlantic and Baltic coastal dune scrub
B1.6b	Mediterranean and Black Sea coastal dune scrub
F1.1	Shrub tundra
F1.2	Moss and lichen tundra
F2.1	Subarctic and alpine dwarf <i>Salix</i> scrub
F2.2a	Alpine and subalpine ericoid heath
F2.2b	Alpine and subalpine <i>Juniperus</i> scrub
F2.2c	Balkan subalpine genistoid scrub
F2.3	Subalpine deciduous scrub
F2.4	Subalpine <i>Pinus mugo</i> scrub
F3.1a	Lowland to montane temperate and submediterranean <i>Juniperus</i> scrub
F3.1b	Temperate <i>Rubus</i> scrub
F3.1c	Lowland to montane temperate and submediterranean genistoid scrub
F3.1d	Balkan-Anatolian submontane genistoid scrub
F3.1e	Temperate and submediterranean thorn scrub
F3.1f	Low steppic scrub

F3.1g	Corylus avellana scrub
F3.1h	Temperate woodland clearing scrub
F4.1	Wet heath
F4.2	Dry heath
F5.1-2	Mediterranean maquis and arborescent matorral
F5.3	Submediterranean pseudomaquis
F5.4	Spartium junceum scrub
F5.5	Thermomediterranean scrub
F6.1a	Western basiphilous garrigue
F6.1b	Western acidophilous garrigue
F6.2	Eastern garrigue
F6.6	Supramediterranean garrigue
F6.7	Mediterranean gypsum scrub
F6.8a	Mediterranean halo-nitrophilous scrub
F6.8b	Caspian halo-nitrophilous scrub
F7.1	Western Mediterranean spiny heath
F7.3	Eastern Mediterranean spiny heath (phrygana)
F7.4a	Western Mediterranean mountain hedgehog-heath
F7.4b	Central Mediterranean mountain hedgehog-heath
F7.4c	Eastern Mediterranean mountain hedgehog-heath
F9.1a	Arctic, boreal and alpine riparian scrub
F9.1b	Temperate riparian scrub
F9.2	Salix fen scrub
F9.3	Mediterranean riparian scrub

In contrast, due to lack of data, indicators could not be defined for the following five habitat types:

B1.6c	Macaronesian coastal dune scrub
F4.3	Macaronesian heath
F7.4d	Canarian mountain hedgehog-heath
F8.1	Canarian xerophytic scrub
F8.2	Madeiran xerophytic scrub

4.3 Update of indicator species of the revised EUNIS woodland habitat types

The new approach developed here to define indicator species of heathland, scrub and tundra habitats was also applied to woodlands. The expert system for EUNIS woodland habitats developed in a previous report (Schaminée et al. 2014) was refined, using the updated species groups and new software functions developed for the work on heathlands/scrub/tundra. Based on this, refined classification of woodlands was prepared and diagnostic, constant and dominant species were also computed for woodlands. This new species list represents a substantial improvement of the species list for woodlands developed by Schaminée et al. (2013) and can replace it.

The stratified dataset for woodland habitat types contained 37,988 plots belonging to the types of group G and 253,405 plots belonging to other habitat types. The stratified dataset for coastal woodlands contained 559 plots belonging to these habitat types and 242,571 plots belonging to other types.

The resulting lists of indicator species for EUNIS woodland habitat types, including diagnostic, constant and dominant species, are presented in Appendix D. After excluding a few habitat types for which no or less than 10 vegetation plots were available, indicator species were defined for the following 40 woodland habitat types:

B1.7a	Atlantic and Baltic broad-leaved coastal dune woodland
B1.7c	Baltic coniferous coastal dune woodland
B1.7d	Mediterranean coniferous coastal dune woodland
G1.1	Temperate and boreal softwood riparian woodland
G1.2a	Alnus woodland on riparian and mineral soils
G1.2b	Temperate and boreal hardwood riparian woodland
G1.3	Mediterranean and Macaronesian riparian woodland
G1.4	Broadleaved swamp woodland on non-acid peat
G1.5	Broadleaved bog woodland on acid peat
G1.6a	Fagus woodland on non-acid soils
G1.6b	Fagus woodland on acid soils
G1.7a	Temperate and submediterranean thermophilous deciduous woodland
G1.7b	Mediterranean thermophilous deciduous woodland
G1.8	Acidophilous Quercus woodland
G1.9a	Boreal-nemoral mountain Betula and Populus tremula woodland on mineral soils
G1.9b	Mediterranean mountain Betula and Populus tremula woodland on mineral soils
G1.Aa	Carpinus and Quercus mesic deciduous woodland
G1.Ab	Ravine woodland
G1.Ba	Alnus cordata woodland
G2.1	Mediterranean evergreen Quercus woodland
G2.2	Mainland laurophyllous woodland
G2.3	Macaronesian laurophyllous woodland

G2.5a	South-Aegean Phoenix grove
G2.6	Ilex aquifolium woodland
G3.1a	Temperate mountain Picea woodland
G3.1b	Temperate mountain Abies woodland
G3.1c	Mediterranean mountain Abies woodland
G3.2-3	Temperate subalpine Larix, Pinus cembra and Pinus uncinata woodland
G3.4a	Temperate and continental Pinus sylvestris woodland
G3.4b	Temperate and submediterranean montane Pinus sylvestris-nigra woodland
G3.4c	Mediterranean montane Pinus sylvestris-nigra woodland
G3.6	Mediterranean and Balkan subalpine Pinus heldreichii-peuce woodland
G3.7	Mediterranean lowland to submontane Pinus woodland
G3.9a	Taxus baccata woodland
G3.9b	Mediterranean Cupressaceae woodland
G3.A	Picea taiga woodland
G3.B	Pinus sylvestris taiga woodland
G3.C	Larix sibirica taiga woodland
G3.Da	Pinus bog woodland
G3.Db	Picea bog woodland

In contrast, due to lack of data, indicator species could not be defined for the following 13 habitat types:

B1.7b	Black Sea broad-leaved coastal dune woodland
G1.C	Highly artificial broadleaved deciduous forestry plantations
G1.D	Fruit and nut tree orchards
G2.4	Olea europaea-Ceratonia siliqua woodland
G2.5b	Canarian Phoenix grove
G2.7	Macaronesian heathy woodland
G2.8	Highly artificial broadleaved evergreen forestry plantations
G2.9	Evergreen orchards and groves
G3.4d	Mediterranean montane Cedrus woodland
G3.8	Pinus canariensis woodland
G3.9c	Macaronesian Juniperus woodland
G3.Dc	Larix sibirica bog woodland
G3.F	Highly artificial coniferous plantations

4.4 Description in a standard format of the revised EUNIS heathland, scrub and tundra habitat types

4.4.1 The existing EUNIS habitat text descriptions

From the start, the aim of a European habitat classification has been to provide a comprehensive and definitive reference list that is scientific, unambiguous and easily understood (Moss & Roy 1998, Moss 2008). To this end, an integral feature of the EUNIS Habitat Classification is the habitat text descriptions which are incorporated into the underlying database, accessible as an interface via the EUNIS website portal and available in the hard-copy download of the classification published as Davies *et al.* (2004).

Such text descriptions were not at first included for the CORINE Biotopes that were the forerunner of EUNIS, simply English language titles of the habitats (Internal Technical Handbook 1988, partially updated 1989, see Moss & Roy 1998). The later development of the CORINE Biotopes Manual (Devillers *et al.* 1991) included a descriptive text for each habitat, together with phytosociological and scientific references. When the classification was expanded to the whole Palaearctic, the published version of the classification (Devillers & Devillers-Terschuren 1996) did not include text descriptions, simply habitat codes and titles, but in 1995 these were added to the underlying PHYSIS database which had first been released the previous year.

The development of the existing text descriptions in the EUNIS Habitat Classification from earlier versions is detailed in Hill *et al.* (2004a, 2004b). The text descriptions are variable in length, detail and content: they often include some kind of general statement about the structure of the habitat, many mention particular characteristic species, sometimes highlighting endemic floras, and references to climatic, terrain and soil characteristics vary in detail and order, often being summarised using broad categories or terms.

There is a glossary appended to the EUNIS Habitats Classification (Davies *et al.* 2004, since been updated in 2006, version supplied by Doug Evans of the ETC-BD) and this has been derived from various sources, detailed in section 5.1.2 of this report, to be delivered in the next stage of the work. In fact, many of the terms in the Glossary, particularly more specific geographical and topographic terms, are redundant, never figuring in the text descriptions.

4.4.2 Other considerations and sources for describing European habitats

The Habitats Directive provides 'a common framework for the conservation of wild animal and plant species and natural habitats of Community importance'

(CEC 2003) and the definitions provided in the *Interpretation Manual of European Union Habitats* (European Commission 2013) include a text description derived from the CORINE Biotopes Manual (Devillers et al. 1991). For each priority habitat (and some non-priority habitats) in the EUR-12, this description was later incorporated into more formalised descriptive sheet which established 'clear, operational, scientific definitions of habitat types using pragmatic descriptive elements and taking into account regional variation' and a 'minimal interpretation' was provided for the remaining non-priority habitats based on CORINE. Text descriptions for new habitats and revisions of existing habitat definitions were made for EUR15, EUR25, EUR 27 and EUR28 with the accession of new countries in 1995, 2004, 2007 and 2013, mostly using the PHYSIS database which gives access to descriptions at EUNIS-4 and -5. Although there is a simple 1:1 correspondence between EUNIS-3 Heath, scrub and tundra types and Annex 1 habitats in only a minority of cases (21%), a further 24 heath and scrub types figure among the Annex 1 habitats and the information at these lower levels of equivalence could allow the often complex relationships between the remainder to be explored. Unlike the definitions of the EUNIS habitats, the interpretations of the Annex 1 habitats have acquired legislative force through the implementation of the Habitats Directive.

The Diversity of European Vegetation (Rodwell et al. 2002) established the idea of a simple descriptor for each alliance which included, as far as possible, standardised references to the vegetation type, the typical physiography and the geographical range, though these were not based on explicit standards nor summarised in a glossary. And the crosswalk to EUNIS-3 (Schaminée et al. 2012) enables such tags to be used to interpret those habitats. In the more ambitious EuroVegChecklist (Mucina et al. in press), such descriptors have been provided for the more comprehensive range of alliances using terminology summarised in a glossary appended to the typology. This has been compiled bottom-up from the definitions provided by contributors to the EuroVegChecklist, so no terms are redundant.

The current 'Red List of European Habitats' project funded by DG Environment uses as its typology a modified version of EUNIS at level 3 (Rodwell et al. 2013) which incorporates, with some further very minor modifications, the changes for heath, scrub and tundra habitats recommended in Schaminée et al. (2014). Discussions between the EEA, the ETC-BD and the Red List project team could from now on ensure that there is a harmonisation between the developing EUNIS-3 habitat typologies. Moreover, and very relevant to the current task of providing revised descriptions of EUNIS habitats is the fact that much more detailed Red List Habitat Definitions are being prepared by experts for the territorial assessments of extent and quality. These Definitions include an audit trail from EUNIS, a detailed text description, crosswalk to the EuroVegChecklist and other typologies, species lists and further details relevant to the character and status of habitats across Europe and images. Though they have not yet been edited into a standardised and harmonious format, we have been able to

draw upon these definitions for the current task of providing brief revised descriptions of heath, scrub and tundra habitats

4.4.3 Description in a standard format of the revised EUNIS Heath, scrub and tundra habitat types

Like the existing EUNIS habitat and Annex I habitat descriptions and the EuroVegChecklist descriptors, the Red List Habitat definitions sit rather lightly to the questions of explicit standardised terminology and parameter frames; and there are unresolved questions about the compatibility of terms in the various glossaries that are currently applied to the description of habitats. Furthermore, there is actually no accepted standard format for the description of a EUNIS habitat. Here we therefore provide only a provisional response to the challenge of what such brief descriptions should look like.

As with the work on woodland habitats provided in Schaminée (2014), what we would recommend is that the descriptions are regarded essentially as definitions: they should provide, as accurately, briefly and precisely as possible, the key distinguishing features of the habitat. They are not the place for small essays in ecology or status, particularly where the habitat is more recognisable. In general, the detail provided should reflect the variability in the habitat, not its richness or structural complexity.

The descriptions we provide have a roughly standardised shape:

- ▶ we have used the terms 'heath' and 'scrub' in the singular throughout;
- ▶ we include a general reference to the character of the vegetation but, with details of species composition now available through analysis of constituent relevés for the alliances of each habitat, we believe that there is no need to repeat this information in the description unless particular species are absolutely definitive;
- ▶ we mention vegetation structure or species-richness only when it is a diagnostic feature of the woodland type;
- ▶ we use non-technical terms as far as possible to describe terrain, soil types, altitudinal belts;
- ▶ we use the biogeographic zones from the Habitats Directive but otherwise avoid any specialised terminology to describe climatic relationships or broad geographical distribution.
- ▶ for the sake of simplicity, we have used lower case for the names of all regions, zones and belts, retaining them only for strictly geographic terms, like

the names of countries and seas, and omitted hyphens in such terms, except where they are split.

The new descriptions along with the originals are attached as Appendix E.

4.5 Maps of distribution of phytosociological relevés and probability of occurrence based on distribution models for each of the revised EUNIS heathland, scrub and tundra habitat types

4.5.1 Habitat suitability modelling

For the habitat suitability modelling, the widely used software Maxent for maximum entropy modelling of species' geographic distributions was used. Maxent is a general-purpose machine-learning method with a simple and precise mathematical formulation, and has a number of aspects that make it well-suited for species distribution modelling when only presence (occurrence) data but not absence data are available (Philips et al. 2006). Because EUNIS habitats have a particular species composition, they are assumed to respond to specific ecological requirements, allowing us to generate correlative estimates of geographic distributions. Modelling habitats that have been floristically defined is a well-known procedure for ecological modelling at local scales, and a promising technique to be applied also at the continental level.

The Maxent method considers presence data (known observations of a given entity) and the so-called background data. Background data comprise a set of points used to describe the environmental variation of the study area according to the available environmental layers. It is assumed that these layers represent well the most important ecological gradients on a European scale. These layers were selected from meaningful environmental predictors commonly used for modelling non-tropical plant and vegetation diversity, and are not mutually strongly correlated.

As environmental data (and their sources) the following climate and soil layers have been used:

- Potential Evapotranspiration
<http://www.cgiar-csi.org/data/global-aridity-and-pet-database>
- Solar radiation
<http://www.worldgrids.org/doku.php?id=wiki:inmsre3>
- Temperature Seasonality (standard deviation *100)
<http://www.worldclim.org/bioclim>

- Mean Temperature of Wettest Quarter
<http://www.worldclim.org/bioclim>
- Annual Precipitation
<http://www.worldclim.org/bioclim>
- Precipitation Seasonality (Coefficient of Variation)
<http://www.worldclim.org/bioclim>
- Precipitation of Warmest Quarter
<http://www.worldclim.org/bioclim>
- Distance to water (rivers, lakes, sea)
derived from the shapefile 'Inland_Waters.shp'
- Bulk density of the soil (kg/m³)
Hengl et al. 2014
- Cation Exchange Capacity of the soil
Hengl et al. 2014
- Weight in % of clay particles (<0.0002 mm)
Hengl et al. 2014
- Volume % of coarse fragments (> 2 mm)
Hengl et al. 2014
- Soil organic carbon content (‰)
Hengl et al. 2014
- Soil pH (water)
Hengl et al. 2014
- Weight in % of silt particles (0.0002-0.05 mm)
Hengl et al. 2014
- Weight in % of sand particles (0.05-2 mm)
Hengl et al. 2014

Compared with the habitat suitability models set up for the EUNIS forest types (Schaminée et al. 2014) we have now included 8 recently published soil parameters (Hengl et al 2014), instead of only one (soil pH).

Maxent is expected to perform well for estimating the geographic distribution of EUNIS habitats in Europe. However, as with any other modelling techniques this method is sensitive to sampling bias, i.e. when the spatial distribution of presence data is reflecting an unequal sampling effort in different geographic regions. In Maxent, it has been proposed that the best way to account for sampling bias (when bias is known or expected to occur) is to generate background data reflecting the same bias of the presence data. When a complete set of presence data is available, a general recommendation is to generate background points from the occurrences of other species/communities that were sampled in a similar way (Elith et al. 2011).

Two different approaches have been followed for the selection of a maximum of 5,000 locations for the background data, assuming biased and non-biased

presence data. For the first approach, 5,000 locations were randomly selected from the heathland, scrub and tundra plot pool, assuming that they reflect the general geographic bias of heathland, scrub and tundra sampling in Europe. The second approach concerns a random selection of 5,000 background points in the whole study area, assuming that the presence data describe a representative subset of the real distribution range of the target habitat.

In contrast to the suitability maps prepared for the EUNIS forest types (Schaminée et al 2014) we now excluded the eastern part of Europe (e.g. Russia, Ukraine), because the plot database shows large gaps in this region. Including this area would cause even more bias than there already is in the available data. An exception was made for F1.1 (Shrub tundra) because the optimal environmental conditions for this type are more or less restricted to the north-eastern part of Europe.

In Appendix I the preliminary results of the analysis are presented. The two modelling approaches (assuming biased and non-biased data) were evaluated for each of the EUNIS habitat types in order to estimate which assumption is more likely. This evaluation was based on the expert knowledge of the team members in the distribution of heathland, scrub and tundra types by assessing (i) the distribution of the available presence data as an estimate of geographic bias, (ii) the realism of the habitat suitability maps to reflect known distribution of heathland, scrub and tundra, and (iii) the environmental predictors that contribute most substantially to the models. The best performing model was then selected by consensus of the expert team for each habitat type. In the overview of EUNIS types on the first page of the Appendix, the preference for one of the two outputs is indicated in the column 'Background data pool used'.

For each EUNIS heathland, scrub and tundra type the following data are presented:

- A distribution map showing the location of the relevés that have been assigned to the EUNIS type concerned and therefore used as presence data.
- A habitat suitability map with colours varying from gray, through green to red, indicating increasingly favourable ecological conditions for the type (expressing the logistic output of the model between 0 and 1).
- AUC, or the Area Under the Curve, as a general estimate of model performance. This is the probability that the classifier correctly orders two points (a random positive example and a random negative example). In general, AUC values in the range 0.5-0.7 were considered low, 0.7-0.9 were moderate and >0.9 were high, suggesting poor, good and very good model performances, respectively. We provide two estimates of the AUC as calculated by Maxent. 'AUC training' reflects the internal fit between observed and predicted occurrences in the computed model. 'AUC test' provides the mean AUC obtained from a 10-fold cross-validation procedure in which ten different models were

computed with a random selection of 90% of data (calibration data set) and 10% for testing the model (validation data set).

- Contribution variables to the Maxent model (%). Indicates to what extent the environmental variables contribute to the model.

The habitat suitability maps will be further reviewed and processed in the ETC/BD Task 1.7.5.C: 'Ecosystem mapping and assessment' in which the maps will be further downscaled to the actual land cover situation.

Appendix E: Formal definitions of heathland, scrub and tundra habitat types used in the expert system

F11a Arctic-alpine ericoid heath

(<#TC Arctic-and-Arctic-alpine-ericoid-dwarf-shrubs GR #TC Vascular EXCEPT #TC Arctic-and-Arctic-alpine-ericoid-dwarf-shrubs> OR
(<#TC Lowland-to-alpine-heath-shrubs GR #TC Vascular EXCEPT #TC Lowland-to-alpine-heath-shrubs> AND ((<#TC Arctic-ericoid-dwarf-shrubs GR00> OR <#TC Arctic-acidophilous-herbs GR00>) OR (<#TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs GR00> OR <#TC Alpine-acidophilous-herbs GR00>))))
NOT ((<#TC Sphagnum GR25> OR <#TC Arctic-alpine-bryophytes-lichens GR #T\$>) OR <#TC Trees GR05>))

F11b Betula nana scrub

(<Betula nana GR50> AND <#TC Betula nana GR #TC Vascular EXCEPT #TC Betula nana>) NOT (<#TC Sphagnum GR25> OR (<Polytrichum commune GR25> OR (<#TC Trees GR10> OR <Molinia caerulea agg. GR00>)))

F12 Moss and lichen tundra

(<#TC Arctic-alpine-bryophytes-lichens GR #T\$> AND <#02 Arctic-alpine-bryophytes-lichens>) NOT (<#TC Sphagnum GR05> OR <#TC Trees GR05>)

F21 Subarctic and alpine dwarf Salix scrub

<#TC Arctic-alpine-dwarf-willows GR15> AND <#TC Arctic-alpine-dwarf-willows GR #TC Vascular EXCEPT #TC Arctic-alpine-dwarf-willows>

F22aa Alpine and subalpine ericoid heath - acidophilous rhododendron heath

(<#TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs GR25> AND <#TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs GR #TC Vascular EXCEPT #TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs>) NOT <#TC Trees GR05>

F22ab Alpine and subalpine ericoid heath - basiphilous ericoid heath (Ericion carneae and Aquilegio nigricantis-Rhododendron)

(<#TC Alpine-subalpine-basiphilous-ericoid-dwarf-shrubs GR25> AND <#TC Alpine-subalpine-basiphilous-ericoid-dwarf-shrubs GR #TC Vascular EXCEPT #TC Alpine-subalpine-basiphilous-ericoid-dwarf-shrubs>) NOT (<#TC Trees GR05> OR <Pinus mugo GR25>)

F22ac Alpine and subalpine ericoid heath - Dryas heath

<#TC Dryas GE #TC Vascular EXCEPT #TC Dryas>

F22b Alpine and subalpine Juniperus scrub

(<#TC Arctic-alpine-shrubby-junipers GR50> AND <#TC Arctic-alpine-shrubby-junipers GR #TC Shrubs EXCEPT #TC Arctic-alpine-shrubby-junipers>) NOT <#TC Trees GR05>

F22c Balkan subalpine genistoid scrub (Daphno oleoidis-Genistion radiatae)

(<Genista radiata GR25> AND <#TC Genista radiata GR #T\$>) NOT (<#TC Trees GR10> OR <#TC Shrubs GR25>)

F23a Subalpine deciduous scrub - not dominated by Salix

(<#TC Subalpine-deciduous-shrubs GR25> AND <#TC Subalpine-deciduous-shrubs GR #TC Shrubs EXCEPT #TC Subalpine-deciduous-shrubs>) NOT (<#TC Sphagnum GR25> OR <#TC Trees GR10>)

F23b Subalpine deciduous scrub - dominated by Salix

((<#TC Subalpine-shrubby-willows GR25> AND <#TC Subalpine-shrubby-willows GR #TC Shrubs EXCEPT #TC Subalpine-shrubby-willows>) OR ((<#TC Arctic-subalpine-shrubby-willows GR25> AND <#TC Arctic-subalpine-shrubby-willows GR #TC Shrubs EXCEPT #TC Arctic-subalpine-shrubby-willows>) AND <#TC Subalpine-shrubby-willows GR00>)) NOT (<#TC Sphagnum GR25> OR <#TC Trees GR10>)

F24 Subalpine Pinus mugo scrub

(<Pinus mugo GR25> AND <#TC Pinus mugo GR #TC Shrubs EXCEPT #TC Pinus mugo>) NOT ((<#TC Sphagnum GR25> OR <#TC Bog-herbs GR15>) OR <#TC Trees GR10>)

F31a Lowland to montane temperate and submediterranean Juniperus scrub

(<Juniperus communis subsp. communis GR25> AND <#TC Juniperus communis subsp. communis GR #TC Shrubs EXCEPT #TC Juniperus communis subsp. communis>) NOT <#TC Trees GR10>

F31ba Temperate Rubus scrub

(<#TC Temperate-Rubus GR50> OR <#TC Temperate-Rubus GR #T\$>) NOT <#TC Trees GR10>

F31ca Lowland to montane temperate genistoid scrub

((<#TC Temperate-genistoid-shrubs GR25> AND <#TC Temperate-genistoid-shrubs GR #TC Shrubs EXCEPT #TC Temperate-genistoid-shrubs>) AND <#TC Temperate-genistoid-shrubs GR #TC Atlantic-heath-shrubs|#TC Lowland-to-alpine-heath-shrubs>) NOT <#TC Trees GR10>

F31cb Lowland to montane Mediterranean genistoid scrub (Cytisetalia scopario-striati and Cytiso villosi-Telinetalia monspessulanae)

(<#TC Mediterranean-genistoid-shrubs GR50> AND <#TC Mediterranean-genistoid-shrubs GR #TC Shrubs EXCEPT #TC Mediterranean-genistoid-shrubs>) NOT <#TC Trees GR10>

F31d Balkan-Anatolian montane genistoid scrub

(<Genista lydia GR25> AND <#TC Genista lydia GR #T\$>) NOT (<#TC Trees GR10> OR <#TC Shrubs GR25>)

F31ea Temperate and submediterranean thorn scrub

(<#TC Temperate-submediterranean-deciduous-shrubs GR50> AND <#TC Temperate-submediterranean-deciduous-shrubs GR #TC Shrubs EXCEPT #TC Temperate-submediterranean-deciduous-shrubs>) NOT <#TC Trees GR10>

F31eb Mediterranean Rubus scrub

(<#TC Mediterranean-Rubus GR50> OR <#TC Mediterranean-Rubus GR #T\$>) NOT <#TC Trees GR10>

F31f Low steppic scrub

(<#TC Low-steppic-shrubs GR25> AND <#TC Low-steppic-shrubs GR #TC Shrubs|#TC Dwarf-shrubs EXCEPT #TC Low-steppic-shrubs>) NOT <#TC Trees GR10>

F31g Corylus avellana scrub

(<Corylus avellana GR50> AND <#TC Corylus avellana GR #TC Shrubs EXCEPT #TC Corylus avellana>) NOT <#TC Trees GR10>

F31h Temperate forest clearing scrub (Sambuco-Salicion capreae)

<#TC Forest-clearing-trees-and-shrubs GR50> AND <#TC Forest-clearing-trees-and-shrubs GR #TC Shrubs|#TC Trees EXCEPT #TC Forest-clearing-trees-and-shrubs>

F41 Wet heath

(<Erica tetralix GR25> AND <Erica tetralix GR #TC Atlantic-heath-shrubs|#TC Lowland-to-alpine-heath-shrubs>) NOT (<#TC Trees GR10> OR <#TC Shrubs GR10>)

F42a Atlantic dry heath

((<#TC Atlantic-heath-shrubs GR50> AND (<#TC Atlantic-heath-shrubs GR #TC Shrubs EXCEPT #TC Atlantic-heath-shrubs> AND <#TC Atlantic-heath-shrubs GR #TC Temperate-genistoid-shrubs>)) OR
(((<#TC Lowland-to-alpine-heath-shrubs GR50> AND <#TC Lowland-to-alpine-heath-shrubs GR #TC Shrubs EXCEPT #TC Lowland-to-alpine-heath-shrubs>))

AND <#TC Lowland-to-alpine-heath-shrubs GR #TC Temperate-genistoid-shrubs>) AND <#TC Atlantic-heath-shrubs GR00>)) NOT
(<#TC Sphagnum GR05> OR (<#TC Wet-heath-species GR05> OR <#TC Trees GR10>))

F42ba Subcontinental dry heath with Empetrum

((<#TC Lowland-to-alpine-heath-shrubs GR50> AND <#TC Lowland-to-alpine-heath-shrubs GR #TC Shrubs|#TC Dwarf-shrubs EXCEPT #TC Lowland-to-alpine-heath-shrubs>) AND <#TC Empetrum GR #TC Lowland-to-alpine-heath-shrubs EXCEPT #TC Empetrum>) NOT
(<#TC Alpine-acidophilous-herbs GR00> OR (<#TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs GR00> OR (<#TC Arctic-alpine-acidophilous-herbs GR00> OR (<#TC Arctic-alpine-bryophytes-lichens GR00> OR (<#TC Arctic-alpine-ericoid-dwarf-shrubs GR00> OR (<#TC Arctic-acidophilous-herbs GR00> OR (<#TC Arctic-ericoid-dwarf-shrubs GR00> OR (<#TC Atlantic-heath-shrubs GR00> OR (<#TC Bog-herbs GR00> OR (<#TC Wet-heath-species GR05> OR (<Juncus squarrosus GR00> OR (<#TC Sphagnum GR05> OR (<#TC Pinus mugo GR10> OR <#TC Trees GR10>))))))))))

F42bb Subcontinental dry heath without Empetrum

(<#TC Lowland-to-alpine-heath-shrubs GR50> AND <#TC Lowland-to-alpine-heath-shrubs GR #TC Shrubs|#TC Dwarf-shrubs EXCEPT #TC Lowland-to-alpine-heath-shrubs>) NOT
(<#TC Empetrum GR #TC Lowland-to-alpine-heath-shrubs EXCEPT #TC Empetrum> OR (<#TC Alpine-acidophilous-herbs GR00> OR (<#TC Alpine-subalpine-acidophilous-ericoid-dwarf-shrubs GR00> OR (<#TC Arctic-alpine-acidophilous-herbs GR00> OR (<#TC Arctic-alpine-bryophytes-lichens GR00> OR (<#TC Arctic-alpine-ericoid-dwarf-shrubs GR00> OR (<#TC Arctic-acidophilous-herbs GR00> OR (<#TC Arctic-ericoid-dwarf-shrubs GR00> OR (<#TC Atlantic-heath-shrubs GR00> OR (<#TC Bog-herbs GR00> OR (<#TC Wet-heath-species GR05> OR (<Juncus squarrosus GR00> OR (<#TC Sphagnum GR05> OR (<#TC Pinus mugo GR10> OR <#TC Trees GR10>))))))))))

F43 Macaronesian heath

(<#TC Macaronesian-dwarf-heath-shrubs GR50> AND <#TC Macaronesian-dwarf-heath-shrubs GR #TC Shrubs|#TC Dwarf-shrubs EXCEPT #TC Macaronesian-dwarf-heath-shrubs>) OR
(<Calluna vulgaris GR25> AND <Huperzia dentata GR00>)

F51 Mediterranean maquis and arborescent matorral

(<#TC Mesomediterranean-maquis-shrubs GR25> AND (<#TC Mesomediterranean-maquis-shrubs GR #TC Shrubs EXCEPT #TC Mesomediterranean-maquis-shrubs> AND <#TC Mesomediterranean-maquis-

shrubs GR #TC Thermomediterranean-maquis-shrubs>)) NOT <#TC Trees GR10>

F53 Submediterranean pseudomaquis

(((<#TC Mesomediterranean-maquis-shrubs GR20> OR <#TC Sclerophyllous-tree-Quercus GR05>) AND (<#TC Submediterranean-deciduous-shrubs GR20> OR <#TC Thermophilous-oak-forest-trees GR05>)) OR (<Buxus sempervirens GR50> AND <#TC Buxus sempervirens GR #TC Shrubs EXCEPT #TC Buxus sempervirens>)) NOT <#TC Trees GR10>

F54 Spartium junceum fields

<Spartium junceum GR50> AND <#TC Spartium junceum GR #TC Shrubs EXCEPT #TC Spartium junceum>

F55 Thermo-Mediterranean scrub

(<#TC Thermomediterranean-maquis-shrubs GR25> AND ((<#TC Thermomediterranean-maquis-shrubs GR #TC Shrubs EXCEPT #TC Thermomediterranean-maquis-shrubs> AND <#TC Thermomediterranean-maquis-shrubs GR #TC Mesomediterranean-maquis-shrubs>) AND <### Thermomediterranean-maquis-shrubs GR ### Mesomediterranean-maquis-shrubs>)) NOT <#TC Trees GR10>

F61a Western basiphilous garrigue

(((<#TC W-basic-garrigue-shrubs GR25> AND <#TC W-basic-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC W-basic-garrigue-shrubs>) OR ((<#TC Pan-Mediterranean-basic-garrigue-shrubs GR25> AND <#TC Pan-Mediterranean-basic-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC Pan-Mediterranean-basic-garrigue-shrubs>) AND (<#03 W-basic-garrigue-herbs> AND <### W-basic-garrigue-herbs GR ### E-garrigue-herbs>))) NOT (<#TC Phrygana-shrubs GR00> OR <#TC Trees GR10>)

F61b Western acidophilous garrigue

(((<#TC W-acidic-garrigue-shrubs GR25> AND <#TC W-acidic-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC W-acidic-garrigue-shrubs>) OR ((<#TC Pan-Mediterranean-acidic-garrigue-shrubs GR25> AND <#TC Pan-Mediterranean-acidic-garrigue-shrubs GR25 GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC Pan-Mediterranean-acidic-garrigue-shrubs>) AND <#03 W-acidic-garrigue-herbs>))) NOT (<#TC Phrygana-shrubs GR00> OR <#TC Trees GR10>)

F62 Eastern garrigue

((<#TC E-garrigue-shrubs GR25> AND <#TC E-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC E-garrigue-shrubs>) OR
(((<#TC Pan-Mediterranean-acidic-garrigue-shrubs GR25> AND <#TC Pan-Mediterranean-acidic-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC Pan-Mediterranean-acidic-garrigue-shrubs>) AND <#03 E-garrigue-herbs>) OR
(((<#TC Pan-Mediterranean-basic-garrigue-shrubs GR25> AND <#TC Pan-Mediterranean-basic-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC Pan-Mediterranean-basic-garrigue-shrubs>) AND <#03 E-garrigue-herbs>)))
NOT <#TC Trees GR10>

F66 Supra-Mediterranean garrigue

(<#TC Supramediterranean-garrigue-shrubs GR25> AND <#TC Supramediterranean-garrigue-shrubs GR #TC Garrigue-phrygana-shrubs|#TC Mediterranean-genistoid-shrubs|#TC Shrubs|#TC Graminoids EXCEPT #TC Supramediterranean-garrigue-shrubs>) NOT <#TC Trees GR10>

F67 Mediterranean gypsum scrub

(<#TC Gypsophilous-dwarf-shrubs GR10> OR
(((<#TC W-basic-garrigue-shrubs GR25> OR <#TC Pan-Mediterranean-basic-garrigue-shrubs GR25>) AND <#03 Gypsophilous-herbs>))
NOT (<#TC Trees GR05> OR <#TC Shrubs GR05>)

F68a Mediterranean halo-nitrophilous scrub (Pegano harmalae-Salsotea vermiculatae)

((<#TC Mediterranean-xero-halophile-scrub-species GR10> AND <#TC Mediterranean-xero-halophile-scrub-species GR #T\$>) AND (<### Mediterranean-xero-halophile-scrub-species GE ### Caspian-xero-halophile-scrub-species>)) NOT <#TC Trees GR10>

F68b Caspian halo-nitrophilous scrub (Artemisietea lerchianae)

((<#TC Caspian-xero-halophile-scrub-species GR10> AND <#TC Caspian-xero-halophile-scrub-species GR #T\$>) AND (<### Caspian-xero-halophile-scrub-species GR ### Mediterranean-xero-halophile-scrub-species>)) NOT <#TC Trees GR10>

F68c Macaronesian-African halo-nitrophilous scrub (Polycarpaeo niveae-Traganetia moquinii)

(<#TC Macaronesian-xero-halophile-scrub-species GR10> AND <#TC Macaronesian-xero-halophile-scrub-species GR #T\$>) NOT <#TC Trees GR10>

F71 Western Mediterranean spiny heath

(<#TC W-Mediterranean-coastal-spiny-shrubs GR25> AND <#TC W-Mediterranean-coastal-spiny-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs EXCEPT #TC W-Mediterranean-coastal-spiny-shrubs>) NOT <#TC Trees GR10>

F73 Eastern Mediterranean spiny heath (phrygana)

(<#TC Phrygana-shrubs GR25> AND <#TC Phrygana-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs EXCEPT #TC Phrygana-shrubs>) NOT <#TC Trees GR10>

F74a Western Mediterranean mountain hedgehog-heath

(<#TC W-Mediterranean-mountain-thorny-cushion-shrubs GR25> AND <#TC W-Mediterranean-mountain-thorny-cushion-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs>) NOT <#TC Trees GR10>

F74b Central Mediterranean mountain hedgehog-heath

(<#TC C-Mediterranean-mountain-thorny-cushion-shrubs GR25> AND <#TC C-Mediterranean-mountain-thorny-cushion-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs>) NOT <#TC Trees GR10>

F74c Eastern Mediterranean mountain hedgehog-heath

(<#TC E-Mediterranean-mountain-thorny-cushion-shrubs GR25> AND <#TC E-Mediterranean-mountain-thorny-cushion-shrubs GR #TC Shrubs|#TC Dwarf-shrubs|#TC Garrigue-phrygana-shrubs>) NOT <#TC Trees GR10>

F74d Canarian mountain hedgehog-heath (Spartocytisetea supranubii)

<#TC Teide-summit-plants GR #T\$>

F81 Canarian xerophytic scrub

(<#TC Canarian-xerophytic-scrub-species GR20> AND <#TC Canarian-xerophytic-scrub-species GR #TC Madeiran-xerophytic-scrub-species>) NOT <#TC Trees GR10>

F82 Madeiran xerophytic scrub

(<#TC Madeiran-xerophytic-scrub-species GR20> AND <#TC Madeiran-xerophytic-scrub-species GR #TC Canarian-xerophytic-scrub-species>) NOT <#TC Trees GR10>

F91a Arctic, boreal and alpine riparian scrub

((<#TC Arctic-shrubby-willows GR50> AND <#TC Arctic-shrubby-willows GR #TC Shrubs EXCEPT #TC Arctic-shrubby-willows>) OR

(<#TC Arctic-subalpine-shrubby-willows GR50> AND <#TC Arctic-subalpine-shrubby-willows GR #TC Shrubs EXCEPT #TC Arctic-subalpine-shrubby-willows>))
NOT (<#TC Sphagnum GR25> OR <#TC Trees GR10>)

F91b Temperate riparian scrub

(<#TC Temperate-riparian-shrubs GR50> AND <#TC Temperate-riparian-shrubs GR #TC Shrubs EXCEPT #TC Temperate-riparian-shrubs>) NOT ((<#TC Mediterranean-riparian-shrubs GR00> OR <#TC Mediterranean-Rubus GR00>) OR <#TC Trees GR10>)

F91c Submediterranean riparian scrub

(<#TC Submediterranean-riparian-willows GR50> AND <#TC Submediterranean-riparian-willows GR #TC Shrubs EXCEPT #TC Submediterranean-riparian-willows>) NOT <#TC Trees GR10>

F92 Salix carr and fen scrub

(<#TC Temperate-fen-shrubs GR50> AND <#TC Temperate-fen-shrubs GR #TC Shrubs EXCEPT #TC Temperate-fen-shrubs>) NOT <#TC Trees GR10>

F93 Mediterranean riparian scrub

(<#TC Mediterranean-riparian-shrubs GR50> AND <#TC Mediterranean-riparian-shrubs GR #TC Shrubs EXCEPT #TC Mediterranean-riparian-shrubs>) NOT <#TC Trees GR10>

Appendix F: Lists of indicator species of the revised EUNIS heathland, scrub, and tundra habitat types

B1.5a - Atlantic and Baltic coastal Empetrum heath

*Diagnostic species (phi coefficient * 100)*

Empetrum nigrum	75.3	Carex arenaria	61.3
Salix repens	56.2	Hypnum jutlandicum	55.9
Dicranum scoparium	44.7	Cladonia portentosa	39.6
Polypodium vulgare	39.1	Carex trinervis	38.8
Hieracium umbellatum	37.3	Ammophila arenaria	36.3
Cladonia chlorophaea	32.7	Festuca filiformis	31.8
Hypogymnia physodes	31.0	Lophocolea bidentata	26.1
Cladonia furcata	25.6	Calamagrostis epigejos	24.9
Erica tetralix	24.7	Palmogloea protuberans	22.9
Calluna vulgaris	22.4	Pseudoscleropodium purum	19.6
Cladonia ramulosa	18.9	Viola canina	18.8
Rosa pimpinellifolia	18.8	Pleurozium schreberi	18.8
Vaccinium macrocarpon	17.5	Cladonia ciliata	16.8
Cladonia pocillum	15.8	Cladonia glauca	15.5

Constant species (occurrence frequencies)

Empetrum nigrum	100.0	Carex arenaria	93.0
Dicranum scoparium	88.0	Salix repens	69.0
Hypnum jutlandicum	67.0	Calluna vulgaris	58.0
Hieracium umbellatum	55.0	Ammophila arenaria	50.0
Polypodium vulgare	49.0	Calamagrostis epigejos	48.0
Cladonia portentosa	36.0	Pseudoscleropodium purum	35.0
Pleurozium schreberi	35.0	Erica tetralix	35.0
Lotus corniculatus	33.0	Lophocolea bidentata	30.0
Viola canina	27.0	Hypnum cupressiforme	27.0
Festuca filiformis	26.0	Hypochaeris radicata	25.0
Luzula campestris	24.0	Cladonia chlorophaea	24.0
Carex trinervis	24.0	Cladonia furcata	23.0
Hypogymnia physodes	22.0	Veronica officinalis	15.0
Potentilla erecta	15.0	Holcus lanatus	15.0
Festuca rubra	15.0	Rosa pimpinellifolia	14.0
Poa pratensis	14.0	Molinia caerulea agg.	14.0
Galium verum	12.0	Anthoxanthum odoratum	11.0
Lonicera periclymenum	10.0	Kindbergia praelonga	10.0
Jasione montana	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Empetrum nigrum	100.0	Hypnum jutlandicum	29.0
Dicranum scoparium	12.0	Pleurozium schreberi	8.0
Calluna vulgaris	8.0		

B1.5b - Atlantic coastal Calluna and Ulex heath

*Diagnostic species (phi coefficient * 100)*

Carex arenaria	52.9	Cladonia portentosa	51.0
Empetrum nigrum	50.1	Hypnum jutlandicum	44.4
Dicranum scoparium	39.4	Salix repens	37.1
Festuca filiformis	34.9	Carex trinervis	34.9
Hypogymnia physodes	34.8	Calluna vulgaris	34.1
Cladonia glauca	31.6	Cladonia chlorophaea	30.0
Cladonia ciliata	27.3	Palmogloea protuberans	26.1
Genista anglica	22.8	Erica tetralix	22.3
Rosa pimpinellifolia	20.0	Erica cinerea	20.0
Pleurozium schreberi	18.6	Campylopus introflexus	18.6
Cladonia arbuscula	17.9	Cladonia floerkeana	17.7
Ammophila arenaria	17.7	Hypnum cupressiforme	16.9
Erica scoparia	16.2	Orthodontium lineare	15.8
Cladonia gracilis	15.8	Cladonia grayi	15.4

Constant species (occurrence frequencies)

Calluna vulgaris	87.0	Carex arenaria	78.0
Dicranum scoparium	77.0	Empetrum nigrum	59.0
Hypnum jutlandicum	51.0	Cladonia portentosa	50.0
Salix repens	42.0	Hypnum cupressiforme	36.0
Pleurozium schreberi	34.0	Erica tetralix	31.0
Festuca filiformis	30.0	Hypogymnia physodes	25.0
Ammophila arenaria	23.0	Pseudoscleropodium purum	22.0
Cladonia chlorophaea	22.0	Carex trinervis	21.0
Calamagrostis epigejos	21.0	Erica cinerea	20.0
Luzula campestris	19.0	Hypochaeris radicata	17.0
Cladonia glauca	17.0	Potentilla erecta	16.0
Lotus corniculatus	16.0	Hieracium umbellatum	16.0
Festuca ovina	16.0	Cladonia arbuscula	16.0
Rosa pimpinellifolia	15.0	Genista anglica	15.0
Agrostis capillaris	15.0	Polypodium vulgare	14.0
Rubia peregrina	11.0	Festuca rubra	11.0
Cladonia furcata	11.0	Cladonia ciliata	11.0
Ulex europaeus	10.0	Erica scoparia	10.0
Cladonia gracilis	10.0	Campylopus introflexus	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Calluna vulgaris	74.0	Empetrum nigrum	32.0
Hypnum jutlandicum	18.0	Erica cinerea	12.0
Dicranum scoparium	12.0	Hypnum cupressiforme	11.0
Cladonia portentosa	8.0	Erica scoparia	7.0

B1.6a - Atlantic and Baltic coastal dune scrub

*Diagnostic species (phi coefficient * 100)*

Salix repens	74.0	Carex trinervis	44.9
Hippophae rhamnoides	40.4	Hydrocotyle vulgaris	35.4
Calamagrostis epigejos	33.5	Rubus caesius	28.3
Epipactis palustris	27.4	Carex arenaria	26.7
Mentha aquatica	23.2	Festuca filiformis	21.6
Liparis loeselii	19.8	Gentianella amarella	19.6
Pyrola rotundifolia	19.1	Dactylorhiza incarnata	19.0
Juncus gerardi	18.9	Juncus anceps	18.9
Euphrasia stricta	18.6	Calliergonella cuspidata	17.2
Cynoglossum officinale	16.4	Vaccinium macrocarpon	15.6
Leontodon taraxacoides	15.6	Taraxacum sect. Erythrosperma	15.5

Constant species (occurrence frequencies)

Salix repens	94.0	Calamagrostis epigejos	64.0
Rubus caesius	52.0	Hydrocotyle vulgaris	48.0
Mentha aquatica	47.0	Agrostis stolonifera	43.0
Poa pratensis	40.0	Calliergonella cuspidata	39.0
Festuca rubra	38.0	Carex arenaria	36.0
Galium palustre	34.0	Lotus corniculatus	33.0
Prunella vulgaris	32.0	Juncus articulatus	32.0
Holcus lanatus	32.0	Carex flacca	31.0
Epipactis palustris	30.0	Trifolium repens	28.0
Potentilla anserina	28.0	Carex trinervis	28.0
Pseudoscleropodium purum	27.0	Hippophae rhamnoides	27.0
Luzula campestris	25.0	Galium verum	25.0
Ranunculus flammula	24.0	Hypnum cupressiforme	24.0
Cardamine pratensis	23.0	Carex nigra	22.0
Juncus gerardi	21.0	Carex panicea	21.0
Phragmites australis	20.0	Galium uliginosum	20.0
Parnassia palustris	19.0	Euphrasia stricta	19.0
Crataegus monogyna	19.0	Senecio jacobaea	18.0
Ranunculus repens	18.0	Ligustrum vulgare	18.0
Leontodon taraxacoides	18.0	Eupatorium cannabinum	18.0
Brachythecium rutabulum	18.0	Salix cinerea	17.0
Dicranum scoparium	17.0	Vicia cracca	16.0
Veronica officinalis	16.0	Festuca filiformis	16.0
Eleocharis palustris	16.0	Dactylorhiza incarnata	16.0
Linum catharticum	15.0	Urtica dioica	14.0
Potentilla erecta	14.0	Galium mollugo	14.0
Viola hirta	13.0	Thymus pulegioides	13.0
Rhamnus catharticus	13.0	Potentilla reptans	13.0
Avenula pubescens	13.0	Koeleria macrantha	12.0
Carex viridula	12.0	Viola canina	11.0
Taraxacum sect. Erythrosperma	11.0	Pyrola rotundifolia	11.0
Cirsium palustre	11.0	Cirsium arvense	11.0

Carex disticha	11.0	Polygala vulgaris	10.0
Lycopus europaeus	10.0	Cynoglossum officinale	10.0
Ceratodon purpureus	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Salix repens	89.0	Calliergonella cuspidata	27.0
Salix cinerea	9.0	Rubus caesius	7.0
Pseudoscleropodium purum	5.0	Festuca filiformis	5.0

B1.6b - Mediterranean and Black Sea coastal dune scrub

*Diagnostic species (phi coefficient * 100)*

Juniperus oxycedrus	59.3	Smilax aspera	54.7
Asparagus acutifolius	54.4	Spartium junceum	48.7
Phillyrea angustifolia	47.2	Rubia peregrina	46.2
Daphne gnidium	44.1	Pinus pinaster	42.5
Lonicera implexa	41.7	Rhamnus alaternus	38.8
Dorycnium hirsutum	38.4	Cistus incanus	38.1
Cutandia divaricata	36.5	Pistacia lentiscus	35.8
Ephedra fragilis	34.8	Periploca graeca	33.7
Clematis flammula	32.8	Prasium majus	32.6
Launaea fragilis	31.4	Seseli tortuosum	31.0
Centaurea sphaerocephala	28.7	Teucrium flavum	27.0
Arbutus unedo	22.7	Scrophularia trifoliata	21.4
Rosa sempervirens	20.8	Helianthemum sessiliflorum	20.8
Limonium divaricatum	20.7	Panocratium maritimum	19.4
Phillyrea latifolia	19.2	Rubus ulmifolius	18.2
Ononis natrix	17.4	Helichrysum stoechas	17.1
Carpobrotus acinaciformis	15.6	Quercus ilex	15.4

Constant species (occurrence frequencies)

Juniperus oxycedrus	72.0	Rubia peregrina	71.0
Asparagus acutifolius	69.0	Smilax aspera	63.0
Phillyrea angustifolia	42.0	Spartium junceum	39.0
Pistacia lentiscus	38.0	Daphne gnidium	38.0
Lonicera implexa	36.0	Rhamnus alaternus	33.0
Pinus pinaster	32.0	Cistus incanus	32.0
Dorycnium hirsutum	27.0	Clematis flammula	25.0
Rubus ulmifolius	23.0	Prasium majus	22.0
Seseli tortuosum	20.0	Arbutus unedo	18.0
Quercus ilex	17.0	Phillyrea latifolia	17.0
Panocratium maritimum	17.0	Hedera helix	16.0
Teucrium flavum	15.0	Helichrysum stoechas	15.0
Ephedra fragilis	15.0	Cutandia divaricata	15.0
Periploca graeca	14.0	Rosa sempervirens	12.0
Ononis natrix	12.0	Launaea fragilis	12.0
Centaurea sphaerocephala	12.0	Eryngium maritimum	11.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Juniperus oxycedrus	59.0	Phillyrea angustifolia	28.0
Spartium junceum	18.0	Smilax aspera	17.0
Salix cinerea	8.0	Rubia peregrina	6.0

F1.1 - Shrub tundra

*Diagnostic species (phi coefficient * 100)*

Empetrum nigrum subsp. hermaphroditum	61.6	Cladonia amaurocraea	55.9
Cassiope tetragona	55.7	Cetraria nivalis	55.2
Betula nana	51.6	Aulacomnium turgidum	49.9
Pedicularis lapponica	49.5	Salix polaris	47.2
Cetraria cucullata	46.8	Vaccinium uliginosum	46.2
Thamnolia vermicularis	45.4	Stereocaulon paschale	45.0
Cetraria ericetorum	42.6	Sphaerophorus globosus	41.8
Sphenobolus minutus	39.4	Rubus chamaemorus	39.3
Carex rariflora	38.8	Cladonia arbuscula	38.3
Nephroma arcticum	37.9	Cladonia stellaris	36.7
Cladonia uncialis	36.6	Dicranum elongatum	36.4
Cladonia gracilis	35.6	Dicranum fuscescens	35.2
Cladonia mitis	35.1	Ptilidium ciliare	33.2
Polytrichum strictum	33.2	Cetraria islandica	33.1
Salix nummularia	32.9	Ochrolechia frigida	32.7
Peltigera scabrosa	32.5	Pannaria pezizoides	32.4
Cephalozia ambigua	32.4	Draba subcapitata	32.3
Bryocaulon divergens	32.2	Barbilophozia binstaedii	32.1
Arctostaphylos alpinus	31.5	Polytrichum hyperboreum	31.1
Psoroma hypnorum	30.9	Dicranum spadiceum	30.9
Cladonia ecmocyna	29.9	Peltigera leucophlebia	29.8
Poa arctica	29.7	Pohlia cruda	29.5
Barbilophozia hatcheri	29.0	Cardamine bellidifolia	28.6
Phyllodoce caerulea	28.5	Loiseleuria procumbens	28.4
Mylia anomala	27.5	Alectoria nigricans	27.5
Distichium capillaceum	26.6	Vaccinium microcarpum	25.9
Blepharostoma trichophyllum	25.9	Carex rupestris	25.6
Cladonia rangiferina	25.2	Oxyria digyna	24.9
Cornus suecica	24.5	Ledum palustre	23.8
Cnestrum glaucescens	23.5	Peltolepis quadrata	23.4
Rinodina mniaraea	23.0	Kiaeria blyttii	23.0
Platydictya jungermannioides	22.9	Peltigera lepidophora	22.9
Tetraplodon mnioides	22.8	Physconia muscigena	22.8
Orthothecium strictum	22.7	Racomitrium microcarpon	22.6
Cyrtomnium hymenophyllum	22.6	Orthocaulis kunzeanus	22.4
Leiocolea heterocolpos	22.4	Hierochloa alpina	22.4
Solorina bispora	22.3	Encalypta alpina	22.3

Tanacetum bipinnatum	22.2	Cladonia macrophylla	22.1
Encalypta rhamnoides	21.9	Pedicularis hirsuta	21.5
Petasites frigidus	21.4	Polygonum viviparum	21.3
Ranunculus sulphureus	21.2	Stellaria longipes	21.1
Myurella julacea	21.1	Brachythecium turgidum	21.0
Cladonia subcervicornis	20.9	Cassiope hypnoides	20.9
Icmadophila ericetorum	20.8	Hylocomium splendens	20.8
Dicranella cerviculata	20.8	Bartramia ithyphylla	20.8
Orthothecium chryseon	20.7	Cladonia verticillata	20.7
Silene acaulis	20.6	Anastrophyllum minutum	20.5
Odontoschisma elongatum	20.4	Equisetum scirpoides	20.4
Cephalozia pleniceps	20.4	Stereocaulon alpinum	20.3
Tortella fragilis	20.1	Luzula arctica	20.1
Carex fuliginosa	20.1	Lophozia wenzelii	19.9
Saxifraga oppositifolia	19.5	Saxifraga cernua	19.5
Cerastium nigrescens	19.1	Anthelia juratzkana	18.9
Cladonia coccifera	18.7	Calypogeia neesiana	18.6
Luzula confusa	18.0	Carex rotundata	18.0
Mnium marginatum	17.9	Oncophorus virens	17.1
Cladonia mediterranea	17.0	Cladonia chlorophaea	16.9
Pinguicula vulgaris	16.5	Meesia uliginosa	16.5
Polytrichum juniperinum	16.4	Cladonia deformis	16.4
Oncophorus wahlenbergii	16.3	Carex bigelowii	16.2
Tomentypnum nitens	15.9	Peltigera aphthosa	15.5
Dryas octopetala	15.3	Corallorhiza trifida	15.3

Constant species (occurrence frequencies)

Vaccinium uliginosum	67.0	Empetrum nigrum subsp. hermaphroditum	61.0
Betula nana	50.0	Hylocomium splendens	39.0
Cladonia arbuscula	39.0	Cetraria nivalis	39.0
Rubus chamaemorus	33.0	Polytrichum strictum	33.0
Cladonia uncialis	33.0	Cladonia amaurocraea	33.0
Cetraria islandica	33.0	Cassiope tetragona	33.0
Vaccinium vitis-idaea	28.0	Thamnolia vermicularis	28.0
Salix polaris	28.0	Ptilidium ciliare	28.0
Polygonum viviparum	28.0	Pedicularis lapponica	28.0
Dicranum scoparium	28.0	Cladonia gracilis	28.0
Cetraria cucullata	28.0	Aulacomnium turgidum	28.0
Sphaerophorus globosus	22.0	Stereocaulon paschale	22.0
Pleurozium schreberi	22.0	Festuca ovina	22.0
Dicranum fuscescens	22.0	Cladonia rangiferina	22.0
Cladonia mitis	22.0	Cetraria ericetorum	22.0
Carex rariflora	22.0	Vaccinium microcarpum	17.0
Sphenobolus minutus	17.0	Silene acaulis	17.0
Polytrichum juniperinum	17.0	Pinguicula vulgaris	17.0
Ochrolechia frigida	17.0	Nephroma arcticum	17.0
Mylia anomala	17.0	Loiseleuria procumbens	17.0

Ledum palustre	17.0	Dicranum elongatum	17.0
Cladonia stellaris	17.0	Arctostaphylos alpinus	17.0
Andromeda polifolia	17.0	Vaccinium myrtillus	11.0
Tomentypnum nitens	11.0	Saxifraga oppositifolia	11.0
Salix nummularia	11.0	Psoroma hypnorum	11.0
Polytrichum hyperboreum	11.0	Polytrichum commune	11.0
Pohlia cruda	11.0	Poa arctica	11.0
Phyllodoce caerulea	11.0	Peltigera scabrosa	11.0
Peltigera leucophlebia	11.0	Pannaria pezizoides	11.0
Oxyria digyna	11.0	Eriophorum vaginatum	11.0
Equisetum arvense	11.0	Empetrum nigrum	11.0
Dryas octopetala	11.0	Draba subcapitata	11.0
Distichium capillaceum	11.0	Dicranum spadiceum	11.0
Cornus suecica	11.0	Cladonia chlorophaea	11.0
Cladonia ecmocyna	11.0	Cladonia coccifera	11.0
Cephalozia ambigua	11.0	Carex rupestris	11.0
Carex bigelowii	11.0	Cardamine bellidifolia	11.0
Bryocaulon divergens	11.0	Blepharostoma trichophyllum	11.0
Bartsia alpina	11.0	Barbilophozia hatcheri	11.0
Barbilophozia binstaedii	11.0	Alectoria nigricans	11.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Empetrum nigrum subsp. hermaphroditum	44.0	Pleurozium schreberi	11.0
Empetrum nigrum	11.0	Cassiope tetragona	11.0
Stereocaulon paschale	6.0	Rubus chamaemorus	6.0
Ptilidium ciliare	6.0	Ochrolechia frigida	6.0
Drepanocladus uncinatus	6.0	Cladonia arbuscula	6.0
Aulacomnium palustre	6.0	Arctostaphylos alpinus	6.0

F1.2 - Moss and lichen tundra

*Diagnostic species (phi coefficient * 100)*

Salix polaris	66.3	Dryas octopetala	59.2
Cerastium nigrescens	47.3	Empetrum nigrum subsp. hermaphroditum	46.7
Cladonia stellaris	46.4	Cetraria cucullata	43.9
Cetraria nivalis	41.7	Orthocaulis kunzeanus	40.0
Betula nana	37.7	Saxifraga oppositifolia	36.9
Pedicularis lapponica	36.9	Luzula confusa	36.7
Dicranum elongatum	36.3	Cladonia rangiferina	35.6
Sphaerophorus globosus	35.0	Ochrolechia frigida	32.6
Carex bigelowii	32.3	Rubus chamaemorus	31.2
Ptilidium ciliare	30.4	Ranunculus affinis	28.7
Draba nivalis	28.7	Draba cinerea	28.7
Silene uralensis	28.6	Taraxacum brachyceras	28.5
Polemonium boreale	28.4	Puccinellia vahlana	28.3

Comastoma tenellum	28.2	Draba lactea	28.0
Dicranum flexicaule	27.6	Barbilophozia binstaedii	27.5
Saxifraga nivalis	27.2	Cladonia subfurcata	26.9
Stellaria longipes	26.7	Polytrichum hyperboreum	26.3
Trisetum spicatum	26.2	Equisetum scirpoides	26.1
Anastrophyllum minutum	26.1	Luzula arctica	25.8
Carex fuliginosa	25.8	Saxifraga cespitosa	25.6
Cladonia amaurocraea	25.5	Cassiope tetragona	25.4
Polygonum viviparum	25.3	Cladonia ecmocyna	25.0
Poa arctica	24.8	Vaccinium uliginosum	24.7
Alectoria ochroleuca	23.6	Alectoria nigricans	22.6
Oncophorus wahlenbergii	22.0	Carex rupestris	20.7
Carex rariflora	19.0	Cladonia arbuscula	18.2
Carex aquatilis	18.0	Salix lapponum	17.6
Polytrichum juniperinum	16.4	Linnaea borealis	16.2
Loiseleuria procumbens	16.1	Cladonia mitis	16.1
Cephalozia bicuspidata	15.7		

Constant species (occurrence frequencies)

Dryas octopetala	58.0	Salix polaris	50.0
Empetrum nigrum subsp. hermaphroditum	42.0	Vaccinium uliginosum	33.0
Polygonum viviparum	33.0	Cladonia rangiferina	33.0
Betula nana	33.0	Saxifraga oppositifolia	25.0
Rubus chamaemorus	25.0	Ptilidium ciliare	25.0
Cladonia stellaris	25.0	Cetraria nivalis	25.0
Cetraria cucullata	25.0	Cerastium nigrescens	25.0
Carex bigelowii	25.0	Sphaerophorus globosus	17.0
Vaccinium vitis-idaea	17.0	Polytrichum juniperinum	17.0
Pedicularis lapponica	17.0	Orthocaulis kunzeanus	17.0
Ochrolechia frigida	17.0	Luzula confusa	17.0
Dicranum elongatum	17.0	Cladonia arbuscula	17.0
Campanula rotundifolia	17.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Empetrum nigrum subsp. hermaphroditum	25.0	Cladonia stellaris	25.0
Racomitrium lanuginosum	8.0	Cetraria nivalis	8.0
Betula nana	8.0		

F2.1 - Subarctic and alpine dwarf Salix scrub

*Diagnostic species (phi coefficient * 100)*

Salix herbacea	57.5	Salix retusa	50.5
Polygonum viviparum	39.3	Gnaphalium supinum	38.4
Salix reticulata	35.7	Saxifraga androsacea	34.7
Silene acaulis	34.4	Poa alpina	33.6

Sibbaldia procumbens	32.6	Veronica alpina	31.2
Ranunculus alpestris	30.9	Pritzelago alpina	30.0
Veronica aphylla	27.1	Potentilla brauniana	26.1
Salix serpyllifolia	25.8	Soldanella alpina	25.3
Myosotis alpestris	25.2	Saxifraga oppositifolia	24.5
Carex foetida	23.8	Salix polaris	23.2
Luzula alpinopilosa	23.2	Anthelia juratzkana	23.0
Conostomum tetragonum	22.0	Kiaeria starkei	21.8
Bartsia alpina	21.5	Galium noricum	21.4
Androsace carnea	20.9	Alchemilla pentaphyllea	20.7
Sedum alpestre	20.6	Gentiana verna	20.4
Festuca quadriflora	20.4	Kobresia myosuroides	20.3
Polytrichastrum sexangulare	20.1	Cardamine bellidifolia	20.0
Minuartia sedoides	19.9	Aulacomnium turgidum	19.7
Dactylina arctica	19.0	Achillea atrata	18.9
Cladonia bellidiflora	18.8	Gnaphalium hoppeanum	18.3
Moehringia ciliata	18.2	Gymnomitrium concinnatum	18.1
Sanionia uncinata	17.9	Festuca glacialis	17.9
Sagina saginoides	17.8	Pedicularis verticillata	17.7
Polytrichastrum alpinum	17.6	Luzula arctica	17.5
Cerastium cerastoides	17.4	Alopecurus gerardii	17.4
Alopecurus alpinus	17.4	Oligotrichum hercynicum	17.0
Leucanthemopsis alpina	17.0	Thamnotia vermicularis	16.8
Psoroma hypnorum	16.6	Plantago alpina	16.6
Arabis bellidifolia	16.6	Taraxacum sect. Alpina	16.5
Juncus trifidus subsp. monanthos	16.3	Gentiana brachyphylla	16.1
Cetraria cucullata	16.0	Arenaria ciliata	16.0
Gentiana bavarica	15.7	Festuca violacea	15.7
Parmelia skultii	15.4	Armeria alpina	15.4
Luzula confusa	15.3	Stereocaulon rivulorum	15.2
Lophozia sudetica	15.2	Salix alpina	15.1
Dicranum spadiceum	15.1		

Constant species (occurrence frequencies)

Polygonum viviparum	53.0	Salix herbacea	50.0
Poa alpina	41.0	Salix retusa	37.0
Silene acaulis	30.0	Gnaphalium supinum	25.0
Salix reticulata	23.0	Soldanella alpina	19.0
Bartsia alpina	19.0	Veronica alpina	17.0
Sibbaldia procumbens	17.0	Ranunculus alpestris	17.0
Myosotis alpestris	17.0	Carex nigra	16.0
Saxifraga androsacea	15.0	Gentiana verna	15.0
Saxifraga oppositifolia	14.0	Pritzelago alpina	14.0
Luzula alpinopilosa	13.0	Campanula scheuchzeri	12.0
Aster bellidiastrium	12.0	Veronica aphylla	11.0
Salix serpyllifolia	11.0	Minuartia sedoides	11.0
Festuca quadriflora	11.0	Dryas octopetala	11.0
Cetraria islandica	11.0	Selaginella selaginoides	10.0

Polytrichastrum alpinum	10.0	Plantago alpina	10.0
Leucanthemopsis alpina	10.0	Homogyne alpina	10.0
Geum montanum	10.0	Carex bigelowii	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Salix herbacea	37.0	Salix retusa	31.0
Salix reticulata	11.0	Salix serpyllifolia	6.0

F2.2a - Alpine and subalpine ericoid heath

*Diagnostic species (phi coefficient * 100)*

Vaccinium uliginosum	34.8	Loiseleuria procumbens	33.0
Rhododendron ferrugineum	28.0	Juncus trifidus	27.4
Cetraria islandica	25.4	Dryas octopetala	24.3
Hieracium alpinum	24.0	Homogyne alpina	22.5
Juniperus communis subsp. alpina	21.9	Festuca airoides	21.3
Empetrum nigrum subsp. hermaphroditum	20.8	Vaccinium vitis-idaea	19.7
Avenula versicolor	19.6	Vaccinium myrtillus	19.2
Rhododendron myrtifolium	16.2	Campanula alpina	16.1
Phyteuma hemisphaericum	16.0	Potentilla aurea	15.9
Agrostis rupestris	15.6	Leontodon pyrenaicus	15.5
Oreochloa disticha	15.1		

Constant species (occurrence frequencies)

Vaccinium myrtillus	59.0	Vaccinium uliginosum	47.0
Vaccinium vitis-idaea	38.0	Deschampsia flexuosa	38.0
Calluna vulgaris	30.0	Homogyne alpina	28.0
Cetraria islandica	24.0	Rhododendron ferrugineum	23.0
Juncus trifidus	21.0	Juniperus communis subsp. alpina	20.0
Loiseleuria procumbens	19.0	Nardus stricta	18.0
Dryas octopetala	18.0	Potentilla erecta	17.0
		Empetrum nigrum subsp. hermaphroditum	15.0
Hylocomium splendens	15.0	Polygonum viviparum	14.0
Potentilla aurea	14.0	Hieracium alpinum	13.0
Pleurozium schreberi	14.0	Cladonia arbuscula	13.0
Dicranum scoparium	13.0	Avenula versicolor	13.0
Carex sempervirens	13.0	Anthoxanthum odoratum	12.0
Festuca airoides	12.0	Luzula luzuloides	11.0
Solidago virgaurea	11.0	Agrostis rupestris	11.0
Cladonia rangiferina	11.0	Huperzia selago	10.0
Phyteuma hemisphaericum	10.0		
Antennaria dioica	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Vaccinium myrtillus	21.0	Vaccinium uliginosum	20.0
Calluna vulgaris	13.0	Loiseleuria procumbens	12.0

Dryas octopetala	12.0	Rhododendron ferrugineum	10.0
Empetrum nigrum subsp. hermaphroditum	10.0		

F2.2b - Alpine and subalpine Juniperus scrub

*Diagnostic species (phi coefficient * 100)*

Juniperus communis subsp. alpina	77.5	Bruckenthalia spiculifolia	25.7
Brachypodium genuense	24.7	Lerchenfeldia flexuosa	24.6
Genista depressa	23.9	Daphne oleoides	23.9
Arctostaphylos uva-ursi	22.0	Potentilla ternata	19.6
Viola eugeniae	18.3	Sesleria tenuifolia	18.3
Festuca valida	18.1	Globularia meridionalis	16.7
Viola dacica	16.0	Carlina macrocephala	15.5
Campanula epigaeae	15.1		

Constant species (occurrence frequencies)

Juniperus communis subsp. alpina	98.0	Vaccinium myrtillus	44.0
Deschampsia flexuosa	32.0	Anthoxanthum odoratum	22.0
Vaccinium uliginosum	20.0	Vaccinium vitis-idaea	19.0
Nardus stricta	18.0	Festuca rubra	18.0
Arctostaphylos uva-ursi	18.0	Thymus praecox	17.0
Helianthemum nummularium	16.0	Calluna vulgaris	15.0
Lotus corniculatus	14.0	Potentilla erecta	13.0
Agrostis capillaris	13.0	Luzula luzuloides	12.0
Lerchenfeldia flexuosa	12.0	Daphne oleoides	12.0
Bruckenthalia spiculifolia	12.0	Bromus erectus	12.0
Phyteuma orbiculare	11.0	Homogyne alpina	11.0
Cruciata glabra	11.0	Campanula scheuchzeri	11.0
Solidago virgaurea	10.0	Rubus idaeus	10.0
Genista depressa	10.0	Festuca nigrescens	10.0
Carex caryophyllea	10.0	Calamagrostis arundinacea	10.0
Brachypodium genuense	10.0	Antennaria dioica	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Juniperus communis subsp. alpina	98.0	Arctostaphylos uva-ursi	8.0
Deschampsia flexuosa	5.0		

F2.2c - Balkan subalpine genistoid scrub

*Diagnostic species (phi coefficient * 100)*

Genista radiata	98.8	Brachypodium genuense	63.3
Carex macrolepis	51.6	Stachys alopecuros	41.9
Daphne oleoides	40.6	Carduus nutans	38.9
Laserpitium siler	35.2	Galium lucidum	33.8
Avenula praetutiana	33.2	Asperula purpurea	32.9

Teucrium montanum	32.3	Chamaecytisus spinescens	32.3
Bromus erectus	31.5	Laserpitium peucedanoides	31.3
Sesleria tenuifolia	30.6	Cynoglottis barrelieri	29.6
Viola eugeniae	29.4	Rosa pendulina	27.7
Koeleria lobata	27.2	Sesleria nitida	27.0
Polygala major	26.1	Cirsium erisithales	26.1
Erica herbacea	25.7	Erysimum pseudorhaeticum	25.6
Thymus longicaulis	25.3	Euphorbia myrsinites	24.6
Globularia meridionalis	24.5	Arabis brassica	24.2
Cerastium tomentosum	24.0	Salix glabra	23.7
Salix appendiculata	23.3	Sorbus aria agg.	23.1
Crepis praemorsa	22.8	Asperula aristata	22.5
Sesleria pichiana	22.3	Festuca billyi	22.2
Anemone trifolia	22.1	Thlaspi brachypetalum	22.0
Potentilla crantzii	22.0	Cephalaria laevigata	22.0
Phleum ambiguum	21.9	Calamagrostis varia	21.8
Scabiosa banatica	21.4	Amelanchier ovalis	21.4
Eryngium alpinum	21.0	Euphorbia kernerii	20.7
Carlina acaulis	20.5	Aquilegia einseleana	20.5
Bupthalmum salicifolium	20.2	Athamanta turbith	20.2
Centaurea haynaldii	20.1	Polygala chamaebuxus	19.6
Lunaria annua	19.3	Helianthemum oelandicum	19.2
Centaurea parlatoris	19.2	Campanula witasekiana	19.2
Thesium rostratum	18.9	Thymus praecox	18.8
Festuca robustifolia	18.8	Pleurospermum austriacum	18.6
Centaurea triumfetti	18.6	Ranunculus carinthiacus	18.3
Lilium carniolicum	18.3	Leontodon incanus	18.3
Bupleurum falcatum	18.2	Scabiosa graminifolia	17.8
Seseli rigidum	17.7	Seseli libanotis	17.3
Helictotrichon sempervirens	17.2	Cotoneaster integerrimus	16.8
Centaurea ambigua	16.8	Teucrium chamaedrys	16.7
Knautia illyrica	16.6	Erysimum jugicola	16.6
Tanacetum corymbosum subsp. clusii	15.9	Sedum rupestre	15.9
Rhamnus alpinus	15.9	Phyteuma scheuchzeri	15.9
Chamaecytisus purpureus	15.8	Dianthus petraeus	15.8
<i>Constant species (occurrence frequencies)</i>			
Genista radiata	100.0	Bromus erectus	70.0
Teucrium montanum	45.0	Brachypodium genuense	45.0
Teucrium chamaedrys	40.0	Sorbus aria agg.	40.0
Galium lucidum	35.0	Thymus praecox	30.0
Stachys alopecuros	30.0	Rosa pendulina	30.0
Carlina acaulis	30.0	Carex macrolepis	30.0
Carduus nutans	30.0	Laserpitium siler	25.0
Helianthemum nummularium	25.0	Erica herbacea	25.0
Daphne oleoides	25.0	Calamagrostis varia	25.0
Brachypodium pinnatum	25.0	Asperula purpurea	25.0

Amelanchier ovalis	25.0	Thymus longicaulis	20.0
Polygala chamaebuxus	20.0	Lotus corniculatus	20.0
Helianthemum oelandicum	20.0	Cirsium erisithales	20.0
Bupleurum falcatum	20.0	Buphthalmum salicifolium	20.0
Tanacetum corymbosum	15.0	Stachys recta	15.0
Sesleria tenuifolia	15.0	Sesleria caerulea	15.0
Seseli libanotis	15.0	Sedum rupestre	15.0
Salix appendiculata	15.0	Quercus pubescens	15.0
Potentilla crantzii	15.0	Polygala major	15.0
Laserpitium peucedanoides	15.0	Koeleria lobata	15.0
Chamaecytisus spinescens	15.0	Gymnadenia conopsea	15.0
Galium mollugo agg.	15.0	Euphorbia myrsinites	15.0
Cerastium arvense	15.0	Carduus defloratus agg.	15.0
Avenula praetutiana	15.0	Asperula aristata	15.0
Anemone trifolia	15.0	Acer opalus	15.0
Viola eugeniae	10.0	Thymus serpyllum	10.0
Silene italica	10.0	Sesleria nitida	10.0
Scabiosa columbaria	10.0	Sanguisorba minor	10.0
Salix glabra	10.0	Rubus idaeus	10.0
Rhamnus alpinus	10.0	Prunella grandiflora	10.0
Prenanthes purpurea	10.0	Polygonatum odoratum	10.0
Pinus sylvestris	10.0	Pimpinella saxifraga	10.0
Phleum ambiguum	10.0	Peucedanum oreoselinum	10.0
Molinia caerulea agg.	10.0	Mercurialis perennis	10.0
Leontodon incanus	10.0	Laserpitium latifolium	10.0
Juniperus communis subsp. alpina	10.0	Hippocrepis comosa	10.0
Globularia meridionalis	10.0	Erysimum pseudorhaeticum	10.0
Dactylis glomerata	10.0	Cynoglossis barrelieri	10.0
Cyclamen purpurascens	10.0	Crepis praemorsa	10.0
Cotoneaster integerrimus	10.0	Cerastium tomentosum	10.0
Centaurea triumfetti	10.0	Carex flacca	10.0
Asperula cynanchica	10.0	Arctostaphylos uva-ursi	10.0
Arabis brassica	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Genista radiata	100.0	Eryngium alpinum	5.0
Erica herbacea	5.0	Brachypodium genuense	5.0

F2.3 - Subalpine deciduous scrub

*Diagnostic species (phi coefficient * 100)*

Alnus viridis	68.1	Viola biflora	43.9
Peucedanum ostruthium	43.4	Adenostyles alliariae	36.4
Saxifraga rotundifolia	35.4	Salix waldsteiniana	33.5
Salix appendiculata	32.3	Rumex alpestris	32.3
Salix helvetica	29.9	Geranium sylvaticum	29.0
Athyrium distentifolium	26.6	Achillea macrophylla	26.3

Aconitum napellus	26.3	Chaerophyllum villarsii	26.2
Cicerbita alpina	26.2	Rhododendron hirsutum	25.3
Polystichum lonchitis	24.3	Epilobium alpestre	23.7
Veratrum album	23.5	Cymbalaria hepaticifolia	22.1
Agrostis agrostiflora	21.7	Salix glabra	21.6
Veratrum lobelianum	20.8	Thalictrum aquilegiifolium	20.7
Rhododendron ferrugineum	20.7	Sorbus chamaemespilus	20.4
Homogyne alpina	20.4	Gentiana punctata	20.1
Valeriana montana	19.7	Soldanella alpina	19.0
Rosa pendulina	18.4	Valeriana tripteris	18.3
Aconitum lycoctonum subsp. vulparia	18.2	Hugueninia tanacetifolia	17.9
Aconitum napellus subsp. firmum	17.8	Pedicularis recutita	17.4
Salix silesiaca	16.9	Astrantia minor	16.8
Rhamnus alpinus	16.7	Asplenium viride	16.5
Rhodiola rosea	16.4	Stellaria nemorum	16.3
Carex ferruginea	16.2	Ranunculus aconitifolius	16.0
Ranunculus platanifolius	15.7	Calamagrostis villosa	15.4
Lonicera caerulea	15.1		

Constant species (occurrence frequencies)

Alnus viridis	59.0	Viola biflora	48.0
Geranium sylvaticum	40.0	Vaccinium myrtillus	38.0
Sorbus aucuparia	38.0	Adenostyles alliariae	35.0
Rubus idaeus	34.0	Saxifraga rotundifolia	33.0
Peucedanum ostruthium	30.0	Solidago virgaurea	28.0
Rumex alpestris	27.0	Homogyne alpina	26.0
Veratrum album	23.0	Dryopteris filix-mas	23.0
Salix appendiculata	22.0	Dryopteris dilatata	22.0
Stellaria nemorum	21.0	Oxalis acetosella	21.0
Deschampsia cespitosa	20.0	Athyrium filix-femina	20.0
Rosa pendulina	19.0	Geum rivale	18.0
Valeriana tripteris	17.0	Thalictrum aquilegiifolium	17.0
Senecio nemorensis	17.0	Rhododendron hirsutum	17.0
Rhododendron ferrugineum	17.0	Polystichum lonchitis	17.0
Picea abies	17.0	Chaerophyllum villarsii	17.0
Chaerophyllum hirsutum	17.0	Hypericum maculatum	17.0
Heracleum sphondylium	17.0	Cicerbita alpina	17.0
Silene vulgaris	15.0	Salix waldsteiniana	15.0
Calamagrostis villosa	15.0	Athyrium distentifolium	15.0
Aconitum napellus	15.0	Acer pseudoplatanus	15.0
Veratrum lobelianum	14.0	Valeriana montana	14.0
Soldanella alpina	14.0	Rubus saxatilis	14.0
Polygonatum verticillatum	14.0	Deschampsia flexuosa	14.0
Campanula scheuchzeri	14.0	Urtica dioica	12.0
Paris quadrifolia	12.0	Juniperus communis subsp. alpina	12.0
Carex ferruginea	12.0	Bistorta officinalis	12.0
Asplenium viride	12.0	Alchemilla vulgaris	12.0

Aconitum lycoctonum subsp. vulparia	12.0	Sorbus chamaemespilus	11.0
Ranunculus serpens subsp. nemorosus	11.0	Poa nemoralis	11.0
Poa alpina	11.0	Hylocomium splendens	11.0
Gentiana asclepiadea	11.0	Adenostyles alpina	11.0
Salix helvetica	10.0	Rhytidiadelphus triquetrus	10.0
Rhamnus alpinus	10.0	Ranunculus aconitifolius	10.0
Luzula sylvatica	10.0	Ligusticum mutellina	10.0
Knautia dipsacifolia	10.0	Fragaria vesca	10.0
Daphne mezereum	10.0	Cystopteris fragilis	10.0
Calamagrostis varia	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Alnus viridis	53.0	Salix helvetica	9.0
Rhamnus alpinus	9.0	Adenostyles alliariae	9.0
Salix waldsteiniana	8.0	Salix silesiaca	6.0
Salix appendiculata	6.0		

F2.4 - Subalpine Pinus mugo scrub

*Diagnostic species (phi coefficient * 100)*

Pinus mugo	88.0	Rhododendron hirsutum	44.8
Sorbus chamaemespilus	39.2	Erica herbacea	37.4
Salix glabra	35.9	Homogyne alpina	33.6
Vaccinium vitis-idaea	32.8	Rhodothamnus chamaecistus	30.9
Lonicera caerulea	30.0	Calamagrostis villosa	28.9
Salix waldsteiniana	28.7	Juniperus communis subsp. alpina	28.6
Salix appendiculata	27.1	Laserpitium peucedanoides	26.6
Clematis alpina	25.7	Daphne striata	24.7
Valeriana montana	24.4	Vaccinium myrtillus	24.1
Rhododendron ferrugineum	24.0	Valeriana saxatilis	23.7
Lycopodium annotinum	23.6	Astrantia bavarica	23.4
Valeriana tripteris	23.3	Dryas octopetala	23.1
Viola biflora	22.9	Stachys alopecuros	22.4
Rosa pendulina	21.7	Aster bellidiastrum	21.4
Sesleria caerulea	20.5	Galium anisophyllum	19.9
Polygala chamaebuxus	19.7	Paederota lutea	19.7
Thymus alpestris	19.4	Carex ferruginea	18.5
Rubus saxatilis	18.4	Calamagrostis varia	18.2
Cetraria islandica	17.7	Globularia cordifolia	17.4
Arctostaphylos uva-ursi	17.1	Biscutella laevigata	17.0
Asplenium viride	16.9	Campanula scheuchzeri	16.4
Soldanella alpina	16.2	Huperzia selago	16.2
Gentiana pannonica	16.1	Bartsia alpina	15.6
Veratrum album	15.3	Anemone trifolia	15.3
Ranunculus hybridus	15.1	Pulsatilla alpina	15.1

Constant species (occurrence frequencies)

Pinus mugo	100.0	Vaccinium myrtillus	73.0
Vaccinium vitis-idaea	64.0	Homogyne alpina	44.0
Erica herbacea	38.0	Dicranum scoparium	35.0
Rhododendron hirsutum	34.0	Sorbus aucuparia	32.0
Sesleria caerulea	31.0	Picea abies	30.0
Hieracium murorum	30.0	Calamagrostis villosa	30.0
Juniperus communis subsp. alpina	28.0	Deschampsia flexuosa	28.0
Sorbus chamaemespilus	25.0	Solidago virgaurea	25.0
Rubus saxatilis	25.0	Pleurozium schreberi	25.0
Hylocomium splendens	25.0	Viola biflora	23.0
Rosa pendulina	23.0	Valeriana tripteris	22.0
Aster bellidiastrum	22.0	Rhytidiadelphus triquetrus	20.0
Polygala chamaebuxus	20.0	Luzula sylvatica	20.0
Geranium sylvaticum	20.0	Calamagrostis varia	20.0
Vaccinium uliginosum	19.0	Rhododendron ferrugineum	19.0
Oxalis acetosella	19.0	Lycopodium annotinum	19.0
Valeriana montana	18.0	Salix appendiculata	18.0
Salix glabra	17.0	Phyteuma orbiculare	17.0
Juniperus communis subsp. communis	17.0	Dryas octopetala	17.0
Clematis alpina	17.0	Lotus corniculatus	16.0
Lonicera caerulea	16.0	Larix decidua	16.0
Galium anisophyllum	16.0	Dryopteris dilatata	16.0
Cetraria islandica	16.0	Campanula scheuchzeri	16.0
Veratrum album	15.0	Rhodothamnus chamaecistus	15.0
Potentilla erecta	15.0	Rubus idaeus	14.0
Polygonum viviparum	14.0	Huperzia selago	14.0
Globularia cordifolia	14.0	Daphne mezereum	14.0
Carex ferruginea	14.0	Biscutella laevigata	14.0
Bartsia alpina	14.0	Amelanchier ovalis	14.0
Tortella tortuosa	13.0	Tofieldia calyculata	13.0
Stachys alopecuroides	13.0	Sorbus aria agg.	13.0
Polygonatum verticillatum	13.0	Asplenium viride	13.0
Arctostaphylos uva-ursi	13.0	Pulsatilla alpina	12.0
Helianthemum oelandicum	12.0	Carduus defloratus agg.	12.0
Valeriana saxatilis	11.0	Soldanella alpina	11.0
Salix waldsteiniana	11.0	Melampyrum sylvaticum	11.0
Laserpitium peucedanoides	11.0	Epipactis atrorubens	11.0
Carex sempervirens	11.0	Campanula rotundifolia	11.0
Calluna vulgaris	11.0	Gymnocarpium dryopteris	10.0
Cladonia rangiferina	10.0	Anemone trifolia	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Pinus mugo	100.0	Vaccinium myrtillus	28.0
Erica herbacea	15.0	Rhododendron hirsutum	10.0
Rhododendron ferrugineum	5.0		

F3.1a - Lowland to montane temperate and submediterranean Juniperus scrub

*Diagnostic species (phi coefficient * 100)*

Juniperus communis subsp.			
communis	48.2	Barbilophozia barbata	23.1
Palmogloea protuberans	22.1	Berberis aetnensis	15.4
Campylopus pyriformis	15.1		

Constant species (occurrence frequencies)

Juniperus communis subsp.			
communis	100.0	Calluna vulgaris	29.0
Deschampsia flexuosa	26.0	Dicranum scoparium	24.0
Brachypodium pinnatum	24.0	Pleurozium schreberi	21.0
Vaccinium myrtillus	19.0	Rosa canina agg.	18.0
Teucrium chamaedrys	17.0	Potentilla erecta	17.0
Hypnum jutlandicum	16.0	Hieracium pilosella	16.0
Festuca ovina	16.0	Agrostis capillaris	16.0
Sanguisorba minor	15.0	Pseudoscleropodium purum	15.0
Pinus sylvestris	15.0	Lotus corniculatus	15.0
Galium saxatile	15.0	Festuca rubra	15.0
Leontodon hispidus	14.0	Hypnum cupressiforme	14.0
Frangula alnus	14.0	Carex flacca	14.0
Hippocrepis comosa	13.0	Campanula rotundifolia	13.0
Lophocolea bidentata	12.0	Helianthemum nummularium	12.0
Euphorbia cyparissias	12.0	Carlina vulgaris	12.0
Briza media	12.0	Anthoxanthum odoratum	12.0
Sorbus aucuparia	11.0	Quercus robur	11.0
Prunus spinosa	11.0	Ligustrum vulgare	11.0
Hylocomium splendens	11.0	Achillea millefolium	11.0
Agrostis vinealis	11.0	Rumex acetosella	10.0
Ptilidium ciliare	10.0	Pohlia nutans	10.0
Plantago lanceolata	10.0	Linum catharticum	10.0
Asperula cynanchica	10.0	Anthyllis vulneraria	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Juniperus communis subsp.			
communis	100.0	Brachypodium pinnatum	10.0
Calluna vulgaris	7.0	Festuca rubra	5.0

F3.1b - Temperate Rubus scrub

*Diagnostic species (phi coefficient * 100)*

Rubus caesius	19.4
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Constant species (occurrence frequencies)

Rubus fruticosus agg.	47.0	Urtica dioica	44.0
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Rubus caesius	38.0	Rubus idaeus	30.0
Galium aparine	24.0	Dactylis glomerata	23.0
Cirsium arvense	22.0	Elymus repens	20.0
Arrhenatherum elatius	20.0	Poa trivialis	15.0
Calamagrostis epigejos	15.0	Agrostis capillaris	15.0
Heracleum sphondylium	14.0	Calystegia sepium	14.0
Galium mollugo agg.	13.0	Festuca rubra	13.0
Epilobium angustifolium	13.0	Sorbus aucuparia	12.0
Holcus lanatus	12.0	Poa pratensis	11.0
Equisetum arvense	11.0	Athyrium filix-femina	11.0
Artemisia vulgaris	11.0	Anthriscus sylvestris	11.0
Achillea millefolium	11.0	Senecio nemorensis	10.0
Sambucus nigra	10.0	Crataegus monogyna	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Rubus fruticosus agg.	38.0	Rubus caesius	37.0
Rubus idaeus	22.0		

F3.1c - Lowland to montane temperate and submediterranean genistoid scrub

*Diagnostic species (phi coefficient * 100)*

Ulex europaeus	43.2	Cytisus scoparius	40.3
Genista florida	24.1	Erica cinerea	15.8
Teucrium scorodonia	15.7	Genista cinerascens	15.4

Constant species (occurrence frequencies)

Cytisus scoparius	57.0	Ulex europaeus	42.0
Pteridium aquilinum	37.0	Agrostis capillaris	31.0
Teucrium scorodonia	27.0	Calluna vulgaris	27.0
Potentilla erecta	18.0	Erica cinerea	18.0
Rubus ulmifolius	17.0	Anthoxanthum odoratum	17.0
Rumex acetosella	16.0	Rubus fruticosus agg.	15.0
Holcus lanatus	14.0	Dactylis glomerata	14.0
Achillea millefolium	14.0	Hypochaeris radicata	13.0
Holcus mollis	13.0	Festuca ovina	13.0
Deschampsia flexuosa	12.0	Plantago lanceolata	11.0
Genista florida	11.0	Galium saxatile	11.0
Festuca rubra	11.0	Crataegus monogyna	11.0
Brachypodium pinnatum	11.0	Rosa canina agg.	10.0
Hypericum perforatum	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Cytisus scoparius	47.0	Ulex europaeus	38.0
Pteridium aquilinum	7.0	Genista florida	5.0
Agrostis capillaris	5.0		

F3.1d - Balkan-Anatolian submontane genistoid scrub

*Diagnostic species (phi coefficient * 100)*

Genista lydia	98.5	Minuartia hirsuta	98.0
Allium guttatum	97.9	Centaurea grisebachii	97.7
Hypericum olympicum	96.5	Thymus sibthorpii	94.4
Koeleria lobata	93.3	Micropyrum tenellum	92.0
Asperula aristata	88.4	Rumex acetosella	43.3

Constant species (occurrence frequencies)

Thymus sibthorpii	100.0	Rumex acetosella	100.0
Minuartia hirsuta	100.0	Micropyrum tenellum	100.0
Koeleria lobata	100.0	Hypericum olympicum	100.0
Genista lydia	100.0	Centaurea grisebachii	100.0
Asperula aristata	100.0	Allium guttatum	100.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Genista lydia	100.0
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F3.1e - Temperate and submediterranean thorn scrub

*Diagnostic species (phi coefficient * 100)*

Prunus spinosa	27.8	Rosa canina agg.	21.3
Rubus ulmifolius	17.2	Crataegus monogyna	16.6

Constant species (occurrence frequencies)

Prunus spinosa	59.0	Crataegus monogyna	53.0
Rosa canina agg.	42.0	Urtica dioica	35.0
Cornus sanguinea	35.0	Ligustrum vulgare	30.0
Galium aparine	28.0	Sambucus nigra	27.0
Rubus ulmifolius	27.0	Euonymus europaeus	23.0
Hedera helix	22.0	Rubus fruticosus agg.	17.0
Dactylis glomerata	17.0	Corylus avellana	17.0
Clematis vitalba	17.0	Rubus caesius	16.0
Glechoma hederacea	15.0	Geum urbanum	15.0
Fraxinus excelsior	14.0	Brachypodium pinnatum	14.0
Rhamnus catharticus	13.0	Galium mollugo agg.	13.0
Viburnum lantana	12.0	Poa trivialis	12.0
Acer campestre	12.0	Rubia peregrina	11.0
Lonicera periclymenum	11.0	Tamus communis	10.0
Arrhenatherum elatius	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Prunus spinosa	34.0	Crataegus monogyna	22.0
Rubus ulmifolius	13.0	Sambucus nigra	9.0
Cornus sanguinea	9.0	Ligustrum vulgare	7.0

F3.1f - Low steppic scrub

*Diagnostic species (phi coefficient * 100)*

Prunus fruticosa	64.7	Prunus tenella	43.2
Spiraea media	40.1	Caragana frutex	39.6
Phlomis tuberosa	25.3	Spiraea crenata	25.2
Thalictrum minus	25.0	Melica transsilvanica	23.7
Aconitum anthora	21.6	Stachys recta	21.2
Fragaria viridis	21.1	Hylotelephium maximum	19.4
Geranium sanguineum	19.4	Rosa pimpinellifolia	19.1
Artemisia sericea	18.8	Poa transbaicalica	17.3
Salvia nemorosa	17.2	Valeriana rossica	17.1
Linaria angustissima	17.0	Vincetoxicum hirundinaria	16.9
Adonis vernalis	16.7	Stipa pennata	16.3
Scutellaria alpina	16.3	Origanum vulgare	16.3
Salvia stepposa	16.2	Hieracium echiodes	16.2
Galium glaucum	16.2	Cotoneaster melanocarpus	16.0
Coronilla varia	16.0	Elymus hispidus	15.8
Medicago romanica	15.7	Verbascum lychnitis	15.5
Fumaria schleicheri	15.5	Artemisia armeniaca	15.4
Medicago falcata	15.3		

Constant species (occurrence frequencies)

Prunus fruticosa	53.0	Galium verum	37.0
Teucrium chamaedrys	33.0	Vincetoxicum hirundinaria	30.0
Stachys recta	30.0	Fragaria viridis	30.0
Euphorbia cyparissias	29.0	Thalictrum minus	28.0
Elymus repens	28.0	Poa angustifolia	27.0
Origanum vulgare	27.0	Hypericum perforatum	25.0
Coronilla varia	25.0	Caragana frutex	25.0
Prunus tenella	24.0	Medicago falcata	24.0
Geranium sanguineum	23.0	Rosa canina agg.	22.0
Hylotelephium maximum	22.0	Spiraea media	19.0
Salvia pratensis	19.0	Prunus spinosa	19.0
Festuca rupicola	18.0	Centaurea scabiosa	18.0
Filipendula vulgaris	17.0	Achillea millefolium	17.0
Phlomis tuberosa	16.0	Galium mollugo agg.	16.0
Brachypodium pinnatum	16.0	Rhamnus catharticus	15.0
Bromus inermis	15.0	Asperula cynanchica	15.0
Stipa pennata	14.0	Rosa pimpinellifolia	14.0
Potentilla cinerea	14.0	Phleum phleoides	14.0
Agrimonia eupatoria	14.0	Vicia cracca	13.0
Verbascum lychnitis	13.0	Melica transsilvanica	13.0
Fallopia convolvulus	13.0	Veronica spicata	12.0
Salvia nemorosa	12.0	Falcaria vulgaris	12.0
Elymus hispidus	12.0	Scabiosa ochroleuca	11.0
Polygonatum odoratum	11.0	Pimpinella saxifraga	11.0

Galium glaucum	11.0	Festuca valesiaca	11.0
Dactylis glomerata	11.0	Bupleurum falcatum	11.0
Asparagus officinalis	11.0	Adonis vernalis	11.0
Viola hirta	10.0	Spiraea crenata	10.0
Silene latifolia subsp. alba	10.0	Sanguisorba minor	10.0
Potentilla argentea	10.0	Plantago media	10.0
Koeleria macrantha	10.0	Eryngium campestre	10.0
Dianthus carthusianorum	10.0	Carex humilis	10.0
Achillea pannonica	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Prunus fruticosa	43.0	Prunus tenella	20.0
Spiraea media	19.0	Caragana frutex	18.0

F3.1g - Corylus avellana scrub

*Diagnostic species (phi coefficient * 100)*

Corylus avellana	31.9
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Constant species (occurrence frequencies)

Corylus avellana	100.0	Crataegus monogyna	45.0
Hedera helix	43.0	Prunus spinosa	31.0
Fragaria vesca	31.0	Geum urbanum	30.0
Geranium robertianum	30.0	Fraxinus excelsior	28.0
Oxalis acetosella	27.0	Cornus sanguinea	27.0
Lonicera periclymenum	26.0	Brachypodium sylvaticum	26.0
Stellaria holostea	25.0	Rubus fruticosus agg.	25.0
Poa nemoralis	25.0	Urtica dioica	24.0
Dryopteris filix-mas	24.0	Mercurialis perennis	23.0
Rosa canina agg.	22.0	Veronica chamaedrys	20.0
Pteridium aquilinum	20.0	Athyrium filix-femina	20.0
Viola reichenbachiana	19.0	Lonicera xylosteum	19.0
Ilex aquifolium	19.0	Hepatica nobilis	19.0
Carex sylvatica	19.0	Vicia sepium	18.0
Sanicula europaea	18.0	Primula vulgaris	18.0
Acer campestre	18.0	Sambucus nigra	16.0
Melica uniflora	16.0	Ligustrum vulgare	16.0
Galium aparine	16.0	Euonymus europaeus	16.0
Campanula trachelium	16.0	Anemone nemorosa	16.0
Lamium galeobdolon	15.0	Asarum europaeum	15.0
Thuidium tamariscinum	14.0	Hyacinthoides non-scripta	14.0
Eurhynchium striatum	14.0	Aegopodium podagraria	14.0
Viburnum lantana	13.0	Tamus communis	13.0
Sorbus aucuparia	13.0	Quercus petraea	13.0
Plagiomnium undulatum	13.0	Kindbergia praelonga	13.0
Heracleum sphondylium	13.0	Euphorbia amygdaloides	13.0
Ajuga reptans	13.0	Viola riviniana	12.0

Viburnum opulus	12.0	Rosa arvensis	12.0
Primula veris	12.0	Polystichum setiferum	12.0
Polygonatum multiflorum	12.0	Clematis vitalba	12.0
Arum maculatum	12.0	Glechoma hederacea	11.0
Conopodium majus	11.0	Potentilla sterilis	10.0
Mycelis muralis	10.0	Fagus sylvatica	10.0
Dryopteris dilatata	10.0	Dactylis glomerata	10.0
Clinopodium vulgare	10.0	Circaea lutetiana	10.0
Carpinus betulus	10.0	Brachypodium pinnatum	10.0
Acer pseudoplatanus	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Corylus avellana	100.0	Hedera helix	11.0
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F3.1h - Temperate forest clearing scrub

*Diagnostic species (phi coefficient * 100)*

Salix caprea	32.8	Sorbus aucuparia	22.9
Rubus idaeus	18.7		

Constant species (occurrence frequencies)

Sorbus aucuparia	71.0	Rubus idaeus	46.0
Salix caprea	44.0	Oxalis acetosella	36.0
Vaccinium myrtillus	34.0	Urtica dioica	33.0
Dryopteris dilatata	30.0	Deschampsia flexuosa	30.0
Picea abies	28.0	Betula pendula	28.0
Senecio nemorensis	23.0	Rubus fruticosus agg.	23.0
Fagus sylvatica	23.0	Acer pseudoplatanus	23.0
Athyrium filix-femina	22.0	Dryopteris filix-mas	21.0
Dryopteris carthusiana	19.0	Polytrichastrum formosum	18.0
Fragaria vesca	18.0	Epilobium montanum	18.0
Epilobium angustifolium	18.0	Dicranum scoparium	18.0
Dactylis glomerata	17.0	Sambucus racemosa	16.0
Quercus robur	16.0	Prenanthes purpurea	16.0
Geranium robertianum	15.0	Agrostis capillaris	15.0
Poa nemoralis	14.0	Polygonatum verticillatum	13.0
Pinus sylvestris	13.0	Corylus avellana	13.0
Solidago virgaurea	12.0	Calamagrostis arundinacea	12.0
Betula pubescens	12.0	Abies alba	12.0
Sambucus nigra	11.0	Rosa canina agg.	11.0
Ranunculus repens	11.0	Pleurozium schreberi	11.0
Moehringia trinervia	11.0	Milium effusum	11.0
Luzula sylvatica	11.0	Hylocomium splendens	11.0
Fraxinus excelsior	11.0	Frangula alnus	11.0
Calamagrostis villosa	11.0	Luzula pilosa	10.0
Galium mollugo agg.	10.0	Galium aparine	10.0
Angelica sylvestris	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Sorbus aucuparia	58.0	Salix caprea	38.0
Sambucus racemosa	9.0	Vaccinium myrtillus	8.0
Urtica dioica	6.0		

F4.1 - Wet heath

*Diagnostic species (phi coefficient * 100)*

Erica tetralix	64.3	Sphagnum compactum	29.1
Trichophorum cespitosum	28.9	Calluna vulgaris	28.7
Narthecium ossifragum	28.5	Juncus squarrosus	26.4
Drosera rotundifolia	25.3	Molinia caerulea agg.	23.9
Sphagnum tenellum	23.1	Sphagnum papillosum	20.6
Drosera intermedia	20.6	Odontoschisma sphagni	20.3
Salix repens	18.2	Gentiana pneumonanthe	18.0
Hypnum jutlandicum	17.9	Cladonia portentosa	17.7
Eriophorum angustifolium	17.3	Rhynchospora alba	15.8
Rhynchospora fusca	15.0	Polygala serpyllifolia	15.0

Constant species (occurrence frequencies)

Erica tetralix	100.0	Calluna vulgaris	79.0
Molinia caerulea agg.	71.0	Potentilla erecta	47.0
Trichophorum cespitosum	37.0	Eriophorum angustifolium	34.0
Drosera rotundifolia	34.0	Narthecium ossifragum	25.0
Juncus squarrosus	25.0	Hypnum jutlandicum	20.0
Sphagnum papillosum	18.0	Sphagnum compactum	17.0
Carex panicea	17.0	Salix repens	16.0
Betula pubescens	15.0	Sphagnum tenellum	14.0
Pinus sylvestris	14.0	Hypnum cupressiforme	14.0
Eriophorum vaginatum	14.0	Cladonia portentosa	14.0
Rhynchospora alba	13.0	Dicranum scoparium	13.0
Aulacomnium palustre	13.0	Sphagnum capillifolium	12.0
Polygala serpyllifolia	12.0	Pleurozium schreberi	12.0
Gentiana pneumonanthe	12.0	Drosera intermedia	12.0
Danthonia decumbens	12.0	Vaccinium oxycoccos	11.0
Carex echinata	11.0	Odontoschisma sphagni	10.0
Nardus stricta	10.0	Genista anglica	10.0
Carex nigra	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Erica tetralix	100.0	Calluna vulgaris	24.0
Molinia caerulea agg.	21.0	Sphagnum papillosum	7.0
Sphagnum compactum	5.0		

F4.2 - Dry heath

*Diagnostic species (phi coefficient * 100)*

Calluna vulgaris	30.0	Erica cinerea	29.6
Ulex gallii	16.7	Genista anglica	16.7
Hypnum jutlandicum	15.2		

Constant species (occurrence frequencies)

Calluna vulgaris	79.0	Deschampsia flexuosa	37.0
Potentilla erecta	35.0	Erica cinerea	32.0
Vaccinium myrtillus	29.0	Dicranum scoparium	27.0
Pleurozium schreberi	24.0	Molinia caerulea agg.	23.0
Festuca ovina	21.0	Agrostis capillaris	21.0
Pteridium aquilinum	19.0	Hypnum cupressiforme	18.0
Danthonia decumbens	17.0	Hypnum jutlandicum	16.0
Nardus stricta	14.0	Genista pilosa	14.0
Carex pilulifera	14.0	Vaccinium vitis-idaea	13.0
Anthoxanthum odoratum	13.0	Galium saxatile	12.0
Pinus sylvestris	11.0	Lotus corniculatus	11.0
Erica tetralix	11.0	Hylocomium splendens	10.0
Genista anglica	10.0	Festuca rubra	10.0
Erica vagans	10.0	Cytisus scoparius	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Calluna vulgaris	61.0	Vaccinium myrtillus	13.0
Erica cinerea	10.0	Pleurozium schreberi	7.0
Ulex gallii	6.0	Hypnum jutlandicum	6.0

F5.1 - Mediterranean maquis and arborescent matorral*Diagnostic species (phi coefficient * 100)*

Pistacia lentiscus	36.1	Erica arborea	35.3
Myrtus communis	31.3	Smilax aspera	31.2
Arbutus unedo	29.9	Cistus salvifolius	26.7
Asparagus acutifolius	25.7	Phillyrea latifolia	25.4
Juniperus oxycedrus	24.9	Rubia peregrina	24.6
Calicotome villosa	24.5	Cistus monspeliensis	24.1
Phillyrea angustifolia	24.0	Rhamnus alaternus	23.6
Lonicera implexa	22.1	Brachypodium retusum	22.1
Quercus ilex	19.7	Cistus incanus	18.4
Clematis flammula	18.2	Pulicaria odora	17.7
Arisarum vulgare	17.3	Juniperus phoenicea	17.2
Prasium majus	16.7	Calicotome spinosa	16.6
Daphne gnidium	16.0		

Constant species (occurrence frequencies)

Rubia peregrina	45.0	Pistacia lentiscus	45.0
Erica arborea	43.0	Smilax aspera	40.0

Asparagus acutifolius	36.0	Arbutus unedo	32.0
Juniperus oxycedrus	29.0	Quercus ilex	28.0
Phillyrea latifolia	28.0	Cistus salvifolius	28.0
Brachypodium retusum	28.0	Myrtus communis	26.0
Rhamnus alaternus	22.0	Rubus ulmifolius	21.0
Phillyrea angustifolia	21.0	Lonicera implexa	20.0
Cistus monspeliensis	19.0	Calicotome villosa	17.0
Clematis flammula	16.0	Daphne gnidium	14.0
Cistus incanus	14.0	Pteridium aquilinum	13.0
Juniperus phoenicea	13.0	Arisarum vulgare	12.0
Dactylis glomerata	11.0	Spartium junceum	10.0
Rosmarinus officinalis	10.0	Quercus pubescens	10.0
Pulicaria odora	10.0	Prasium majus	10.0
Hedera helix	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Erica arborea	27.0	Juniperus oxycedrus	17.0
Myrtus communis	12.0	Arbutus unedo	12.0
Calicotome villosa	8.0	Pistacia lentiscus	6.0
Phillyrea latifolia	6.0	Brachypodium retusum	5.0

F5.3 - Submediterranean pseudomaquis

*Diagnostic species (phi coefficient * 100)*

Juniperus oxycedrus	49.9	Spartium junceum	39.2
Chamaecytisus spinescens	38.8	Paliurus spina-christi	38.5
Osiris alba	37.9	Cytisus sessilifolius	37.8
Buxus sempervirens	35.9	Pistacia terebinthus	35.5
Lonicera etrusca	34.2	Rhamnus alaternus	32.4
Asparagus acutifolius	32.2	Phillyrea latifolia	28.7
Rubia peregrina	25.1	Jasminum fruticans	24.6
Viola alba	24.2	Cephalaria leucantha	23.7
Galium flavescens	23.1	Saxifraga cuneata	23.0
Jasonia glutinosa	22.6	Clematis flammula	22.3
Stachys angustifolia	22.2	Chaenorhinum origanifolium	22.2
Rosmarinus officinalis	22.0	Rorippa thracica	22.0
Fraxinus ornus	21.5	Tordylium maximum	21.4
Fumana procumbens	21.2	Galium frutescens	21.1
Salvia lavandulifolia	21.0	Rhamnus saxatilis	20.5
Anemone hortensis	20.2	Teucrium chamaedrys	19.7
Asperula purpurea	19.5	Aristolochia pistolochia	19.5
Pyracantha coccinea	19.1	Olea europaea var. europaea	19.1
Bupleurum fruticosum	18.7	Viburnum tinus	18.5
Genista januensis	18.4	Asphodelus cerasiferus	17.9
Thymus vulgaris	17.7	Juniperus phoenicea	17.5
Amelanchier ovalis	17.3	Spiraea hypericifolia	17.0
Cistus incanus	16.7	Genista scorpius	16.6

Bupleurum frutescens	16.6	Quercus rotundifolia	16.4
Pistacia lentiscus	16.3	Rosa sempervirens	16.1
Stipa offneri	16.0	Potentilla pedata	15.8
Smilax aspera	15.4	Fumana ericoides	15.4
Arenaria grandiflora	15.2	Allium rotundum	15.2
Quercus pubescens	15.1	Helichrysum stoechas	15.1

Constant species (occurrence frequencies)

Juniperus oxycedrus	67.0	Teucrium chamaedrys	47.0
Rubia peregrina	47.0	Buxus sempervirens	47.0
Asparagus acutifolius	47.0	Spartium junceum	33.0
Rhamnus alaternus	33.0	Pistacia terebinthus	33.0
Phillyrea latifolia	33.0	Osyris alba	33.0
Lonicera etrusca	33.0	Fraxinus ornus	33.0
Cytisus sessilifolius	33.0	Viola alba	27.0
Quercus pubescens	27.0	Paliurus spina-christi	27.0
Brachypodium pinnatum	27.0	Thymus vulgaris	20.0
Smilax aspera	20.0	Rosmarinus officinalis	20.0
Quercus ilex	20.0	Pistacia lentiscus	20.0
Chamaecytisus spinescens	20.0	Hedera helix	20.0
Fumana procumbens	20.0	Clematis flammula	20.0
Amelanchier ovalis	20.0	Viburnum tinus	13.0
Tanacetum corymbosum	13.0	Ruscus aculeatus	13.0
Rubus ulmifolius	13.0	Rosa sempervirens	13.0
Rosa arvensis	13.0	Rhamnus saxatilis	13.0
Quercus rotundifolia	13.0	Pteridium aquilinum	13.0
Olea europaea var. europaea	13.0	Lonicera implexa	13.0
Koeleria vallesiana	13.0	Juniperus phoenicea	13.0
Juniperus communis subsp. communis	13.0	Jasminum fruticans	13.0
Hippocrepis emerus	13.0	Helichrysum stoechas	13.0
Helianthemum nummularium	13.0	Geranium sanguineum	13.0
Genista scorpius	13.0	Erica arborea	13.0
Crataegus monogyna	13.0	Cornus mas	13.0
Cistus incanus	13.0	Cephalaria leucantha	13.0
Carex humilis	13.0	Carex flacca	13.0
Brachypodium retusum	13.0	Asperula purpurea	13.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Juniperus oxycedrus	40.0	Buxus sempervirens	40.0
Cytisus sessilifolius	27.0	Pistacia lentiscus	20.0
Paliurus spina-christi	13.0	Juniperus phoenicea	13.0
Hedera helix	13.0	Spartium junceum	7.0
Rhamnus alaternus	7.0	Phillyrea latifolia	7.0
Cornus mas	7.0	Brachypodium retusum	7.0
Asparagus acutifolius	7.0		

F5.4 - Spartium junceum scrub

*Diagnostic species (phi coefficient * 100)*

Spartium junceum	85.8	Rubus ulmifolius	43.8
Asparagus acutifolius	30.7	Clematis flammula	28.4
Rosa sempervirens	26.4	Dittrichia viscosa	22.6
Paliurus spina-christi	22.3	Rubia peregrina	22.1
Foeniculum vulgare	21.1	Clematis vitalba	20.7
Quercus pubescens	19.7	Pyrus amygdaliformis	19.4
Centaurea aspera	19.3	Psoralea bituminosa	18.9
Galactites elegans	18.3	Achillea ligustica	18.3
Carlina corymbosa	18.1	Fraxinus ornus	18.0
Arundo plinii	17.8	Asperula laevigata	17.4
Osyris alba	17.1	Brachypodium phoenicoides	15.1
Opopanax chironium	15.0		

Constant species (occurrence frequencies)

Spartium junceum	100.0	Rubus ulmifolius	74.0
Asparagus acutifolius	44.0	Rubia peregrina	41.0
Brachypodium pinnatum	39.0	Clematis vitalba	36.0
Quercus pubescens	34.0	Crataegus monogyna	34.0
Rosa canina agg.	28.0	Fraxinus ornus	28.0
Dactylis glomerata	26.0	Clematis flammula	26.0
Sanguisorba minor	25.0	Rosa sempervirens	23.0
Ulmus minor	21.0	Teucrium chamaedrys	21.0
Prunus spinosa	20.0	Cornus sanguinea	18.0
Hedera helix	16.0	Dittrichia viscosa	16.0
Bromus erectus	16.0	Hypericum perforatum	15.0
Hippocrepis emerus	15.0	Eryngium campestre	15.0
Carlina corymbosa	15.0	Brachypodium phoenicoides	15.0
Paliurus spina-christi	13.0	Osyris alba	13.0
Juniperus oxycedrus	13.0	Galium mollugo agg.	13.0
Rhamnus alaternus	11.0	Psoralea bituminosa	11.0
Pistacia terebinthus	11.0	Lonicera etrusca	11.0
Juniperus communis subsp. communis	11.0	Foeniculum vulgare	11.0
Erica arborea	11.0	Daucus carota	11.0
Carex flacca	11.0	Pyrus amygdaliformis	10.0
Pistacia lentiscus	10.0	Helichrysum italicum	10.0
Euonymus europaeus	10.0	Dactylis glomerata subsp. glomerata	10.0
Cistus monspeliensis	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Spartium junceum	100.0	Brachypodium pinnatum	10.0
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F5.5 - Thermomediterranean scrub

*Diagnostic species (phi coefficient * 100)*

Pistacia lentiscus	61.2	Olea europaea var. sylvestris	54.3
Euphorbia dendroides	50.5	Prasium majus	43.6
Ceratonia siliqua	41.2	Arisarum vulgare	37.2
Asphodelus ramosus	34.8	Asparagus acutifolius	28.1
Chamaerops humilis	27.6	Thymbra capitata	27.5
Smilax aspera	26.7	Asparagus albus	26.4
Juniperus phoenicea	26.3	Brachypodium retusum	25.9
Urginea maritima	25.8	Calicotome villosa	25.2
Phagnalon graecum	23.3	Hyparrhenia hirta	22.8
Ruta chalepensis	22.3	Teucrium fruticans	21.9
Asparagus aphyllus	21.0	Senecio bicolor	20.6
Teucrium flavum	20.4	Piptatherum coerulescens	19.9
Rubia peregrina	19.1	Valantia hispida	18.8
Sarcopoterium spinosum	18.8	Corema album	18.8
Aetheorhiza bulbosa	18.7	Lagoecia cuminoides	18.4
Artemisia arborescens	18.4	Bromus intermedius	18.1
Charybdis pancration	18.0	Hypochaeris achyrophorus	17.9
Ferula communis	17.9	Piptatherum miliaceum	17.7
Urospermum picroides	17.4	Olea europaea var. europaea	16.6
		Periploca laevigata subsp. angustifolia	16.4
Galium murale	16.6	Parietaria cretica	16.3
Phagnalon saxatile	16.3	Euphorbia acanthothamnus	16.0
Melica minuta	16.0	Clematis cirrhosa	15.3
Biscutella didyma	15.6	Tordylium apulum	15.1
Coronilla valentina	15.2		
Ampelodesmos mauritanica	15.1		

Constant species (occurrence frequencies)

Pistacia lentiscus	86.0	Olea europaea var. sylvestris	42.0
Asparagus acutifolius	40.0	Smilax aspera	35.0
Rubia peregrina	35.0	Euphorbia dendroides	35.0
Prasium majus	34.0	Brachypodium retusum	33.0
Arisarum vulgare	30.0	Asphodelus ramosus	29.0
Ceratonia siliqua	25.0	Juniperus phoenicea	21.0
Calicotome villosa	18.0	Urginea maritima	16.0
Thymbra capitata	16.0	Chamaerops humilis	15.0
Dactylis glomerata	15.0	Rhamnus alaternus	13.0
Rosmarinus officinalis	12.0	Hyparrhenia hirta	12.0
Teucrium fruticans	11.0	Teucrium flavum	11.0
Piptatherum miliaceum	11.0	Olea europaea var. europaea	11.0
Lonicera implexa	11.0	Cistus monspeliensis	11.0
Asparagus albus	11.0	Aetheorhiza bulbosa	11.0
Reichardia picroides	10.0	Hypochaeris achyrophorus	10.0
Helichrysum italicum	10.0	Dactylis glomerata subsp. hispanica	10.0
Asparagus aphyllus	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Pistacia lentiscus	64.0	Euphorbia dendroides	20.0
Olea europaea var. sylvestris	10.0	Ceratonia siliqua	6.0
Brachypodium retusum	6.0		

F6.1a - Western basiphilous garrigue

*Diagnostic species (phi coefficient * 100)*

Genista hispanica	42.9	Genista scorpius	41.3
Thymus vulgaris	40.2	Lavandula latifolia	37.2
Aphyllanthes monspeliensis	34.5	Coronilla minima	34.0
Coris monspeliensis	32.4	Linum suffruticosum	31.1
Koeleria vallesiana	31.1	Erica vagans	29.0
Dorycnium pentaphyllum	28.6	Avenula bromoides	26.7
Argyrobolium zanonii	25.8	Teucrium pyrenaicum	25.4
Stachys dubia	25.4	Rosmarinus officinalis	24.5
Helichrysum stoechas	24.5	Avenula mirandana	24.4
Fumana ericophylla	23.7	Helianthemum oelandicum	23.4
Thymelaea ruizii	21.7	Helictotrichon cantabricum	21.7
Leuzea conifera	20.4	Fumana thymifolia	19.9
Ononis minutissima	19.4	Lithodora fruticosa	19.4
Catananche caerulea	19.3	Fumana procumbens	19.2
Globularia bisnagarica	18.8	Atractylis humilis	18.8
Santolina chamaecyparissus	18.6	Bupleurum frutescens	18.6
Fumana ericoides	18.3	Euphorbia flavicoma	18.2
Erica multiflora	18.2	Teucrium polium	18.0
Helianthemum apenninum	17.6	Brachypodium retusum	17.6
Onobrychis argentea	17.0	Linum narbonense	17.0
Ononis fruticosa	16.2	Carduncellus monspeliensis	16.1
Carex hallerana	15.8	Onobrychis reuteri	15.6
Helianthemum croceum	15.5	Inula montana	15.3

Constant species (occurrence frequencies)

Thymus vulgaris	48.0	Genista scorpius	37.0
Genista hispanica	36.0	Coronilla minima	35.0
Koeleria vallesiana	33.0	Aphyllanthes monspeliensis	32.0
Teucrium chamaedrys	28.0	Lavandula latifolia	28.0
Brachypodium pinnatum	28.0	Dorycnium pentaphyllum	27.0
Bromus erectus	26.0	Eryngium campestre	25.0
Linum suffruticosum	24.0	Helianthemum oelandicum	24.0
Erica vagans	24.0	Teucrium polium	22.0
Rosmarinus officinalis	22.0	Helichrysum stoechas	22.0
Brachypodium retusum	22.0	Sanguisorba minor	21.0
Coris monspeliensis	20.0	Avenula bromoides	20.0
Potentilla tabernaemontani	19.0	Hieracium pilosella	19.0
Carex humilis	19.0	Fumana procumbens	18.0
Hippocrepis comosa	17.0	Helianthemum nummularium	17.0
Carex hallerana	17.0	Asperula cynanchica	17.0

Argyrolobium zanonii	17.0	Staehelina dubia	16.0
Lotus corniculatus	16.0	Teucrium pyrenaicum	15.0
Juniperus oxycedrus	15.0	Fumana ericophylla	15.0
Carex flacca	15.0	Buxus sempervirens	15.0
Scabiosa columbaria	14.0	Juniperus communis subsp. communis	14.0
Anthyllis vulneraria	14.0	Thymus praecox	13.0
Sedum sediforme	13.0	Rubia peregrina	13.0
Globularia bisnagarica	13.0	Seseli montanum	12.0
Ononis minutissima	12.0	Helianthemum apenninum	12.0
Dactylis glomerata	12.0	Catananche caerulea	12.0
Pinus halepensis	11.0	Leuzea conifera	11.0
Fumana thymifolia	11.0	Festuca rubra	11.0
Avenula mirandana	11.0	Astragalus monspessulanus	11.0
Quercus coccifera	10.0	Erica multiflora	10.0
Brachypodium phoenicoides	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Genista hispanica	29.0	Thymus vulgaris	14.0
Erica vagans	11.0	Rosmarinus officinalis	9.0
Genista scorpius	9.0	Erica multiflora	9.0

F6.1b - Western acidophilous garrigue

*Diagnostic species (phi coefficient * 100)*

Lavandula stoechas	65.5	Cistus populifolius	45.4
Cistus ladanifer	44.9	Erica australis	43.7
Thymus mastichina	42.6	Cistus salvifolius	39.4
Cistus crispus	38.8	Cytisus striatus	36.6
Halimium ocymoides	32.7	Thymus zygis	32.6
Cytisus multiflorus	31.7	Tuberaria lignosa	30.6
Cistus psilosepalus	30.4	Chamaespartium tridentatum	30.1
Polygala microphylla	29.6	Halimium halimifolium	29.4
Phillyrea angustifolia	27.5	Daphne gnidium	27.4
Cistus monspeliensis	26.9	Lavandula pedunculata	26.3
Cytinus hypocistis	24.6	Erica arborea	23.6
Erica umbellata	22.6	Stipa gigantea	21.7
Genista hystrix	21.7	Tuberaria guttata	21.1
Euphorbia broteri	21.1	Arbutus unedo	21.1
Genista corsica	20.7	Santolina rosmarinifolia	20.0
Agrostis castellana	19.4	Origanum virens	19.3
Astragalus lusitanicus	19.3	Thapsia villosa	19.2
Tolpis barbata	19.1	Linum trigynum	18.9
Halimium lasianthum	18.5	Aira caryophyllea	18.5
Briza maxima	18.2	Silene paradoxa	18.1
Genista triacanthos	18.1	Andryala integrifolia	18.1
Cistus laurifolius	17.9	Dianthus laricifolius	17.5

Avenula bromoides	17.4	Agrostis truncatula	17.3
Odontites tenuifolia	17.2	Genista tournefortii	17.2
Sedum forsterianum	16.8	Thapsia maxima	16.7
Calicotome spinosa	16.7	Hypericum linarifolium	16.6
Urginea maritima	16.4	Cladonia endiviifolia	16.2
Ulex parviflorus	16.1	Carlina corymbosa	16.0
Quercus rotundifolia	15.9	Crucianella angustifolia	15.9
Teucrium marum	15.8	Andryala ragusina	15.8
Vulpia bromoides	15.6	Helichrysum italicum	15.6
Micropyrum tenellum	15.4	Erica scoparia	15.2

Constant species (occurrence frequencies)

Lavandula stoechas	68.0	Cistus salvifolius	45.0
Erica arborea	29.0	Cistus ladanifer	29.0
Thymus mastichina	26.0	Phillyrea angustifolia	26.0
Erica australis	26.0	Daphne gnidium	26.0
Cistus populifolius	24.0	Cistus monspeliensis	23.0
Arbutus unedo	23.0	Calluna vulgaris	21.0
Cytisus striatus	19.0	Cistus crispus	18.0
Brachypodium retusum	18.0	Cytisus multiflorus	16.0
Asparagus acutifolius	16.0	Thymus zygis	15.0
Halimium ocymoides	15.0	Cytisus scoparius	15.0
Aira caryophylla	15.0	Tuberaria lignosa	13.0
Tuberaria guttata	13.0	Rubia peregrina	13.0
Quercus rotundifolia	13.0	Pistacia lentiscus	13.0
Jasione montana	13.0	Chamaespartium tridentatum	13.0
Helichrysum italicum	13.0	Cistus psilosepalus	13.0
Carlina corymbosa	13.0	Briza maxima	13.0
Avenula bromoides	13.0	Agrostis castellana	13.0
Trifolium campestre	11.0	Trifolium arvense	11.0
Thymus vulgaris	11.0	Rosmarinus officinalis	11.0
Pteridium aquilinum	11.0	Lavandula pedunculata	11.0
Erica scoparia	11.0	Dorycnium pentaphyllum	11.0
Dactylis glomerata subsp. hispanica	11.0	Dactylis glomerata	11.0
Vulpia bromoides	10.0	Urginea maritima	10.0
Polygala microphylla	10.0	Linum trigynum	10.0
Juniperus oxycedrus	10.0	Hypochaeris radicata	10.0
Helichrysum stoechas	10.0	Halimium halimifolium	10.0
Eryngium campestre	10.0	Erica cinerea	10.0
Cytinus hypocistis	10.0	Corynephorus canescens	10.0
Calicotome spinosa	10.0	Asphodelus ramosus	10.0
Andryala integrifolia	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Lavandula stoechas	27.0	Cistus populifolius	21.0
Cistus crispus	15.0	Halimium halimifolium	10.0
Cistus ladanifer	8.0	Thymus mastichina	6.0

F6.2 - Eastern garrigue

*Diagnostic species (phi coefficient * 100)*

Phlomis fruticosa	68.0	Erica manipuliflora	57.6
Micromeria juliana	53.6	Tordylium apulum	46.4
Salvia officinalis	38.5	Urginea maritima	37.5
Cistus incanus	35.5	Quercus coccifera	34.2
Convolvulus althaeoides	32.7	Thymbra capitata	31.8
Desmazeria rigida	30.7	Satureja thymbra	29.8
Genista acanthoclada	29.6	Asphodeline lutea	29.0
Briza maxima	28.4	Crepis rubra	27.3
Carlina corymbosa	27.2	Cynosurus echinatus	27.1
Fumana ericoides	26.7	Leontodon tuberosus	25.7
Brachypodium retusum	25.7	Asparagus acutifolius	25.7
Urospermum picroides	25.1	Paliurus spina-christi	24.9
Eryngium creticum	24.5	Trifolium stellatum	24.4
Asperula scutellaris	24.3	Genista sylvestris	24.2
Avena sterilis	24.1	Campanula ramosissima	23.7
Calicotome villosa	23.5	Stipa bromoides	23.0
Acanthus spinosus	23.0	Koeleria splendens	22.6
Hypericum empetrifolium	22.6	Allium rubrovittatum	22.4
Fumana thymifolia	22.3	Anthyllis hermanniae	22.1
Nigella damascena	21.9	Cistus salvifolius	21.9
Valantia hispida	21.8	Polypogon monspeliensis	21.7
Sideritis romana	21.4	Pistorinia hispanica	21.2
Hieracium heterogynum	21.1	Crepis zacintha	20.9
Hymenocarpus circinnatus	20.8	Phillyrea latifolia	20.7
Thesium bergeri	20.2	Consolida ajacis	20.2
Cistus parviflorus	20.1	Pyrus amygdaliformis	19.7
Lathyrus cicera	19.7	Euphorbia acanthothamnus	19.5
Asperula rigida	19.4	Anagallis foemina	19.3
Teucrium polium	19.1	Securigera securidaca	18.9
Muscari spreitzenhoferi	18.8	Aegilops geniculata	18.6
Teucrium microphyllum	18.4	Ceterach officinarum	18.4
Dasypyrum villosum	18.3	Trifolium scabrum	18.2
Muscari tenuiflorum	18.2	Genista sericea	18.2
Phagnalon graecum	18.1	Tordylium maximum	17.7
Crupina crupinastrum	17.6	Saponaria calabrica	17.5
Linum arboreum	17.5	Euphorbia spinosa	17.4
Euphorbia dimorphocaulon	17.4	Carex illegitima	17.4
Centaurea glaberrima	17.3	Arceuthobium oxycedri	17.3
Arbutus unedo	17.3	Galium murale	17.2
Bromus fasciculatus	17.2	Plantago bellardii	17.1
Helictotrichon agropyroides	17.1	Biscutella didyma	16.4
Andropogon distachyos	16.4	Centaurium erythraea	16.1
Onopordum illyricum	15.9	Bromus intermedius	15.9

Helictotrichon convolutum	15.6	Edraianthus tenuifolius	15.6
Tanacetum cinerariifolium	15.5	Pallenis spinosa	15.5
Scorpiurus muricatus	15.4	Sarcopoterium spinosum	15.4
Micromeria graeca	15.4	Lathyrus sphaericus	15.4
Juniperus oxycedrus	15.4	Iris unguicularis	15.4
Galium parisiense	15.4	Frangula rupestris	15.4
Filago aegaea	15.3		

Constant species (occurrence frequencies)

Phlomis fruticosa	57.0	Dactylis glomerata	45.0
Erica manipuliflora	40.0	Quercus coccifera	38.0
Micromeria juliana	37.0	Asparagus acutifolius	37.0
Brachypodium retusum	33.0	Cistus incanus	32.0
Tordylium apulum	28.0	Desmazeria rigida	28.0
Urginea maritima	27.0	Teucrium polium	23.0
Phillyrea latifolia	23.0	Cynosurus echinatus	23.0
Cistus salvifolius	23.0	Carlina corymbosa	23.0
Briza maxima	22.0	Thymbra capitata	20.0
Salvia officinalis	20.0	Convolvulus althaeoides	20.0
Trifolium campestre	18.0	Juniperus oxycedrus	18.0
Arbutus unedo	18.0	Teucrium chamaedrys	17.0
Pistacia lentiscus	17.0	Calicotome villosa	17.0
Trifolium stellatum	15.0	Trifolium scabrum	15.0
Poa bulbosa	15.0	Paliurus spina-christi	15.0
Melica ciliata	15.0	Centaurium erythraea	15.0
Anthyllis vulneraria	15.0	Anthoxanthum odoratum	15.0
Stipa bromoides	13.0	Sherardia arvensis	13.0
Leontodon tuberosus	13.0	Koeleria splendens	13.0
Genista acanthoclada	13.0	Fumana thymifolia	13.0
Fumana ericoides	13.0	Anagallis arvensis	13.0
Urospermum picroides	12.0	Satureja thymbra	12.0
Sanguisorba minor	12.0	Pistacia terebinthus	12.0
Dasypyrum villosum	12.0	Ceterach officinarum	12.0
Avena sterilis	12.0	Asphodeline lutea	12.0
Spartium junceum	10.0	Pyrus amygdaliformis	10.0
Polypogon monspeliensis	10.0	Pinus halepensis	10.0
Lotus corniculatus	10.0	Linum strictum	10.0
Hypericum empetrifolium	10.0	Hippocrepis comosa	10.0
Geranium molle	10.0	Eryngium campestre	10.0
Avena fatua	10.0	Avena barbata	10.0
Asphodelus ramosus	10.0	Arenaria leptoclados	10.0
Anthyllis hermanniae	10.0	Aegilops geniculata	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Phlomis fruticosa	57.0	Erica manipuliflora	37.0
Urginea maritima	7.0	Cistus salvifolius	5.0
Cistus incanus	5.0	Brachypodium retusum	5.0

F6.6 - Supramediterranean garrigue

*Diagnostic species (phi coefficient * 100)*

Genista cinerea	55.7	Lavandula angustifolia	52.4
Genista lobelii	49.4	Anthyllis montana	44.8
Helianthemum oelandicum	35.8	Linum suffruticosum	35.7
Thymus vulgaris	33.5	Thymus herba-barona	31.8
Carex hallerana	30.9	Carlina acanthifolia	30.7
Erysimum rhaeticum	29.0	Koeleria vallesiana	28.8
Laserpitium gallicum	28.3	Galium corrudifolium	27.9
Inula montana	27.5	Galium corsicum	27.0
Teucrium montanum	26.5	Thesium divaricatum	26.4
Coronilla minima	26.1	Aphyllanthes monspeliensis	25.7
Cerastium stenopetalum	25.6	Leuzea conifera	25.5
Satureja montana	25.2	Serratula nudicaulis	24.6
Achnatherum calamagrostis	23.2	Leucanthemum graminifolium	23.0
Iberis saxatilis	22.8	Anthyllis hermanniae	22.8
Valeriana tuberosa	22.7	Bellium bellidioides	22.2
Fumana procumbens	21.9	Ononis striata	21.8
Stachys corsica	21.7	Crocus corsicus	21.6
Sedum ochroleucum	21.5	Astragalus monspessulanus	21.0
Teucrium polium	20.5	Arenaria aggregata	20.5
Astragalus purpureus	20.2	Avenula bromoides	19.5
Santolina chamaecyparissus	19.4	Onobrychis supina	19.4
Erysimum jugicola	19.2	Crepis albida	19.2
Brimeura fastigiata	18.8	Hypochaeris robertia	18.5
Dianthus caryophyllus	18.2	Artemisia alba	18.0
Seseli montanum	17.8	Carex humilis	17.8
Carduncellus monspeliensis	17.8	Knautia purpurea	17.7
Globularia repens	17.6	Fumana ericophylla	17.5
Echinops ritro	17.4	Helianthemum pilosum	17.2
Carlina macrocephala	17.2	Centaurea paniculata	17.1
Thymus dolomiticus	16.9	Thymus serpyllum	16.8
Teucrium chamaedrys	16.6	Odontites lanceolata	16.6
Berberis aetnensis	16.5	Trinia glauca	16.4
Sagina pilifera	16.2	Helianthemum canum	16.2
Sesleria coerulans	15.7	Bupleurum ranunculoides	15.2

Constant species (occurrence frequencies)

Lavandula angustifolia	49.0	Genista cinerea	43.0
Thymus vulgaris	40.0	Teucrium chamaedrys	40.0
Helianthemum oelandicum	40.0	Teucrium montanum	36.0
Carex hallerana	34.0	Anthyllis montana	34.0
Koeleria vallesiana	31.0	Linum suffruticosum	29.0
Carex humilis	28.0	Coronilla minima	27.0
Bromus erectus	27.0	Hieracium pilosella	26.0
Genista lobelii	26.0	Teucrium polium	25.0

Sanguisorba minor	23.0	Galium corrudifolium	23.0
Aphyllanthes monspeliensis	23.0	Anthyllis vulneraria	23.0
Thymus serpyllum	22.0	Asperula cynanchica	22.0
Satureja montana	21.0	Fumana procumbens	21.0
Festuca rubra	21.0	Brachypodium pinnatum	21.0
Carlina acanthifolia	19.0	Seseli montanum	18.0
Inula montana	18.0	Potentilla tabernaemontani	17.0
Juniperus communis subsp. communis	17.0	Hippocrepis comosa	17.0
Thesium divaricatum	16.0	Sesleria coerulans	16.0
Scabiosa columbaria	16.0	Lotus corniculatus	16.0
Leuzea conifera	16.0	Erysimum rhaeticum	16.0
Cerastium arvense	16.0	Astragalus monspessulanus	16.0
Amelanchier ovalis	16.0	Quercus pubescens	15.0
Pinus sylvestris	15.0	Laserpitium gallicum	15.0
Festuca ovina	15.0	Buxus sempervirens	15.0
Avenula bromoides	15.0	Sedum ochroleucum	14.0
Eryngium campestre	14.0	Vincetoxicum hirundinaria	13.0
Echinops ritro	13.0	Carlina vulgaris	13.0
Achnatherum calamagrostis	13.0	Thymus herba-barona	12.0
Genista pilosa	12.0	Trinia glauca	11.0
Ononis striata	11.0	Helianthemum nummularium	11.0
Helianthemum canum	11.0	Fumana ericophylla	11.0
Stachys recta	10.0	Prunus mahaleb	10.0
Petrorhagia saxifraga	10.0	Hieracium murorum	10.0
Globularia cordifolia	10.0	Euphorbia cyparissias	10.0
Dactylis glomerata	10.0	Artemisia alba	10.0
Anthyllis hermanniae	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Genista cinerea	41.0	Anthyllis montana	26.0
Genista lobelii	25.0	Lavandula angustifolia	6.0

F6.7 - Mediterranean gypsum scrub

*Diagnostic species (phi coefficient * 100)*

Herniaria fruticosa	88.4	Helianthemum syriacum	88.2
Ononis tridentata	81.3	Helianthemum squamatum	81.2
Launaea pumila	64.0	Atractylis humilis	61.2
Fumana ericoides	60.6	Plantago albicans	57.2
Thymus vulgaris	56.9	Helichrysum stoechas	53.7
Genista scorpius	53.5	Koeleria vallesiana	51.8
Rosmarinus officinalis	50.7	Brachypodium retusum	50.2
Santolina chamaecyparissus	50.0	Lepidium subulatum	49.7
Stipa parviflora	48.2	Lygeum spartum	47.4
Coris monspeliensis	45.5	Linum suffruticosum	42.9
Artemisia herba-alba	42.4	Teucrium polium	41.3

Gypsophila struthium subsp. hispanica	40.2	Bromus rubens	37.3
Matthiola fruticulosa	37.1	Fumana hispidula	35.1
Reseda stricta	34.9	Thymus loscosii	34.6
Odontites longiflora	33.9	Fumana thymifolia	31.7
Sedum sediforme	31.0	Helianthemum cinereum	30.3
Boleum asperum	28.7	Limonium viciosoi	27.7
Mercurialis tomentosa	27.5	Cistus clusii	26.6
Sideritis scordioides	26.3	Stipa offneri	26.1
Helianthemum violaceum	25.4	Euphorbia serrata	24.9
Astragalus incanus	24.5	Launaea resedifolia	24.2
Lithodora fruticosa	22.0	Dipcadi serotinum	21.6
Senecio auricula	20.1	Helianthemum oelandicum	20.0
Teucrium aragonense	19.6	Schismus barbatus	19.5
Crucianella patula	19.4	Asterolinon linum-stellatum	19.1
Helianthemum asperum	19.0	Bombycilaena discolor	18.4
Ephedra major	17.6	Dianthus furcatus	17.5
Thymelaea tinctoria	17.4	Centaurea linifolia	17.2
Euphorbia minuta	17.1	Eruca vesicaria	16.9
Salsola vermiculata	16.8	Echinops ritro	16.8
Avenula bromoides	16.8	Arrhenatherum album	16.4
Centaurea melitensis	15.7	Salvia lavandulifolia	15.1

Constant species (occurrence frequencies)

Herniaria fruticosa	79.0	Helianthemum syriacum	79.0
Thymus vulgaris	75.0	Brachypodium retusum	71.0
Ononis tridentata	67.0	Helianthemum squamatum	67.0
Koeleria vallesiana	62.0	Helichrysum stoechas	58.0
Teucrium polium	54.0	Rosmarinus officinalis	54.0
Genista scorpius	54.0	Fumana ericoides	46.0
Launaea pumila	42.0	Atractylis humilis	42.0
Plantago albicans	38.0	Linum suffruticosum	38.0
Santolina chamaecyparissus	33.0	Coris monspeliensis	33.0
Sedum sediforme	29.0	Stipa parviflora	25.0
Lygeum spartum	25.0	Lepidium subulatum	25.0
Helianthemum oelandicum	21.0	Fumana thymifolia	21.0
Eryngium campestre	21.0	Bromus rubens	21.0
Artemisia herba-alba	21.0	Matthiola fruticulosa	17.0
Gypsophila struthium subsp. hispanica	17.0	Thymus loscosii	12.0
Stipa offneri	12.0	Reseda stricta	12.0
Odontites longiflora	12.0	Helianthemum cinereum	12.0
Fumana hispidula	12.0	Euphorbia serrata	12.0
Echinops ritro	12.0	Avenula bromoides	12.0
Asterolinon linum-stellatum	12.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Rosmarinus officinalis	33.0	Brachypodium retusum	12.0
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F6.8a - Mediterranean halo-nitrophilous scrub

*Diagnostic species (phi coefficient * 100)*

Atriplex halimus	58.2	Artemisia arborescens	46.7
Artemisia herba-alba	46.2	Salsola vermiculata	44.3
Santolina chamaecyparissus	33.9	Bromus rubens	32.5
Piptatherum miliaceum	32.3	Suaeda braun-blancquetii	30.0
Ptilostemon casabonae	25.2	Herniaria cinerea	25.1
Foeniculum vulgare	24.9	Suaeda vera	24.8
Dittrichia viscosa	24.8	Anacyclus clavatus	24.8
Asphodelus fistulosus	24.0	Sonchus tenerrimus	23.3
Plantago lagopus	23.3	Lygeum spartum	22.6
Anagallis foetida	22.6	Centaurea melitensis	22.5
Euphorbia pithyusa	22.3	Camphorosma monspeliaca	21.7
Santolina rosmarinifolia	21.3	Opuntia ficus-indica	21.3
Malva parviflora	21.1	Malva arborea	20.4
Sisymbrium irio	20.3	Hordeum murinum	19.9
Lycium schweinfurthii	19.8	Bupleurum semicompositum	19.8
Dactylis glomerata subsp. hispanica	19.5	Lophochloa cristata	19.4
Galactites elegans	19.4	Ruta graveolens	19.3
Dipsacus ferox	19.3	Salsola oppositifolia	19.1
Diploaxis virgata	19.0	Carduus tenuiflorus	18.6
Marrubium vulgare	17.9	Scrophularia canina	17.6
Carlina corymbosa	17.4	Eruca vesicaria	17.1
Plantago albicans	16.8	Filago pyramidata	16.8
Marrubium alysson	16.6	Scorzonera laciniata	16.1
Moricandia arvensis	16.0	Arisarum vulgare	15.9
Papaver hybridum	15.4	Helichrysum italicum	15.3

Constant species (occurrence frequencies)

Atriplex halimus	37.0	Daucus carota	27.0
Artemisia herba-alba	24.0	Artemisia arborescens	24.0
Piptatherum miliaceum	23.0	Salsola vermiculata	21.0
Asparagus acutifolius	20.0	Santolina chamaecyparissus	18.0
Dittrichia viscosa	18.0	Eryngium campestre	17.0
Bromus rubens	17.0	Hordeum murinum	15.0
Dactylis glomerata subsp. hispanica	15.0	Pistacia lentiscus	14.0
Foeniculum vulgare	14.0	Carlina corymbosa	14.0
Sonchus oleraceus	13.0	Helichrysum italicum	13.0
Suaeda braun-blancquetii	11.0	Plantago lagopus	11.0
Camphorosma monspeliaca	11.0	Arisarum vulgare	11.0
Sonchus tenerrimus	10.0	Plantago lanceolata	10.0
Filago pyramidata	10.0	Desmazeria rigida	10.0
Anacyclus clavatus	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Atriplex halimus	25.0	Artemisia arborescens	20.0
Santolina chamaecyparissus	18.0	Salsola vermiculata	11.0
Artemisia herba-alba	7.0	Santolina rosmarinifolia	6.0

F6.8b - Caspian halo-nitrophilous scrub

*Diagnostic species (phi coefficient * 100)*

Artemisia lerchiana	74.3	Trigonella orthoceras	55.4
Artemisia tschernieviana	49.8	Alyssum linifolium	48.3
Alyssum turkestanicum	47.0	Ceratocarpus arenarius	46.6
Alhagi pseudalhagi	46.6	Eremopyrum orientale	45.3
Eremopyrum triticeum	40.3	Leymus ramosus	36.8
Neotorularia contortuplicata	35.4	Ceratocephala testiculata	34.0
Centaurea arenaria	32.5	Senecio noeanus	29.6
Salsola kali subsp. tragus	29.1	Xanthoparmelia ryssolea	28.5
Bromus tectorum	27.7	Bromus squarrosus	27.2
Holosteum umbellatum	26.8	Xanthoria parietina	26.2
Leymus racemosus	25.8	Anabasis aphylla	25.0
Carduus uncinatus	24.9	Xanthoria polycarpa	24.0
Astragalus dolichophyllus	23.7	Rinodina exigua	23.3
Lappula semiglaba	23.1	Matricaria parviflora	22.7
Erodium hoefftianum	22.7	Festuca beckeri	22.6
Tragopogon dubius	22.3	Agropyron fragile	22.3
Artemisia taurica	21.8	Ranunculus oxyspermus	21.6
Cachrys odontalgica	21.6	Filago arvensis	20.7
Bassia prostrata	20.7	Agropyron desertorum	20.5
Tulipa sylvestris	20.2	Ferula caspica	20.0
Descurainia sophia	19.9	Bassia sedoides	19.7
Poa bulbosa	19.5	Buglossoides arvensis	19.5
Androsace maxima	19.4	Artemisia scoparia	17.9
Camphorosma monspeliaca	17.7	Atriplex aucheri	17.3
Ephedra distachya	17.2	Medicago kotovii	17.0
Tribulus terrestris	16.7	Seiophora lacunosa	16.6
Salsola pontica	16.4	Carduus pycnocephallus	16.2
Iris scariosa	16.1	Helichrysum graveolens	16.1
Trisetum loeflingianum	16.0	Senecio vernalis	16.0
Fumaria schleicheri	15.6	Carex ligerica	15.6
Crambe maritima	15.4	Hordeum brevisubulatum	15.3
Tragopogon ruber	15.1	Carex diluta	15.1

Constant species (occurrence frequencies)

Artemisia lerchiana	68.0	Alyssum turkestanicum	41.0
Trigonella orthoceras	35.0	Poa bulbosa	29.0
Eremopyrum triticeum	29.0	Eremopyrum orientale	29.0
Ceratocarpus arenarius	29.0	Artemisia tschernieviana	29.0

Alyssum linifolium	29.0	Alhagi pseudalhagi	29.0
Bromus tectorum	26.0	Bromus squarrosus	26.0
Leymus ramosus	18.0	Holosteum umbellatum	18.0
Centaurea arenaria	18.0	Tragopogon dubius	15.0
Salsola kali subsp. tragus	15.0	Neotorularia contortuplicata	15.0
Leymus racemosus	15.0	Filago arvensis	15.0
Descurainia sophia	15.0	Ceratocephala testiculata	15.0
Senecio noeanus	12.0	Festuca valesiaca	12.0
Eryngium maritimum	12.0	Carduus uncinatus	12.0
Buglossoides arvensis	12.0	Bassia prostrata	12.0
Artemisia austriaca	12.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Artemisia lerchiana	32.0	Artemisia tschernieviana	21.0
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F7.1 - Western Mediterranean spiny heath

*Diagnostic species (phi coefficient * 100)*

Genista corsica	74.1	Helichrysum italicum	60.5
Astragalus massiliensis	54.7	Cistus monspeliensis	44.8
Stachys glutinosa	41.0	Teucrium marum	39.5
Rosmarinus officinalis	38.6	Euphorbia pithyusa	38.3
Reichardia picroides	37.7	Carlina corymbosa	37.7
Genista sardoa	33.8	Pallenis maritima	31.4
Cistus salvifolius	31.2	Lagurus ovatus	29.9
Armeria pungens	27.7	Pistacia lentiscus	27.5
Brachypodium retusum	26.6	Calicotome villosa	26.4
Anchusa crispa	26.3	Silene sedoides	25.4
Lotus cytisoides	25.1	Rumex bucephalophorus	25.0
Senecio bicolor	24.9	Lavandula stoechas	24.6
Thymelaea tartonraira	24.4	Juniperus phoenicea	24.2
Ptilostemon casabonae	23.6	Dactylis glomerata subsp. hispanica	23.6
Hirschfeldia incana	22.0	Camphorosma monspeliaca	22.0
Lobularia maritima	21.7	Asparagus acutifolius	21.7
Ephedra distachya	21.5	Phillyrea angustifolia	21.1
Plantago subulata	20.9	Senecio leucanthemifolius	20.5
Asphodelus ramosus	20.2	Asparagus albus	19.5
Teucrium polium	18.9	Centranthus calcitrapae	18.9
Centaurea horrida	18.9	Aetheorhiza bulbosa	18.9
Lotus drepanocarpus	18.8	Limonium acutifolium	18.7
Parapholis incurva	18.4	Valantia muralis	18.2
Lathyrus articulatus	17.8	Matthiola sinuata	16.9
Medicago praecox	16.8	Chamaerops humilis	16.2
Desmazeria marina	16.0	Plantago coronopus	15.8
Umbilicus horizontalis	15.7	Linaria arvensis	15.5
Convolvulus althaeoides	15.1		

Constant species (occurrence frequencies)

Helichrysum italicum	65.0	Genista corsica	58.0
Cistus monspeliensis	42.0	Rosmarinus officinalis	38.0
Reichardia picroides	35.0	Pistacia lentiscus	35.0
Cistus salvifolius	35.0	Carlina corymbosa	35.0
Brachypodium retusum	35.0	Astragalus massiliensis	31.0
Asparagus acutifolius	31.0	Rubia peregrina	27.0
Daucus carota	27.0	Teucrium polium	23.0
Lagurus ovatus	23.0	Dactylis glomerata	23.0
Teucrium marum	19.0	Stachys glutinosa	19.0
Phillyrea angustifolia	19.0	Lavandula stoechas	19.0
Juniperus phoenicea	19.0	Euphorbia pithyusa	19.0
Dactylis glomerata subsp. hispanica	19.0	Calicotome villosa	19.0
Rumex bucephalophorus	15.0	Plantago coronopus	15.0
Lotus cytisoides	15.0	Erica arborea	15.0
Asphodelus ramosus	15.0	Senecio bicolor	12.0
Plantago subulata	12.0	Pallenis maritima	12.0
Lobularia maritima	12.0	Helichrysum stoechas	12.0
Genista sardoa	12.0	Ephedra distachya	12.0
Cistus incanus	12.0	Camphorosma monspeliaca	12.0
Armeria pungens	12.0	Aetheorhiza bulbosa	12.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Genista corsica	58.0	Astragalus massiliensis	31.0
Genista sardoa	12.0	Armeria pungens	12.0
Rosmarinus officinalis	8.0		

F7.3 - Eastern Mediterranean spiny heath (phrygana)

*Diagnostic species (phi coefficient * 100)*

Thymbra capitata	72.5	Sarcopoterium spinosum	66.2
Genista acanthoclada	54.1	Leontodon tuberosus	46.6
Hypochaeris achyrophorus	39.9	Phagnalon graecum	36.2
Satureja thymbra	35.4	Valantia hispida	35.0
Crepis cretica	34.8	Carlina corymbosa	34.4
Paronychia macrosepala	33.3	Bromus intermedius	32.6
Euphorbia acanthothamnos	32.4	Centaurea raphanina	31.5
Allium rubrovittatum	31.3	Phagnalon rupestre	30.8
Urginea maritima	30.7	Medicago coronata	30.5
Phlomis fruticosa	30.2	Filago aegaea	30.2
Lagoecia cuminoides	30.0	Galium murale	30.0
Bromus fasciculatus	30.0	Asperula rigida	29.9
Gastroidium phleoides	29.7	Rostraria cristata	29.4
Daucus involucratus	29.1	Teucrium microphyllum	29.0
Hyparrhenia hirta	29.0	Crucianella latifolia	29.0
Asphodelus ramosus	28.7	Convolvulus althaeoides	28.6

<i>Fumana arabica</i>	27.8	<i>Linum strictum</i>	27.6
<i>Ononis reclinata</i>	26.8	<i>Calicotome villosa</i>	26.5
<i>Polygala venulosa</i>	26.2	<i>Bupleurum gracile</i>	25.9
<i>Sideritis curvidens</i>	25.8	<i>Lagurus ovatus</i>	25.8
<i>Brachypodium retusum</i>	25.7	<i>Erica manipuliflora</i>	25.6
<i>Urospermum picroides</i>	25.0	<i>Biscutella didyma</i>	24.8
<i>Aegilops dichasians</i>	24.4	<i>Scorpiurus muricatus</i>	23.9
<i>Lotus edulis</i>	23.8	<i>Centaurea idaea</i>	23.6
<i>Thesium bergeri</i>	23.5	<i>Trifolium stellatum</i>	23.3
<i>Scaligeria napiformis</i>	23.1	<i>Centaureum tenuiflorum</i>	22.6
<i>Anthyllis hermanniae</i>	22.5	<i>Pyrus amygdaliformis</i>	22.1
<i>Muscari spreitzenhoferi</i>	22.1	<i>Micromeria nervosa</i>	22.1
<i>Desmazeria rigida</i>	21.9	<i>Ranunculus paludosus</i>	21.6
<i>Fumana thymifolia</i>	21.6	<i>Lotus ornithopodioides</i>	21.4
<i>Helictotrichon convolutum</i>	21.4	<i>Cichorium spinosum</i>	21.2
<i>Trifolium infamia-ponertii</i>	21.1	<i>Arisarum vulgare</i>	21.0
<i>Teucrium alpestre</i>	20.9	<i>Hypericum empetrifolium</i>	20.8
<i>Hyoseris scabra</i>	20.8	<i>Valantia muralis</i>	20.7
<i>Aira elegantissima</i>	20.5	<i>Micromeria juliana</i>	20.3
<i>Hymenocarpus circinnatus</i>	20.3	<i>Plantago afra</i>	20.2
<i>Iris unguicularis</i>	20.2	<i>Festuca jeanpertii</i>	19.9
<i>Prasium majus</i>	19.7	<i>Mandragora autumnalis</i>	19.7
<i>Galium setaceum</i>	19.6	<i>Trigonella spinosa</i>	19.4
<i>Filago eriocephala</i>	19.4	<i>Centaurea spinosa</i>	19.3
<i>Asphodeline lutea</i>	19.3	<i>Thymelaea hirsuta</i>	18.8
<i>Trifolium scabrum</i>	18.6	<i>Tordylium apulum</i>	18.6
<i>Teucrium fruticans</i>	18.6	<i>Gagea graeca</i>	18.6
<i>Echium humile</i>	18.6	<i>Micromeria graeca</i>	18.4
<i>Convolvulus oleifolius</i>	18.4	<i>Asparagus aphyllus</i>	18.4
<i>Trigonella monspeliaca</i>	18.3	<i>Plantago bellardii</i>	18.3
<i>Olea europaea var. sylvestris</i>	18.3	<i>Euphorbia peplus</i>	18.3
<i>Crepis tybakiensis</i>	18.3	<i>Cardopatum corymbosum</i>	18.2
<i>Verbascum spinosum</i>	18.0	<i>Salvia triloba</i>	18.0
<i>Asterolinon linum-stellatum</i>	17.9	<i>Linum trigynum</i>	17.8
<i>Lamyropsis cynaroides</i>	17.8	<i>Cuscuta palaestina</i>	17.8
<i>Trifolium tomentosum</i>	17.7	<i>Cistus incanus</i>	17.6
<i>Avena barbata</i>	17.5	<i>Petrorhagia dubia</i>	17.4
<i>Lotus halophilus</i>	17.4	<i>Helianthemum stipulatum</i>	17.2
<i>Aegilops biuncialis</i>	17.2	<i>Tremastelma palaestinum</i>	17.1
<i>Quercus coccifera</i>	17.1	<i>Cistus parviflorus</i>	17.1
<i>Ballota acetabulosa</i>	17.0	<i>Vicia cretica</i>	16.9
<i>Prospero autumnale</i>	16.7	<i>Briza maxima</i>	16.5
<i>Scandix australis</i>	16.3	<i>Gynandrisis sisyrinchium</i>	16.2
<i>Carlina lanata</i>	16.1	<i>Avellinia michelii</i>	16.1
<i>Trifolium uniflorum</i>	16.0	<i>Lotus cytisoides</i>	16.0
<i>Reichardia picroides</i>	15.9	<i>Nigella stricta</i>	15.9
<i>Teucrium polium</i>	15.8	<i>Hedypnois cretica</i>	15.8
<i>Cerastium scaposum</i>	15.4	<i>Tragopogon porrifolius</i>	15.3

Hippocrepis unisiliquosa	15.2	Aetheorhiza bulbosa	15.2
Psilurus incurvus	15.1	Pallenis spinosa	15.1
Biarum davisii	15.1	Dianthus crinitus	15.0

Constant species (occurrence frequencies)

Thymbra capitata	67.0	Sarcopoterium spinosum	53.0
Genista acanthoclada	35.0	Brachypodium retusum	33.0
Leontodon tuberosus	31.0	Carlina corymbosa	31.0
Hypochaeris achyrophorus	27.0	Asphodelus ramosus	23.0
Linum strictum	22.0	Dactylis glomerata	22.0
Urginea maritima	21.0	Asparagus acutifolius	21.0
Teucrium polium	19.0	Lagurus ovatus	19.0
Desmazeria rigida	19.0	Calicotome villosa	19.0
Trifolium campestre	18.0	Quercus coccifera	18.0
Pistacia lentiscus	18.0	Phagnalon graecum	18.0
Anagallis arvensis	18.0	Valantia hispida	17.0
Phlomis fruticosa	17.0	Hyparrhenia hirta	17.0
Convolvulus althaeoides	17.0	Trifolium scabrum	15.0
Satureja thymbra	15.0	Poa bulbosa	15.0
Arisarum vulgare	15.0	Trifolium stellatum	14.0
Galium murale	14.0	Euphorbia acanthothamnus	14.0
Crepis cretica	14.0	Cistus incanus	14.0
Centaurea raphanina	14.0	Bromus intermedius	14.0
Rostraria cristata	13.0	Reichardia picroides	13.0
Prasium majus	13.0	Paronychia macrosepala	13.0
Lagoecia cuminoides	13.0	Fumana thymifolia	13.0
Crucianella latifolia	13.0	Avena barbata	13.0
Aira elegantissima	13.0	Urospermum picroides	12.0
Sherardia arvensis	12.0	Scorpiurus muricatus	12.0
Pyrus amygdaliformis	12.0	Phagnalon rupestre	12.0
Ononis reclinata	12.0	Medicago coronata	12.0
Helichrysum stoechas	12.0	Erica manipuliflora	12.0
Bromus fasciculatus	12.0	Briza maxima	12.0
Asterolinon linum-stellatum	12.0	Allium rubrovittatum	12.0
Teucrium microphyllum	10.0	Olea europaea var. sylvestris	10.0
Micromeria graeca	10.0	Gastidium phleoides	10.0
Fumana arabica	10.0	Filago aegaea	10.0
Daucus involucratus	10.0	Asperula rigida	10.0
Anthyllis hermanniae	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Thymbra capitata	40.0	Sarcopoterium spinosum	27.0
Genista acanthoclada	24.0	Euphorbia acanthothamnus	6.0

F7.4a - Western Mediterranean mountain hedgehog-heath

*Diagnostic species (phi coefficient * 100)*

Cytisus balansae	90.6	Genista cinerascens	44.8
Senecio adonidifolius	31.2	Festuca summilusitana	29.7
Arenaria querioides	27.6	Carduus carpetanus	27.2
Luzula lactea	25.3	Echinopartum lusitanicum	23.7
Orobanch rapum-genistae	23.4	Festuca eskia	23.3
Echinopartum ibericum	23.3	Festuca elegans	23.0
Jasione crispa	22.6	Ornithogalum concinnum	22.1
Linaria repens	21.4	Koeleria crassipes	20.0
Anarrhinum bellidifolium	19.9	Stipa gigantea	18.8
Santolina rosmarinifolia	18.8	Avenula marginata	17.9
Agrostis delicatula	17.8	Agrostis castellana	17.8
Thymus zygis	17.5	Lactuca viminea	17.5
Genista florida	16.9	Deschampsia flexuosa	15.8
Gentiana lutea	15.7	Linaria nivea	15.6
Veronica fruticulosa	15.5	Plantago subulata	15.5
Leucanthemopsis pulverulenta	15.3	Molopospermum peloponnesiacum	15.2
Leucanthemopsis pallida	15.1		

Constant species (occurrence frequencies)

Cytisus balansae	92.0	Deschampsia flexuosa	49.0
Calluna vulgaris	35.0	Genista cinerascens	23.0
Teucrium scorodonia	22.0	Cytisus scoparius	20.0
Agrostis capillaris	20.0	Rumex acetosella	18.0
Rubus idaeus	18.0	Pteridium aquilinum	17.0
Jasione montana	16.0	Senecio adonidifolius	15.0
Juniperus communis subsp. communis	15.0	Arrhenatherum elatius	15.0
Vaccinium myrtillus	14.0	Thymus praecox	14.0
Gentiana lutea	13.0	Thymus pulegioides	12.0
Linaria repens	12.0	Juniperus communis subsp. alpina	12.0
Jasione crispa	12.0	Genista pilosa	12.0
Festuca eskia	12.0	Conopodium majus	12.0
Achillea millefolium	12.0	Agrostis castellana	12.0
Galium verum	11.0	Festuca rubra	11.0
Festuca ovina	11.0	Anthoxanthum odoratum	11.0
Veronica officinalis	10.0	Solidago virgaurea	10.0
Festuca summilusitana	10.0	Epilobium angustifolium	10.0
Crataegus monogyna	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Cytisus balansae	91.0	Echinopartum ibericum	6.0
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F7.4b - Central Mediterranean mountain hedgehog-heath

*Diagnostic species (phi coefficient * 100)*

Chamaecytisus spinescens	69.3	Armeria brutia	54.9
Centaurea sarfattiana	54.8	Astragalus calabrus	54.8

<i>Festuca circummediterranea</i>	51.0	<i>Anthemis cretica</i>	49.7
<i>Thymus longicaulis</i>	49.3	<i>Sesleria tenuifolia</i>	48.8
<i>Phleum ambiguum</i>	47.8	<i>Genista michelii</i>	47.7
<i>Genista desoleana</i>	47.7	<i>Hypericum calabricum</i>	47.2
<i>Bromopsis caprina</i>	47.1	<i>Festuca curvula</i>	46.0
<i>Koeleria lobata</i>	45.4	<i>Erysimum pseudorhaeticum</i>	43.3
<i>Avenula praetutiana</i>	43.3	<i>Globularia meridionalis</i>	42.3
<i>Plantago maritima</i> subsp. <i>serpentina</i>	40.8	<i>Viola corsica</i>	38.3
<i>Herniaria glabra</i> subsp. <i>nebrodensis</i>	37.7	<i>Alyssoides utriculata</i>	37.7
<i>Tolpis virgata</i>	35.5	<i>Centaurea rupestris</i>	35.5
<i>Bunium alpinum</i>	34.8	<i>Koeleria splendens</i>	34.6
<i>Dianthus sylvestris</i>	34.3	<i>Petrorhagia saxifraga</i>	34.1
<i>Eryngium amethystinum</i>	33.3	<i>Valeriana tuberosa</i>	31.6
<i>Sedum amplexicaule</i>	31.0	<i>Globularia bisnagarica</i>	30.4
<i>Galium lucidum</i>	30.2	<i>Helianthemum oelandicum</i>	28.5
<i>Teucrium montanum</i>	28.0	<i>Knautia purpurea</i>	27.9
<i>Poa perligularis</i>	27.6	<i>Satureja montana</i>	27.5
<i>Festuca gamisansii</i> subsp. <i>aethaliae</i>	27.5	<i>Festuca centro-apenninica</i>	27.5
<i>Orchis spitzelii</i>	27.4	<i>Silene italica</i>	27.1
<i>Sempervivum tectorum</i>	26.9	<i>Orchis italica</i>	26.9
<i>Colchicum alpinum</i>	26.8	<i>Anthyllis montana atropurpurea</i>	26.8
<i>Alyssum diffusum</i>	26.7	<i>Silene tyrrhenia</i>	26.6
<i>Cephalaria leucantha</i>	26.5	<i>Ranunculus monspeliacus</i>	26.4
<i>Helichrysum italicum</i>	26.3	<i>Erysimum majellense</i>	26.2
<i>Anthemis triumfetti</i>	25.9	<i>Allium pallens</i> subsp. <i>tenuiflorum</i>	25.9
<i>Pedicularis elegans</i>	25.8	<i>Carlina nebrodensis</i>	25.6
<i>Helianthemum nummularium</i>	25.5	<i>Myosotis ambigens</i>	24.9
<i>Ligusticum lucidum</i>	24.9	<i>Artemisia alba</i>	24.9
<i>Thesium humifusum</i>	24.3	<i>Alyssum montanum</i>	24.3
<i>Silene paradoxa</i>	24.2	<i>Festuca inops</i>	24.2
<i>Armeria majellensis</i>	24.2	<i>Potentilla detommasii</i>	23.9
<i>Trinia dalechampii</i>	23.8	<i>Muscari neglectum</i>	23.1
<i>Sesleria nitida</i>	22.8	<i>Centaurea ambigua</i>	22.7
<i>Serratula nudicaulis</i>	22.5	<i>Anthyllis vulneraria</i>	22.5
<i>Onobrychis alba</i>	22.3	<i>Poa molinerii</i>	22.1
<i>Asperula purpurea</i>	22.0	<i>Allium guttatum</i>	21.9
<i>Ranunculus gramineus</i>	21.1	<i>Brachypodium genuense</i>	20.9
<i>Bromus erectus</i>	20.7	<i>Galactites elegans</i>	20.6
<i>Paronychia kapela</i>	20.5	<i>Thlaspi praecox</i>	20.1
<i>Cerastium tomentosum</i>	19.8	<i>Osyris alba</i>	19.7
<i>Althaea hirsuta</i>	19.5	<i>Carlina corymbosa</i>	18.8
<i>Reichardia picroides</i>	18.7	<i>Crepis leontodontoides</i>	18.7
<i>Brachypodium retusum</i>	18.1	<i>Xeranthemum cylindraceum</i>	17.4
<i>Fumana ericoides</i>	17.3	<i>Fumana procumbens</i>	16.6
<i>Alyssum simplex</i>	16.6	<i>Bunium bulbocastanum</i>	16.4
<i>Sedum rupestre</i>	16.3	<i>Sedum hispanicum</i>	15.7

Silene conica	15.6	Scabiosa argentea	15.4
Seseli montanum	15.2	Teucrium flavum	15.1
Polygala major	15.0		

Constant species (occurrence frequencies)

Chamaecytisus spinescens	54.0	Helianthemum nummularium	54.0
Thymus longicaulis	46.0	Bromus erectus	46.0
Anthyllis vulneraria	46.0	Teucrium montanum	38.0
Festuca circummediterranea	38.0	Teucrium chamaedrys	31.0
Sesleria tenuifolia	31.0	Plantago maritima subsp. serpentina	31.0
Phleum ambiguum	31.0	Petrorhagia saxifraga	31.0
Koeleria lobata	31.0	Helianthemum oelandicum	31.0
Galium lucidum	31.0	Dianthus sylvestris	31.0
Centaurea sarfattiana	31.0	Astragalus calabrus	31.0
Armeria brutia	31.0	Anthemis cretica	31.0
Silene italica	23.0	Satureja montana	23.0
Koeleria splendens	23.0	Hypericum calabricum	23.0
Helichrysum italicum	23.0	Globularia meridionalis	23.0
Globularia bisnagarica	23.0	Genista michelii	23.0
Genista desoleana	23.0	Festuca curvula	23.0
Erysimum pseudorhaeticum	23.0	Eryngium amethystinum	23.0
Bromopsis caprina	23.0	Brachypodium retusum	23.0
Brachypodium pinnatum	23.0	Avenula praetutiana	23.0
Anthoxanthum odoratum	23.0	Viola corsica	15.0
Valeriana tuberosa	15.0	Tolpis virgata	15.0
Thesium humifusum	15.0	Silene vulgaris	15.0
Seseli montanum	15.0	Sempervivum tectorum	15.0
Sedum rupestre	15.0	Sedum amplexicaule	15.0
Sedum acre	15.0	Reichardia picroides	15.0
Plantago lanceolata	15.0	Osyris alba	15.0
Muscari neglectum	15.0	Knautia purpurea	15.0
Jasione montana	15.0	Hieracium pilosella	15.0
Herniaria glabra subsp. nebrodensis	15.0	Fumana procumbens	15.0
Deschampsia flexuosa	15.0	Cerastium arvense	15.0
Cephalaria leucantha	15.0	Centaurea rupestris	15.0
Carlina corymbosa	15.0	Bunium alpinum	15.0
Asperula purpurea	15.0	Artemisia alba	15.0
Alyssum montanum	15.0	Alyssoides utriculata	15.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Astragalus calabrus	31.0	Plantago maritima subsp. serpentina	23.0
Chamaecytisus spinescens	23.0	Genista michelii	23.0
Genista desoleana	23.0	Festuca circummediterranea	15.0
Thymus longicaulis	8.0	Teucrium montanum	8.0
Silene italica	8.0	Potentilla cinerea	8.0
Phleum ambiguum	8.0	Globularia meridionalis	8.0
Fumana procumbens	8.0	Brachypodium retusum	8.0

F7.4c - Eastern Mediterranean mountain hedgehog-heath

*Diagnostic species (phi coefficient * 100)*

Astragalus angustifolius	73.5	Astragalus creticus	72.2
Marrubium velutinum	65.5	Daphne oleoides	65.2
Eryngium amethystinum	63.5	Poa thessala	55.1
Carduus tmoleus	55.0	Asyneuma limonifolium	53.2
Cerastium candidissimum	50.9	Festuca varia	47.5
Phleum montanum	44.0	Cirsium hypopsilum	42.5
Prunus prostrata	41.1	Campanula spatulata	40.3
Centaurea affinis	39.9	Festuca polita	39.3
Lepidium hirtum	39.2	Galium thymifolium	39.2
Koeleria lobata	38.2	Bromus cappadocicus	37.0
Geranium macrostylum	36.4	Morina persica	35.0
Ptilostemon afer	34.8	Dianthus biflorus	33.7
Acantholimon androsaceum	33.3	Herniaria parnassica	33.2
Malcolmia graeca	33.0	Rosa pulverulenta	32.8
Minuartia verna	32.4	Cerastium brachypetalum	31.8
Thymus longicaulis	31.7	Berberis cretica	31.3
Trifolium parnassi	30.3	Verbascum epixanthinum	29.9
Acantholimon ulicinum	29.9	Marrubium cylleneum	29.7
Melica ciliata	29.4	Sesleria vaginalis	29.1
Crocus sieberi	29.1	Taraxacum sect. Scariosa	28.9
Veronica thymifolia	28.7	Stipa pennata	28.2
Senecio squalidus	27.5	Pimpinella tragium	27.5
Aubrieta deltoidea	27.4	Armeria canescens	26.7
Corydalis uniflora	26.3	Allium frigidum	26.1
Rosa heckeliana	26.0	Myosotis refracta	26.0
Galium taygeteum	26.0	Festuca jeanpertii	25.9
Scilla nana	25.8	Anchusa cespitosa	25.6
Erysimum cephalonicum	25.5	Achillea fraasii	25.2
Thymus leucotrichus	25.1	Lactuca alpestris	24.9
Asperula idaea	24.6	Crupina crupinastrum	22.9
Silene radicata	22.6	Sideritis syriaca	22.1
Sedum amplexicaule	22.0	Salvia argentea	21.8
Paronychia albanica subsp. graeca	21.6	Leontodon crispus	21.4
Linaria peloponnesiaca	21.3	Marrubium thessalum	21.1
Colchicum cretense	21.1	Astragalus thracicus subsp. cylleneus	21.0
Hyacinthella leucophaea	20.8	Erysimum pectinatum	20.8
Cirsium candelabrum	20.8	Buglossoides incrassata	20.8
Alyssum fragillimum	20.8	Scandix australis	20.6
Cirsium heldreichii	20.6	Minuartia juniperina	20.2
Astragalus sirinicus	20.2	Bromus tomentellus	20.1
Thymus striatus	20.0	Lamium bifidum	20.0
Crataegus pycnoloba	20.0	Euphorbia herniariifolia	19.8
Pterocephalus perennis	19.7	Telephium imperati	19.3

Acinos alpinus	19.3	Prunus cocomilia	19.0
Juniperus foetidissima	18.6	Anthemis cretica	18.6
Achillea ageratifolia	18.6	Poa timoleontis	17.4
Nepeta nuda	17.4	Euphorbia myrsinites	16.8
Agropyron cristatum	16.5	Hypericum rumeliacum	16.3
Astragalus depressus	16.3	Alyssum montanum	16.2
Ballota acetabulosa	16.0	Alyssum minutum	15.9
Trifolium physodes	15.8	Poa bulbosa	15.7
Galium verticillatum	15.6	Allium guttatum	15.6
Asphodeline lutea	15.5	Hieracium parnassi	15.4
Draba lasiocarpa	15.4	Centaurea pinardii	15.4
Aethionema carlsbergii	15.4	Viola rauliniana	15.2
Thlaspi graecum	15.2	Senecio fruticulosus	15.2
Muscari neglectum	15.2	Galium absurdum	15.2
Enarthrocarpus arcuatus	15.2	Silene melzheimeri	15.1
Peucedanum alpinum	15.1	Galium incanum	15.1
Campanula radicata	15.1	Astragalus erinaceus	15.1
Astragalus apollineus	15.1	Asperula aristata	15.1
Allium phthioticum	15.1	Acantholimon graecum	15.1
Thymus leucospermus	15.0	Reseda saadae	15.0
Ranunculus subhomophyllus	15.0	Geranium cinereum	15.0
Gagea chrysantha	15.0	Erysimum mutabile	15.0
Drabopsis nuda	15.0	Astragalus thracicus subsp. parnassi	15.0
Asperula oetaea	15.0	Aethionema speciosum subsp. compactum	15.0

Constant species (occurrence frequencies)

Astragalus angustifolius	60.0	Eryngium amethystinum	57.0
Astragalus creticus	55.0	Daphne oleoides	52.0
Marrubium velutinum	45.0	Dactylis glomerata	45.0
Melica ciliata	36.0	Poa thessala	33.0
Carduus tmoleus	33.0	Asyneuma limonifolium	33.0
Festuca varia	31.0	Sanguisorba minor	29.0
Minuartia verna	29.0	Cerastium candidissimum	29.0
Thymus longicaulis	26.0	Stipa pennata	26.0
Phleum montanum	26.0	Poa bulbosa	24.0
Koeleria lobata	24.0	Cerastium brachypetalum	24.0
Campanula spatulata	24.0	Prunus prostrata	19.0
Leontodon crispus	19.0	Cirsium hypopsilum	19.0
Centaurea affinis	19.0	Acinos alpinus	19.0
Lepidium hirtum	17.0	Galium thymifolium	17.0
Festuca polita	17.0	Eryngium campestre	17.0
Bromus cappadocicus	17.0	Teucrium chamaedrys	14.0
Sedum album	14.0	Ptilostemon afer	14.0
Pimpinella tragium	14.0	Morina persica	14.0
Geranium macrostylum	14.0	Thymus striatus	12.0
Rosa pulverulenta	12.0	Malcolmia graeca	12.0
Juniperus oxycedrus	12.0	Herniaria parnassica	12.0

Erophila verna	12.0	Dianthus biflorus	12.0
Cynosurus echinatus	12.0	Bromus squarrosus	12.0
Berberis cretica	12.0	Armeria canescens	12.0
Arenaria serpyllifolia	12.0	Acantholimon androsaceum	12.0
Veronica thymifolia	10.0	Verbascum epixanthinum	10.0
Trisetum flavescens	10.0	Trifolium parnassi	10.0
Teucrium polium	10.0	Teucrium montanum	10.0
Taraxacum sect. Scariosa	10.0	Sesleria vaginalis	10.0
Senecio squalidus	10.0	Sedum amplexicaule	10.0
Phleum alpinum agg.	10.0	Myosotis sylvatica	10.0
Muscari neglectum	10.0	Medicago lupulina	10.0
Marrubium cylleneum	10.0	Hypericum rumeliacum	10.0
Festuca jeanpertia	10.0	Euphorbia myrsinites	10.0
Crupina crupinastrum	10.0	Crocus sieberi	10.0
Crepis sancta	10.0	Aubrieta deltoidea	10.0
Astragalus onobrychis	10.0	Asperula aristata	10.0
Alyssum montanum	10.0	Acantholimon ulicinum	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Astragalus creticus	52.0	Astragalus angustifolius	36.0
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F9.1a - Arctic, boreal and alpine riparian scrub

*Diagnostic species (phi coefficient * 100)*

Salix lapponum	69.2	Salix phylicifolia	55.8
Salix lanata	41.6	Salix glauca	38.2
Stellaria borealis	36.8	Betula nana	35.7
Trientalis europaea	34.8	Carex bigelowii	31.5
Polygonum viviparum	31.0	Lophozia longiflora	31.0
Salix hastata	30.3	Rhodiola rosea	27.9
Pedicularis lapponica	27.7	Rubus chamaemorus	26.7
Salix borealis	25.9	Cerastium alpinum	25.9
Saussurea alpina	25.6	Epilobium anagallidifolium	25.5
Harpanthus flotovianus	25.1	Cerastium glabratum	25.0
Alchemilla alpina	25.0	Calamagrostis purpurea	24.7
Rhizomnium pseudopunctatum	24.4	Viola epipsila	23.9
Pedicularis sceptrum-carolinum	22.4	Stellaria crassifolia	22.2
Sphagnum girgensohnii	21.8	Carex vaginata	21.2
Drepanocladus uncinatus	20.6	Carex brunnescens	19.2
Empetrum nigrum subsp. hermaphroditum	18.9	Tritomaria quinqueidentata	18.3
Jungermannia pumila	18.3	Angelica archangelica	18.3
Thalictrum alpinum	18.0	Salix nummularia	17.9
Cephalozia spinigera	17.9	Lobaria linita	17.7
Epilobium hornemannii	17.4	Marchantia polymorpha	17.3
Primula nutans	17.2	Nephroma expallidum	17.2
Diplophyllum taxifolium	17.2	Alchemilla glomerulans	17.1

Plagiothecium platyphyllum	16.8	Calamagrostis stricta	16.8
Salix herbacea	16.4	Sibbaldia procumbens	15.7
Carex aquatilis	15.5	Galium trifidum	15.3
Veronica alpina	15.2	Agrostis mertensii	15.2
Psoroma hypnorum	15.1	Betula pubescens subsp. tortuosa	15.1
Equisetum scirpoides	15.0		

Constant species (occurrence frequencies)

Salix lapponum	59.0	Deschampsia cespitosa	48.0
Trientalis europaea	41.0	Polygonum viviparum	41.0
Salix phylicifolia	38.0	Deschampsia flexuosa	38.0
Rumex acetosa	34.0	Ranunculus acris	31.0
Betula nana	31.0	Solidago virgaurea	28.0
Anthoxanthum odoratum	28.0	Vaccinium myrtillus	24.0
Carex bigelowii	24.0	Caltha palustris	24.0
Salix lanata	21.0	Salix glauca	21.0
Rubus chamaemorus	21.0	Potentilla palustris	21.0
Filipendula ulmaria	21.0	Viola palustris	17.0
Geum rivale	17.0	Alchemilla alpina	17.0
Vaccinium vitis-idaea	14.0	Stellaria borealis	14.0
Sphagnum girgensohnii	14.0	Saussurea alpina	14.0
Salix hastata	14.0	Rhodiola rosea	14.0
Rhizomnium punctatum	14.0	Luzula sylvatica	14.0
Chaerophyllum hirsutum	14.0	Geranium sylvaticum	14.0
Festuca rubra	14.0	Festuca ovina	14.0
Empetrum nigrum subsp. hermaphroditum	14.0	Crepis paludosa	14.0
Carex rostrata	14.0	Aulacomnium palustre	14.0
Viola epipsila	10.0	Viola biflora	10.0
Vaccinium uliginosum	10.0	Thalictrum alpinum	10.0
Sphagnum warnstorffii	10.0	Salix herbacea	10.0
Rhizomnium pseudopunctatum	10.0	Ptilidium ciliare	10.0
Phleum alpinum agg.	10.0	Pedicularis lapponica	10.0
Oxalis acetosella	10.0	Marchantia polymorpha	10.0
Lophozia longiflora	10.0	Hylocomium splendens	10.0
Eriophorum vaginatum	10.0	Equisetum sylvaticum	10.0
Equisetum palustre	10.0	Equisetum fluviatile	10.0
Equisetum arvense	10.0	Epilobium palustre	10.0
Epilobium anagallidifolium	10.0	Drepanocladus uncinatus	10.0
Cerastium alpinum	10.0	Carex vaginata	10.0
Cardamine pratensis	10.0	Calamagrostis stricta	10.0
Calamagrostis purpurea	10.0	Bistorta officinalis	10.0
Betula pubescens	10.0	Alchemilla vulgaris	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Salix lapponum	59.0	Salix phylicifolia	24.0
Salix glauca	17.0	Salix lanata	10.0
Betula nana	10.0	Salix hastata	7.0

Rumex acetosa	7.0	Deschampsia flexuosa	7.0
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F9.1b - Temperate riparian scrub

*Diagnostic species (phi coefficient * 100)*

Salix purpurea	49.1	Salix triandra	44.5
Salix viminalis	35.5	Hippophae rhamnoides	34.0
Salix elaeagnos	33.0	Solanum dulcamara	21.5
Rubus caesius	19.9	Calystegia sepium	17.0
Urtica dioica	15.9	Salix fragilis	15.0

Constant species (occurrence frequencies)

Urtica dioica	57.0	Salix purpurea	48.0
Rubus caesius	39.0	Solanum dulcamara	35.0
Salix triandra	34.0	Phalaris arundinacea	30.0
Galium aparine	29.0	Calystegia sepium	28.0
Poa trivialis	25.0	Salix viminalis	23.0
Ranunculus repens	23.0	Salix elaeagnos	22.0
Agrostis stolonifera	22.0	Hippophae rhamnoides	21.0
Glechoma hederacea	20.0	Angelica sylvestris	20.0
Lythrum salicaria	18.0	Symphytum officinale	15.0
Sambucus nigra	15.0	Lysimachia vulgaris	15.0
Equisetum arvense	15.0	Dactylis glomerata	15.0
Aegopodium podagraria	15.0	Salix alba	13.0
Lycopus europaeus	13.0	Galium mollugo agg.	13.0
Tussilago farfara	12.0	Mentha aquatica	12.0
Heracleum sphondylium	12.0	Salix fragilis	11.0
Rumex obtusifolius	11.0	Rorippa amphibia	11.0
Phragmites australis	11.0	Galium palustre	11.0
Filipendula ulmaria	11.0	Elymus caninus	11.0
Cirsium arvense	11.0	Brachythecium rutabulum	11.0
Brachypodium sylvaticum	11.0	Scrophularia nodosa	10.0
Mentha longifolia	10.0	Lysimachia nummularia	10.0
Iris pseudacorus	10.0	Fraxinus excelsior	10.0
Eupatorium cannabinum	10.0	Cornus sanguinea	10.0
Calamagrostis epigejos	10.0		

Dominant species (percentage frequencies of occurrences with cover > 25%)

Salix purpurea	32.0	Salix triandra	23.0
Hippophae rhamnoides	21.0	Salix viminalis	15.0
Salix elaeagnos	15.0	Urtica dioica	11.0

F9.2 - Salix fen scrub

*Diagnostic species (phi coefficient * 100)*

Salix cinerea	37.0	Salix repens	17.6
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Solanum dulcamara	17.3	Salix atrocinerea	17.0
Myrica gale	17.0	Calamagrostis canescens	15.0
<i>Constant species (occurrence frequencies)</i>			
Salix cinerea	59.0	Lysimachia vulgaris	34.0
Galium palustre	33.0	Solanum dulcamara	28.0
Urtica dioica	26.0	Phragmites australis	26.0
Lycopus europaeus	23.0	Iris pseudacorus	21.0
Molinia caerulea agg.	20.0	Frangula alnus	19.0
Filipendula ulmaria	19.0	Lythrum salicaria	18.0
Juncus effusus	18.0	Calamagrostis canescens	18.0
Mentha aquatica	17.0	Cirsium palustre	17.0
Calliergonella cuspidata	17.0	Salix repens	15.0
Poa trivialis	15.0	Angelica sylvestris	15.0
Holcus lanatus	14.0	Salix aurita	13.0
Salix atrocinerea	13.0	Alnus glutinosa	13.0
Agrostis stolonifera	13.0	Rubus fruticosus agg.	12.0
Ranunculus repens	12.0	Potentilla palustris	12.0
Potentilla erecta	12.0	Peucedanum palustre	12.0
Myrica gale	12.0	Hydrocotyle vulgaris	12.0
Dryopteris carthusiana	12.0	Caltha palustris	12.0
Betula pubescens	12.0	Cardamine pratensis	11.0
Scutellaria galericulata	10.0	Galium aparine	10.0
Equisetum fluviatile	10.0	Deschampsia cespitosa	10.0
Carex elata	10.0	Carex acutiformis	10.0
<i>Dominant species (percentage frequencies of occurrences with cover > 25%)</i>			
Salix cinerea	54.0	Salix repens	13.0
Salix atrocinerea	12.0	Myrica gale	10.0
Salix aurita	7.0	Molinia caerulea agg.	6.0
Frangula alnus	6.0		

F9.3 - Mediterranean riparian scrub

*Diagnostic species (phi coefficient * 100)*

Nerium oleander	53.8	Vitex agnus-castus	51.1
Tamarix gallica	43.9	Tamarix africana	41.0
Tamarix canariensis	32.3	Oxalis pes-caprae	24.7
Juncus acutus	24.5	Tamarix hampeana	23.8
Suaeda braun-blanchetii	21.3	Atriplex halimus	20.7
Piptatherum miliaceum	20.6	Rubus sanctus	20.0
Hypericum hircinum	20.0	Parietaria cretica	18.7
Dracunculus vulgaris	18.1	Arisarum vulgare	17.4
Rubus ulmifolius	16.4	Sarcopoterium spinosum	16.3
Phlomis lanata	16.2	Limonium vulgare agg.	16.0
Hordeum marinum	15.5	Carex microcarpa	15.3

Constant species (occurrence frequencies)

Nerium oleander	35.0	Vitex agnus-castus	31.0
Rubus ulmifolius	26.0	Tamarix gallica	23.0
Tamarix africana	18.0	Galium aparine	18.0
Smilax aspera	15.0	Solanum dulcamara	14.0
Asparagus acutifolius	14.0	Pistacia lentiscus	13.0
Piptatherum miliaceum	13.0	Phragmites australis	12.0
Juncus acutus	12.0	Arisarum vulgare	12.0
Tamarix canariensis	11.0	Atriplex prostrata	10.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Nerium oleander	29.0	Tamarix gallica	22.0
Vitex agnus-castus	19.0	Tamarix africana	13.0
Tamarix canariensis	10.0	Tamarix hampeana	9.0

G2.5a - South-Aegean Phoenix grove

*Diagnostic species (phi coefficient * 100)*

Phoenix theophrasti	99.9	Oxalis pes-caprae	67.8
Nerium oleander	65.2	Leontodon tuberosus	62.7
Phlomis lanata	59.2	Salvia triloba	56.6
Tordylium apulum	54.8	Arisarum vulgare	53.6
Sarcopoterium spinosum	53.4	Cerantia siliqua	52.4
Arum concinnum	49.2	Ballota pseudodictamnus	48.9
Crepis commutata	48.7	Urtica pilulifera	48.6
Urginea maritima	47.7	Anthemis chia	47.3
Satureja thymbra	46.5	Theligonum cynocrambe	44.3
Urospermum picroides	42.3	Torilis nodosa	41.4
Asparagus aphyllus	39.6	Thymbra capitata	37.3
Bromus madritensis	35.5	Centaurea redempta	35.2
Stachys spinulosa	35.0	Notobasis syriaca	35.0
Juncus heldreichianus	34.6	Arum creticum	34.6
Malcolmia flexuosa	34.2	Alcea pallida	34.2
Capparis spinosa	34.1	Scorzonera cretica	34.0
Petromarula pinnata	34.0	Lithodora hispidula	34.0
Silene sedoides	33.4	Parietaria cretica	32.9
Daucus involucratus	32.4	Crepis cretica	32.1
Centaurea idaea	31.7	Lamyropsis cynaroides	31.4
Geranium purpureum	31.2	Dracunculus vulgaris	31.2
Hymenocarpus circinnatus	31.1	Atractylis cancellata	30.9
Asphodelus ramosus	30.5	Orlaya kochii	30.4
Hirschfeldia incana	30.2	Cirsium creticum subsp. creticum	30.1
Asphodeline lutea	30.1	Bromus intermedius	29.9
Pistacia lentiscus	29.6	Anagallis arvensis	29.1
Centaurea raphanina	28.9	Scaligeria napiformis	28.8
Valantia hispidula	28.7	Reichardia picroides	28.7
Rostraria cristata	28.6	Vitex agnus-castus	28.3

Plantago afra	28.3	Scandix pecten-veneris	27.9
Carduus pycnocephalus	27.6	Piptatherum coerulescens	27.3
Ficus carica	26.5	Valantia muralis	26.3
Polypogon viridis	25.8	Conyzanthus squamatus	25.8
Euphorbia peplus	23.8	Euphorbia dendroides	23.3
Allium subhirsutum	22.2	Geranium rotundifolium	21.6
Olea europaea var. sylvestris	21.5	Rumex bucephalophorus	21.1
Lotus cytisoides	21.1	Samolus valerandi	21.0
Trifolium stellatum	20.9	Psoralea bituminosa	20.3
Piptatherum miliaceum	19.8	Prasium majus	19.2
Juncus maritimus	17.9	Spartium junceum	17.1
Avena barbata	17.1	Brachypodium distachyon	16.7
Hordeum murinum	16.4	Apium nodiflorum	16.2
Muscari comosum	16.1	Scirpoides holoschoenus	16.0
Myrtus communis	15.8	Melilotus alba	15.8
Carlina corymbosa	15.5	Trifolium scabrum	15.3

Constant species (occurrence frequencies)

Phoenix theophrasti	100.0	Oxalis pes-caprae	50.0
Nerium oleander	50.0	Leontodon tuberosus	50.0
Arisarum vulgare	50.0	Urginea maritima	38.0
Tordylium apulum	38.0	Sarcopoterium spinosum	38.0
Salvia triloba	38.0	Pistacia lentiscus	38.0
Phlomis lanata	38.0	Ceratonia siliqua	38.0
Anagallis arvensis	38.0	Urtica pilulifera	25.0
Urospermum picroides	25.0	Torilis nodosa	25.0
Thymbra capitata	25.0	Theligonum cynocrambe	25.0
Satureja thymbra	25.0	Reichardia picroides	25.0
Geranium purpureum	25.0	Crepis commutata	25.0
Bromus madritensis	25.0	Ballota pseudodictamnus	25.0
Asphodelus ramosus	25.0	Asparagus aphyllus	25.0
Arum concinnum	25.0	Anthemis chia	25.0
Vitex agnus-castus	12.0	Valantia muralis	12.0
Valantia hispida	12.0	Trifolium stellatum	12.0
Trifolium scabrum	12.0	Trifolium campestre	12.0
Tamus communis	12.0	Stachys spinulosa	12.0
Spartium junceum	12.0	Smilax aspera	12.0
Silene sedoides	12.0	Schoenus nigricans	12.0
Sherardia arvensis	12.0	Scorzonera cretica	12.0
Scirpoides holoschoenus	12.0	Scandix pecten-veneris	12.0
Scaligeria napiformis	12.0	Samolus valerandi	12.0
Rumex conglomeratus	12.0	Rumex bucephalophorus	12.0
Rostraria cristata	12.0	Psoralea bituminosa	12.0
Prasium majus	12.0	Polypogon viridis	12.0
Plantago afra	12.0	Piptatherum miliaceum	12.0
Piptatherum coerulescens	12.0	Phragmites australis	12.0
Petromarula pinnata	12.0	Parietaria cretica	12.0
Orlaya kochii	12.0	Olea europaea var. sylvestris	12.0

Notobasis syriaca	12.0	Myrtus communis	12.0
Muscari comosum	12.0	Melilotus alba	12.0
Malcolmia flexuosa	12.0	Lotus cytisoides	12.0
Lithodora hispidula	12.0	Lamyropsis cynaroides	12.0
Juncus maritimus	12.0	Juncus heldreichianus	12.0
Hymenocarpos circinnatus	12.0	Hordeum murinum	12.0
Hirschfeldia incana	12.0	Geranium rotundifolium	12.0
Galium aparine	12.0	Ficus carica	12.0
Euphorbia peplus	12.0	Euphorbia dendroides	12.0
Eryngium campestre	12.0	Dracunculus vulgaris	12.0
Desmazeria rigida	12.0	Daucus involucratus	12.0
Cynodon dactylon	12.0	Crepis cretica	12.0
Conyzanthus squamatus	12.0	Cirsium creticum subsp. creticum	12.0
Centaurea redempta	12.0	Centaurea raphanina	12.0
Centaurea idaea	12.0	Carlina corymbosa	12.0
Carduus pycnocephalus	12.0	Capsella bursa-pastoris	12.0
Capparis spinosa	12.0	Bromus sterilis	12.0
Bromus intermedius	12.0	Brachypodium sylvaticum	12.0
Brachypodium retusum	12.0	Brachypodium distachyon	12.0
Avena barbata	12.0	Atractylis cancellata	12.0
Asphodeline lutea	12.0	Asparagus acutifolius	12.0
Arum creticum	12.0	Apium nodiflorum	12.0
Allium subhirsutum	12.0	Alcea pallida	12.0

Dominant species (percentage frequencies of occurrences with cover > 25%)

Phoenix theophrasti	100.0	Nerium oleander	25.0
Pistacia lentiscus	12.0		

Appendix G: Descriptions of EUNIS heathland, scrub and tundra habitat types

In the following text, the EUNIS F Heath, scrub and tundra habitats, and similar vegetation occurring on B1 & B2 coastal heaths and scrub, have been given their original text description (Davies et al. 2004), then the proposed revised description. Where there has been a name change, the proposed name is given first, then the original EUNIS name in brackets. Green text indicates those habitats where Schaminée et al. (2014) recommended some revision, either splitting of habitats or fusion of adjacent habitats and splitting, a note of which is then provided, together with descriptions for each new habitat. In almost all cases, the recommended changes were adopted for the DG(Env) Red List of European Habitats project but, where further splits or changes of name were proposed for the Red List project, these are highlighted in red and this project recommends to align with the Red List proposals.

B1.5 Coastal dune heaths

Original description: Stable dunes with a leached surface and vegetation dominated by *Calluna vulgaris*, *Empetrum nigrum* or *Erica* spp.

Proposed split into two sub-types according to the dominant species:

B1.5a Atlantic and Baltic coastal *Empetrum* heath

Heath on stable, decalcified dune sands along the cooler north Atlantic and Baltic coasts of Europe, dominated by *Empetrum nigrum*, with or without *Calluna vulgaris*, or occurring in dune slacks when *Erica tetralix* may also be abundant or even replace *Empetrum* with the same suite of associates. Persistent where wind-exposure or light grazing prevent succession to scrub or woodland.

B1.5b Atlantic coastal *Calluna* and *Ulex* heath

Heath on stable, decalcified, sharply-draining dune sands along the warmer, more humid Atlantic coast of Europe, dominated by *Calluna vulgaris*, *Erica* spp. and/or *Ulex* spp and other low spiny legumes often with a strong contingent of grasses and sedges. Persistent where wind-exposure or light grazing prevent succession to scrub or woodland.

B1.6 Coastal dune scrub

Original description: Stable dunes with scrub, e.g. *Hippophae rhamnoides*, *Salix repens* in the north, or *Juniperus* spp. or sclerophyllous shrubs in the south.

Proposed split into two types on the basis of geographical location:

B1.6a Atlantic and Baltic coastal dune scrub

Scrub dominated by a wide diversity of low to tall shrubs on stabilised dry dune sands and in dune slacks along the Atlantic and Baltic coasts, the composition varying according to regional climate and ground conditions. Fen vegetation with low *Salix repens* or grassland with *Rosa spinosissima* are not included.

B1.6b Mediterranean and Black Sea coastal dune scrub

Scrub dominated by a wide diversity of low to tall shrubs on stabilised dry dune sands along the Mediterranean and Black sea coasts, often grading to dune grassland or woodland, the associated herb flora showing elements from these neighbouring vegetation types or mosaics.

The Red List project added a further sub-type

B1.6c Macaronesian coastal dune scrub.

Often sparse scrub on coastal dune sands in the arid Mediterranean climate in parts of the Canarian archipelago.

B2.5 Shingle and gravel beaches with scrub

Original description: Coastal gravel banks with scrub. Included are dense thermo-mediterranean brushes on gravel banks beside the Mediterranean and heaths on shingle in the nemoral zone.

Proposed merger with other habitat types on shingle and gravel beaches.

F1.1 Shrub tundra

Original description: Tundras of the southernmost tundra belt, characterized by an abundance of medium small and small shrubs, including 1-2 m tall *Alnus fruticosa*, 0.5-0.8 m tall *Salix lanata*, *Betula nana*, *Betula exilis*, *Salix reptans*, *Salix pulchra*, and of dwarf shrubs, in particular, *Vaccinium uliginosum*, *Vaccinium vitis-idaea*, *Ledum decumbens*, *Rubus chamaemorus*, *Empetrum hermaphroditum*, *Empetrum nigrum*, *Arctostaphylos alpina*. They extend south to the wooded taiga belt.

Tundra with a usually extensive cover of sub-shrubs or low shrubs over herbs, mosses and lichens on sporadically permafrost soils of the southern arctic and subarctic zones, often grazed into grassy mosaics.

F1.2 Moss and lichen tundra

Original description: Tundras of the middle tundra belt, characterized by a thick cover of mosses, formed notably by *Hylocomium splendens*, *Aulacomnium turgidum*, *Tomentypnum nitens*, *Ptilidium ciliare*, with dwarf shrubs, particularly *Dryas octopetala*, *Cassiope tetragona*, *Salix reptans*, *Vaccinium vitis-idaea*, sedges, among which the often dominant *Carex ensifolia*. Drier stands alternate in mosaic fashion with wetter areas dominated by sedges, in particular, *Carex stans*, *Eriophorum angustifolium*, *Eriophorum scheuchzeri*, and grasses, notably *Arctophila fulva*, *Dupontia fischeri*.

Tundra of the middle and northern high arctic zone where permafrost soils, often occurring in patterned ground, support a frequently sparse cover of mosses, lichens and low herbs.

F2.1 Subarctic and alpine dwarf Salix scrub (Subarctic and alpine dwarf willow scrub)

Original description: Salix scrub composed of species that rarely exceed 1.5 m in height. Dwarf willow scrub is well developed in boreal and arctic mountains and in subarctic lowlands. In mountains of the nemoral and warm-temperate zones, stands of dwarf willow scrub are of much smaller extent and are characteristic of late-lying snow patches. They occur in the Alps, Pyrenees, Carpathians and Caucasus, and very locally to the south in the Paeonian mountains, Sierra Nevada, Cordillera Central, Monti Sibillini and Abruzzi. They occur locally in the Scottish Highlands and in the Sudeten.

Salix-dominated dwarf scrub, often with abundant bryophytes and lichens, on skeletal calcareous or siliceous soils in late snow beds with a short growing-season, occurring in the subarctic north of the woodland zone and in the high mountains of nemoral Europe, increasingly local and fragmentary to the south.

F2.2 Evergreen alpine and subalpine heath and scrub

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

Proposed split into three types on the basis of dominant growth form:

F2.2a Alpine and subalpine ericoid heath

Dwarf-shrub vegetation dominated by ericoids and other woody species (not Juniperus or genistoids) occurring in high mountains throughout Europe, varying in dominants and associates according to regional climate, degree of exposure and snow lie, soil reaction, soil depth and moisture.

F2.2b Alpine and subalpine Juniperus scrub

Juniper-dominated vegetation of the montane to sub-alpine belts of European mountains, occurring as primary vegetation tolerant of both high exposure and snow-lie, but also a secondary derivative of deforested, long-grazed and eroded ground at high altitudes.

F2.2c Balkan subalpine genistoid scrub

Genistoid heath and scrub of high mountains in the Balkans, often in primary grassy mosaics at higher altitudes, but also extending below the timberline where wood-cutting and grazing open up the woodland cover and sustain the vegetation as an anthropogenic replacement.

F2.3 Subalpine deciduous scrub

Original description: Subalpine scrubs of Alnus, Betula, Salix and Rosaceae (Amelanchier, Potentilla, Rubus, Sorbus), less than 5 m tall, often accompanied by tall herbs that in the absence of scrub would be classified as E5.5. Excludes dwarf Salix scrub (F2.1), which is composed of species that rarely exceed 1.5 m in height, and scrub on waterlogged soils (F9.2).

Low scrub, including *krummholz*, dominated by various deciduous trees and shrubs, on moist but free-draining, sometimes quite fertile, soils on high mountain slopes throughout Europe, often with long snow-lie and prone to natural disturbance due to avalanche and scree slides, after which it is well able to recover and recolonise. The associated flora can be rich in tall mountain herbs. It can also be found as a secondary succession stage in abandoned subalpine pastures and meadows.

F2.4 Subalpine *Pinus mugo* scrub (Conifer scrub close to the tree limit)

Original description: Scrubland with dwarf conifers (*krummholz*), often with incomplete canopy cover, close to the tree limit. At the arctic tree limit, the trees are of species that can grow to large stature under favourable conditions. However *Pinus mugo* of central and southern Europe is often genetically fixed as a shrub. Excluded are stands of forest conifers with height > 3 m (G3).

Pinus mugo krummholz on mineral soils with long snow-lie above the tree line through the mountains of central and eastern Europe. Woody and herbaceous associates and the sometimes abundant bryophyte layer vary according to the base-richness of the soils and ground moisture.

F3.1 Temperate thickets and scrub

Original description: Successional and plagioclimax scrub, mostly deciduous, of Atlantic, sub-Atlantic or subcontinental affinities, characteristic of the nemoral zone, but also colonizing cool, moist or disturbed stations of the Mediterranean evergreen forest zone. Included are thickets of *Buxus sempervirens*, *Corylus avellana*, *Cytisus scoparius*, *Juniperus communis*, *Prunus spinosa*, *Rubus fruticosus* and *Ulex europaeus*.

F3.2 Submediterranean deciduous thickets and brushes

Original description: Successional and plagioclimax scrub, mostly deciduous, of the submediterranean and supramediterranean zones, but also colonizing cool, moist or disturbed stations of the mediterranean evergreen forest zone. Included are some non-leafy brushes, for example *Cytisus purgans* and *Genista aetnensis*.

Proposed merger of F3.1 and F3.2 with a split into six types of the basis of dominant growth form. To this were added two further habitats in the Red List habitat typology, with a shift of one code, giving a total of 8 new sub-types:

F3.1a Lowland to montane temperate and submediterranean *Juniperus* scrub

Juniperus communis scrub on nutrient-poor sandy and calcareous soils through the temperate and submediterranean lowlands and foothills of Europe. The juniper can be very patchy in occurrence, often related to past land-use, and with a striking variety of growth forms, the associated flora being very diverse according to soil base-status, sharing much in common, where the scrub is open, with local calcicolous grasslands or heath.

F3.1b Temperate *Rubus* scrub

Low *Rubus*-dominated scrub, deciduous or sometimes evergreen, of successions and ecotones in a wide variety of semi-natural landscapes through

the Atlantic zone and elsewhere in sub-montane Europe where a locally moist climate prevails. *Rubus* is an enormously diverse genus of often apomictic and endemic taxa with associated floras related to soil base-status and moisture.

F3.1c Lowland to montane temperate and submediterranean genistoid scrub

Low scrub dominated by various woody legumes on mostly sharply-draining, nutrient-poor acidic soils through the temperate and submediterranean lowlands and mediterranean foothills of Europe. To the north the vegetation is usually found in successions or ecotones within pastoral landscapes and is often rather species-poor; further south, the scrub can occur as a more persistent or repeatedly renewed habitat among rocky or unstable hill-slopes with richer associated floras.

F3.1d Balkan-Anatolian submontane genistoid scrub

Open scrub, dominated by *Genista rumelica*/*lydia* endemic to steep rocky slopes and scree, and also degraded woodland, in the lowlands and foothills of the south-eastern Balkans, on various soils but especially rich on limey substrates where calcicolous grassland species figure strongly among the associated flora.

F3.1e Temperate and submediterranean thorn scrub

Scrub dominated by a diversity of mostly thorny shrubs, small trees and saplings, in successions and ecotones on mesic soils in a wide variety of semi-natural landscapes through the temperate and submediterranean lowlands of Europe but sometimes extending to higher altitudes, as with the Balkan *šibljak*. The dominants and associated floras vary widely with differences in regional climate and soils.

F3.1f Low steppic scrub

Low scrub, dominated by various, often clonal, shrubs frequently forming patches in locally mesic and sheltered situations within the dry grasslands of the steppe zone of central and eastern Europe. It can form a persistent natural landscape element or develop after abandonment of pasturing.

F3.1g *Corylus avellana* scrub

Low scrub dominated by *Corylus avellana*, permanently maintained by exposure to winds and on shallow soils along the north Atlantic coast and locally on rocky slopes and cliffs through the Continental region.

F3.1h Temperate woodland clearing scrub

Often dense scrub of shrubs and small trees invading after natural or anthropogenic clearance in woodlands of the temperate zone.

F4.1 Wet heath (Wet heaths)

Original description: Wet or humid ericoid-shrub dominated heaths of the Atlantic and sub-Atlantic zones, developed on peaty or semipeaty soils, waterlogged for at least part of the year, sometimes temporarily inundated, and usually moist even in summer.

Heath with prominent *Erica tetralix* on shallow, acid, nutrient-poor peats and peaty mineral soils, kept moist for much of the year and often seasonally waterlogged, through the Atlantic and sub-Atlantic lowlands and foothills of Europe. Typically occurring in wet depressions and seepage areas within dry heaths or as a marginal zone around bogs where drainage of deeper peats can increase its extent. In milder oceanic climates, other *Erica* and *Ulex* spp. occur in richer humid heath. Frequently influenced by grazing and sod-cutting.

F4.2 Dry heath (Dry heaths)

Original description: Heaths on siliceous, podsolic, rarely- or never-waterlogged soils in moist Atlantic and sub-Atlantic climates of the plains and low mountains of Western and Central Europe.

Heath dominated by various ericaceous sub-shrubs on free-draining, nutrient-poor, acid sands and siliceous soils through the lowlands and foothills of western and central Europe, extending northwards in more oceanic situations and into continental regions at higher rainier altitudes. Very often influenced by grazing and burning and frequently a secondary vegetation type derived by clearance of acidophilous woodland and maintained anthropogenically.

F4.3 Macaronesian heath (Macaronesian heaths)

Original description: Heaths of the Canary Islands, Azores and Madeira.

Shrubby vegetation on thin soils in the Azores, Madeira and Canary Islands, colonising pyroclastic debris, lava, rock outcrops and landslips, sometimes cyclically renewed by further disturbance or seral to woodland. Floristically diverse between and within the archipelagoes.

F5.1 Arborescent matorral

Original description: Successional and plagioclimax evergreen sclerophyllous or lauriphyllous vegetation of mediterranean or warm-temperate humid affinities with a more or less dense, broken or low arborescent cover and with a usually thick, high evergreen shrub stratum. Arborescent matorral derives mostly from degradation or regrowth of broad-leaved evergreen forests (G2) or is intermediate between them and maquis (F5.2); some derives from thermophilous deciduous (G1.7) or conifer (G3.7) forests.

F5.2 Maquis

Original description: Evergreen sclerophyllous or lauriphyllous shrub vegetation, with a more or less closed canopy structure, and with few annuals, some geophytes and often scattered trees, some of which may be in shrub form. Unlike arborescent matorral, maquis is typically dominated by species that do not have the potential to grow into tall trees. In high maquis these may be *Arbutus* spp., *Erica arborea*, *Erica scoparia*, *Juniperus oxycedrus*, *Phillyria* spp. In low maquis, *Cistus* spp., *Erica* spp., *Genista* spp., *Lavandula* spp. may predominate.

Proposed merger of these two habitats into a single type

F5.1 Mediterranean maquis and arborescent matorral

Evergreen sclerophyllous or lauriphyllous shrub vegetation forming a dense closed canopy, with or without low emergent trees, on a wide variety of substrates and soils through the thermo- to meso-Mediterranean belts. May be permanent primary vegetation on xeric sites but is usually derived by degradation of evergreen deciduous or coniferous woodland and much influenced in structure and composition by grazing and fire.

F5.3 Submediterranean pseudomaquis (Pseudomaquis)

Original description: Mixed sclerophyllous evergreen and deciduous shrub thickets of the periphery of the range of Mediterranean sclerophyllous scrublands. They include, in particular, shrub formations of the Balkan and Italian peninsulas intermediate between Mediterranean maquis and schibljak, resulting from the degradation of thermophilous deciduous woodland G1.7, with a mixture of evergreen and deciduous bushes including *Quercus coccifera*, *Juniperus oxycedrus*, *Quercus trojana*, *Carpinus orientalis*, *Ostrya carpinifolia*, *Pistacia terebinthus*, *Buxus sempervirens*, *Berberis cretica*, *Paliurus spinachristi*, *Pyrus spinosa*, *Rosa* spp., similar Iberian formations with *Amelanchier ovalis*, *Prunus lusitanica*, *Ilex aquifolium*, French and Italian formations with *Quercus pubescens* and *Quercus ilex*, formations of Mediterranean Asia Minor and the Levant dominated by mixed deciduous and evergreen shrubs or small trees, in particular, *Quercus coccifera* (*Quercus calliprinos*) and *Pistacia palaestina*.

Mixed deciduous and evergreen scrub of shallow, rocky, mostly calcareous soils in the lowlands and foothills of southern Europe, particularly the east. Usually derived by woodland degradation and much affected in structure and composition by grazing, fire and logging.

F5.4 Spartium junceum scrub (Spartium junceum fields)

Original description: Thickets and brushes of Spanish broom, *Spartium junceum*, widespread in mediterranean and submediterranean areas of western Europe.

Scrub dominated by *Spartium junceum*, typical of disturbed, open, sunny situations on a wide variety of soils through the Mediterranean and sub-Mediterranean, where its rapid establishment is favoured by post-fire seed germination, aggressive rooting, nitrogen-fixation and unpalatability.

F5.5 Thermomediterranean scrub

Original description: Shrub formations characteristic of the thermo-Mediterranean zone. Included here are those formations, for the most part indifferent to the siliceous or calcareous nature of the substrate, that reach their greatest extent or optimal development in the thermo-Mediterranean zone, typically with abundant *Pistacia lentiscus*, *Myrtus communis*, *Phillyrea* spp., *Erica manipuliflora*, *Styrax officinalis*, *Genista fasselata*, *Euphorbia dendroides*, *Calicotome villosa* and *Sarcopoterium spinosum*. Also included are the numerous, strongly characterized, thermophile formations endemic to the south of the Iberian peninsula, mostly thermo-Mediterranean but

sometimes meso-Mediterranean; in their great local diversity they are a western counterpart of, and sometimes approach in appearance, the mostly eastern Mediterranean phryganas F7.

Scrub with a usually low and rather open cover of shrubs with sub-shrubs, dwarf shrubs and herbs between, on dry soils of varied composition through the thermomediterranean zone, and of very diverse local composition. Primary and

permanent in more arid and exposed situations, but can be successional to woodland and often much affected by grazing.

F6.1 Western garrigues

Original description: Shrubby formations, often low, on mostly calcareous soils of the meso-mediterranean zone of the Iberian peninsula, France, Italy and the large western Mediterranean islands, notably the Balearics, Corsica, Sardinia, Sicily and Malta. Included here are those formations that reach their optimal development within the mesomediterranean zone although they often enter the thermo- or supra-mediterranean levels.

Proposed split into two types on the basis of soil characteristics:

F6.1a Western basiphilous garrigue

Sub-shrub vegetation dominated by nanophanerophytes and chamaephytes on thin, base-rich soils through the western thermo- to mesomediterranean belts, very diverse in composition with differences in local climate and soils. In rockier situations, it can be a permanent coloniser but is often derived from woodland clearance and is much affected by grazing and fire.

F6.1b Western acidophilous garrigue.

Sub-shrub vegetation dominated by nanophanerophytes on thin acidic soils, both hard silicate and soft sands, through the western thermo- to lower supramediterranean belts, very diverse in composition with differences in local climate and soils. In rockier situations, it can be a permanent coloniser but is often derived from woodland clearance or abandonment of farm fields and is much affected by grazing and fire.

F6.2 Eastern non-Illyrian garrigues

Original description: Shrubby formations, often low, of the meso-, thermo- and occasionally supramediterranean zones of Greece, southern Albania, Cyprus and southern Anatolia. Included here are all sclerophyllous formations, regardless of substrate, except those with conspicuous spiny cushion structure (F7), those with abundant thermo-Mediterranean scrub species (F5.5) and high maquis with *Erica arborea* and *Arbutus* spp. (F5.2).

F6.3 Illyrian garrigues

Original description: Shrubby formations, often low, of the meso- and occasionally supra-Mediterranean zones of the Adriatic lowlands of the Balkan peninsula from Istria to southern Albania. Included here are all sclerophyllous formations, regardless of substrate, except high maquis (F5.2) with *Erica arborea* and *Arbutus* spp.

F6.4 Black Sea garrigues

Original description: Shrubby formations of the Mediterranean enclaves of the Black Sea coasts, in Crimea, southern Bulgaria, Turkey-in-Europe and northern Anatolia, as well as of the Mediterraneo-steppic zone of southern Thrace. Included here are all sclerophyllous formations, regardless of substrate, except high maquis (F5.2) with *Erica arborea* and *Arbutus* spp. and *Phryganas* (F7).

Proposed merger of these three into a single type:

F6.2 Eastern garrigue

Low, mostly evergreen sclerophyllous scrub on diverse soils through the eastern meso-, thermo- and occasionally supramediterranean belts, including around the Black Sea, where deciduous species can prevail. Derived by woodland degradation and usually maintained by grazing and fire, their structure and composition vary greatly with local climate and human impacts.

F6.5 Macaronesian garrigues

Original description: Low shrub vegetation with an open canopy, of the Canary Islands, Azores and Madeira.

Proposed merger with other B Coastal habitats characteristic of shingle and gravel beaches.

F6.6 Supramediterranean garrigue (Supra-Mediterranean garrigues)

Original description: Low shrub formations with pronounced Mediterranean affinities formed as a degradation stage of thermophilous deciduous woodland (G1.7) or sometimes of evergreen *Quercus* woodland (G2.1) in the supra-Mediterranean belt of the Mediterranean region. Included here are only those formations that are characteristic of the supra-Mediterranean level; formations, particularly of the lower supra-Mediterranean, that are closely related to meso-Mediterranean communities have been included under F6.1, F6.2, F6.3 or F6.4.

Open low scrub of calcareous soils through the western and central supramediterranean belt. Derived originally by woodland clearance and long maintained by grazing, abandonment is now allowing widespread reversion.

F6.7 Mediterranean gypsum scrub (Mediterranean gypsum scrubs)

Original description: Garrigues occupying gypsum-rich soils of the Iberian peninsula, usually very open and floristically characterised by the presence of numerous gypsophilous species, among which *Gypsophila struthium*, *Gypsophila hispanica*, *Centaurea hyssopifolia*, *Teucrium libanitis*, *Ononis tridentata*, *Lepidium subulatum*, *Herniaria fruticosa*, *Reseda stricta*, *Helianthemum squamatum*. They are often rich in thymes (*Thymus*), germanders (*Teucrium*), rockroses (*Helianthemum*), composites (*Centaurea*, *Jurinea*, *Santolina*), *Frankenia*.

Open chamaephyte scrub with a lichen crust and rainy-spring annual herb flora, on gypsum-rich substrates in areas with a dry to semi-arid mediterranean climate in the Iberian peninsula. The extreme climatic and edaphic conditions maintain the habitat as naturally stable but it can bear some light grazing.

F6.8 Xero-halophile scrub

Original description: Salt-tolerant shrub formations of dry ground in low-precipitation areas of the mediterranean zone, in particular, the Iberian peninsula and Sicily, and of the Macaronesian Islands.

Proposed split into two types on the basis of geographical variation:

F6.8a Mediterranean halo-nitrophilous scrubs

Perennial scrubby vegetation with nitrophilous and salt-tolerant associates in often artificially-disturbed places through the semi-arid thermo- and inframediterranean belts where the dry climate slows the decomposition of litter and aids precipitation of salt from the soil.

F6.8b Caspian Sea halo-nitrophilous scrub. This habitat was not included in the Red List project since it does not occur within the boundaries of the EU28+ countries.

Perennial scrubby vegetation with nitrophilous and salt-tolerant associates in often artificially-disturbed places around the Caspian Sea where the dry climate slows the decomposition of litter and aids precipitation of salt from the soil.

F7.1 West Mediterranean spiny heaths

Original description: Spiny shrublands, mainly on coastal cliffs, of the western Mediterranean region.

F7.2 Central Mediterranean spiny heaths

Original description: Spiny shrublands, mainly coastal, of the central Mediterranean region.

Proposed merger of these two habitats

F7.1 Western Mediterranean spiny heaths

Low scrub of often spiny, cushion-forming plants on thin soils on wind-exposed and spray-splashed tops of rocky cliffs on Corsica, Sardinia, Pantelleria and in the Gulf of Taranto.

F7.3 Eastern Mediterranean spiny heath/phrygana (East Mediterranean phrygana)

Original description: Spiny shrublands, widespread at low and middle altitudes in the eastern Mediterranean and Anatolian regions. *Sarcopoterium spinosum* is a common dominant in the Aegean region.

Low scrub dominated by thorny hemispherical chamaephytes on various base-rich and acidic substrates in the thermo-, meso- and supramediterranean belts of mainland Greece, Anatolia, the Aegean and Ionian islands, Crete, Cyprus and the north-east Mediterranean coast. Can be of primary origin or result from clearance of evergreen sclerophyll woodland.

F7.4 Hedgehog-heaths

Original description: Primary cushion heaths of the high, dry mountains of the Mediterranean region and Anatolia, with low, cushion-forming, often spiny shrubs, in particular of genera *Acantholimon*, *Astragalus*, *Erinacea*, *Vella*, *Bupleurum*, *Ptilotrichum*, *Genista*, *Echinopartum*, *Anthyllis*, and various composites and labiates; secondary, zoogenic cushion heaths of the same regions, either downslope extensions of the high-altitude formations, and dominated by the same species, or specifically montane or steppic, often *Genista*-dominated in the Mediterranean region. Excluded are cushion-heaths of thermo-Mediterranean lowlands (F7.1, F7.2 and F7.3).

Proposed split into four types on the basis of geographical variation:

F7.4a Western Mediterranean mountain hedgehog-heath

Heath of often spiny hedgehog sub-shrubs on base-rich and acidic soils in the cold and droughty upper supra- and oromediterranean belts of the Iberian Peninsula, historically sustaining transhumance pastoralism but often extending down from crests and steep slopes due to grazing and burning.

F7.4b Central Mediterranean mountain hedgehog-heath

Heath of often spiny hedgehog sub-shrubs on base-rich and acidic soils in windy and sunny situations in the supra- and oromediterranean belts of Corsica, Sardinia, Elba, Sicily and the southern mainland Mountains of Italy. Downslope expansion below the timberline can follow clearance and grazing.

F7.4c Eastern Mediterranean mountain hedgehog-heath

Heath of often spiny hedgehog sub-shrubs on mostly base-rich soils in dry mountains of the supra- and oromediterranean belts of the east Mediterranean. Downslope expansion below the timberline can follow clearance and grazing.

F7.4d Canarian mountain hedgehog-heath

Heath of hedgehog sub-shrubs on screes and volcanic soils in the subalpine semi-desert belt of Tenerife and la Palma.

F8.1 Canarian xerophytic scrub (Canary Island xerophytic scrub)

Original Description: Xerophytic scrub of the Canary Islands. Varied types include stem succulents, leaf succulents and woody sclerophyllous shrubs.

Open scrub of sclerophyllous shrubs and succulent herbs on rocky substrates with skeletal soils in the arid lowlands and on deeper soils in the moister foothills of the Canary Islands.

F8.2 Madeiran xerophytic scrub

Original description: Xerophytic scrub of Madeira.

Diverse scrub of sclerophyllous shrubs, small trees and succulent herbs on usually thin soils of rocky outcrops, cliffs and abandoned fields in the arid lowlands of Madeira.

F9.1 Riverine scrub

Original description: Scrub of broad-leaved willows, e.g. *Salix aurita*, *Salix cinerea*, *Salix pentandra*, beside rivers. Scrub of *Alnus* spp. and narrow-leaved willows, e.g. *Salix eleagnos*, where these are less than 5 m tall. Riverside scrub of *Hippophae rhamnoides* and *Myricaria germanica*. Excludes riversides dominated by taller narrow-leaved willows *Salix alba*, *Salix purpurea*, *Salix viminalis* (G1.1).

Proposed split into two units based on climatic differences.

F9.1a Arctic, boreal and alpine riparian scrub

Scrub of *Salix* spp. and *Myricaria germanica* establishing on unsorted mineral sediments deposited in turbulent seasonal streams and flood-prone permanent rivers through the uplands of the arctic, boreal and alpine zones. More or less permanent where kept wet, re-establishing after seasonal flooding or succeeding to thorn scrub where the sediments stabilise.

F9.1b Temperate riparian scrub

Scrub of *Salix* spp developed on the mineral sediments of shoals and banks of lowland rivers through the temperate zone, re-establishing after seasonal flooding or succeeding to riparian and gallery woodland where the sediments stabilise.

F9.2 Salix fen scrub (Willow carr and fen scrub; Scientific name: *Salix* carr and fen scrub)

Original description: Low woods and scrubs colonizing fens, marshy floodplains and fringes of lakes and ponds, dominated by large or medium sized shrubby willows, generally *Salix aurita*, *Salix cinerea*, *Salix atrocinerea*, *Salix pentandra*, alone or in association with *Frangula alnus*, *Rhamnus cathartica*, *Alnus glutinosa* or *Betula pubescens*, any of which may dominate the upper canopy. In boreal regions and on cold subboreal plateaux, small shrubs may dominate, e.g. dwarf *Salix* spp. associated with *Betula humilis* or *Betula nana*. Excludes boreal and subalpine lakeside scrub on well drained soils (F2).

Scrub dominated by various *Salix* spp. on peaty and mineral soils maintained in a permanently waterlogged state by high ground water in floodplain backwaters, around lakes and ponds, among mires and dunes, and in abandoned wet meadows and pastures, occurring through the lowlands of atlantic, boreal and continental Europe and extending into the mediterranean region at higher altitudes. Associated floras vary according to the base status of the ground waters and soils.

F9.3 Mediterranean riparian scrub (Southern riparian galleries and thickets)

Original description: Tamarisk, oleander, chaste tree galleries and thickets and similar low woody vegetation of permanent or temporary streams and wetlands of the thermo-Mediterranean zone and southwestern Iberia.

Usually open scrub of *Tamarix* spp., *Nerium oleander*, *Vitex agnus-castus* and similar shrubs and small trees on seasonally droughted and irregularly flooded riverbeds, streamsides and depressions through the thermo- and mesomediterranean belts.

Appendix I: Preliminary distribution and suitability maps of the revised EUNIS heathland, scrub and tundra habitat types

EUNIS-3 code	EUNIS-3 habitat name	Background data pool
F1.1	Shrub tundra	Study area
F1.2	Moss and lichen tundra	No data
F2.1	Subarctic and alpine dwarf Salix scrub	Heathland, scrub, tundra
F2.2a	Alpine and subalpine ericoid heath	Study area
F2.2b	Alpine and subalpine Juniperus scrub	Study area
F2.2c	Balkan subalpine genistoid scrub	Study area
F2.3	Subalpine deciduous scrub	Heathland, scrub, tundra
F2.4	Subalpine Pinus mugo scrub	Heathland, scrub, tundra
F3.1a	Lowland to montane temperate and submediterranean Juniperus scrub	Study area
F3.1b	Temperate Rubus scrub	Study area
F3.1c	Lowland to montane temperate and submediterranean genistoid scrub	Study area
F3.1d	Balkan-Anatolian montane genistoid scrub	Study area
F3.1e	Temperate and submediterranean thorn scrub	Study area
F3.1f	Low steppic scrub	Heathland, scrub, tundra
F3.1g	Corylus avellana scrub	Study area
F3.1h	Temperate woodland clearing scrub	Study area
F4.1	Wet heath	Study area
F4.2	Dry heath	Study area
F4.3	Macaronesian heath	No data
F5.1-2	Arborescent matorral and maquis	Heathland, scrub, tundra
F5.3	Submediterranean pseudomaquis	Study area
F5.4	Spartium junceum fields	Study area
F5.5	Thermo-Mediterranean scrub	Study area
F6.1a	Western basiphilous garrigue	Heathland, scrub, tundra
F6.1b	Western acidophilous garrigue	Heathland, scrub, tundra
F6.2	Eastern garrigue	Study area
F6.6	Supra-Mediterranean garrigue	Study area
F6.7	Mediterranean gypsum scrub	Heathland, scrub, tundra
F6.8a	Mediterranean halo-nitrophilous scrub	Heathland, scrub, tundra
F6.8b	Caspian halo-nitrophilous scrub	No data
F7.1	Western Mediterranean coastal garrigue	Heathland, scrub, tundra
F7.3	Eastern Mediterranean spiny heath (phrygana)	Study area

F7.4a	Western Mediterranean mountain hedgehog-heath	Study area
F7.4b	Central Mediterranean mountain hedgehog-heath	Study area
F7.4c	Eastern Mediterranean mountain hedgehog-heath	Study area
F7.4d	Canarian mountain hedgehog-heath	No data
F8.1	Canary Island xerophytic scrub	No data
F8.2	Madeiran xerophytic scrub	No data
F9.1a	Arctic, boreal and alpine riparian scrub	Heathland, scrub, tundra
F9.1b	Temperate riparian scrub	Study area
F9.2	Salix fen scrub	Heathland, scrub, tundra
F9.3	Mediterranean riparian scrub	Heathland, scrub, tundra
B1.5a	Atlantic and Baltic coastal Empetrum heaths	Study area
B1.5b	Atlantic coastal Calluna and Ulex heaths	Study area
B1.6a	Atlantic and Baltic coastal dune scrub	Study area
B1.6b	Mediterranean and Black Sea coastal dune scrub	Study area
B1.6c	Macaronesian coastal dune scrub	No data
B2.5	Shingle and gravel beaches with scrub	Study area