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Report for a list of Annex I habitat types important for Pollinators

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1 Context

In the framework of EU Pollinators Initiative, the Commission intends to identify the habitat types from the Annex I of the Habitats Directive that are the most important for pollinators, and then to assess their condition based on the reporting provided by Member States under the Article 17 and other available data. In order to develop such a list of important habitat types for pollinators, the best indicators to consider are their ability to provide food sources (pollen and nectar) and nesting sites, as those are the two essential parameters governing the life cycles of pollinator insects.

Plant species richness is the best suitable variable to assess the ability of a habitat type to provide food source to pollinators. Indeed, the use of pollen and nectar by insects can definitely be expected for all insect-pollinated plants, called entomophilous plants species, as well as for a high number of wind or self-pollinated plants. Identifying Annex I habitat types with a high proportion of plant species providing foraging resources to pollinators can be done by detecting pollinator-dependent plant species present in each habitat type, through literature already collected by the ETC/BD, as well as considering the proportion of those pollinator-dependent species in the list of typical species for the habitat type. A detailed rationale for using richness of plant species as an indicator for important habitat types for pollinators is provided in the Annex of this report.

Gathering information on habitat type's ability to provide nesting sites for pollinators is much more difficult, because there is no "simple" indicator to detect this feature. Occurrence of nesting sites in a specific habitat type are indeed dependent on the structures locally available (e.g. areas of bare ground, deadwood, dead stems of plants, sandy river banks, …) and cannot be evaluated at the level of the overall distribution of the habitat type. However, a strong hypothesis is that nesting sites should be adjacent to the foraging resources, because long flight distances are too energy demanding for most pollinators. Thus, flowering plants richness will also be the major indicator to consider the occurrence of nesting sites. If some indications about specific habitats providing foraging sources but no nesting sites can be found during the literature search, it will be considered in the evaluation. Additionally, to the number of plant species providing food sources and their abundance in certain habitat types, additional parameters like flowering / phenology and spatial distribution should be considered to assess the importance of a habitat type for pollinating insects.

2 Method

2.1 Data sources for taxonomic lists and quality assessment

The main data sources to identify plant species of the habitat types of European interest are the *Interpretation manual of European Union Habitats* (European Commission 2013) and the *compilation of typical species used by Member States to assess the parameter 'Specific structure and functions (including typical species)' for the reporting period 2007-2012* (EEA 2019). Those two species lists have been compiled into a joint database, in order to facilitate data processing. Additional information is also provided by the species list mentioned in the study *Links between species listed in Annex II and Annex IV of the Habitat Directive and habitat types* (Halada et al. 2010).

However, this combined list of relevant species provides a very heterogeneous list of species for habitat types. Indeed, from a phytosociological point of view, most of them cannot be considered as diagnostic species of the related vegetation unit.

In order to assess the level of uncertainty relating to this heterogeneity, habitat types that appear highly ranked for pollinators by using the joint database were further analysed to explore the change of species sets, when phytosociologically harmonised and revised by focussing on only highly constant and diagnostic species (see Table 1).

Table 1: Selected habitat types for a phytosociological harmonization of their species lists by using the sources in the column "references"

Habitat Code	Name	References
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	Willner et al. 2017, Ellenberg 1986, Mucina et al. 1993, Fischer et al. 2008, Calcaiura & Spinelli 2008, Wikipedia
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	Ellenberg 1986, Ellmauer & Mucina 1993, Wikipedia
8210	Calcareous rocky slopes with chasmophytic vegetation	Bernardos et al. 2004, Biondi et al. 1997, Camarda et al. 1995, Carmona et al. 1997, Dakskobler et al. 2014, Dakskobler & Surina 2016, Dimopoulos et al. 1997, Escudero & Pajarón 1994, Frajman et al. 2013, Gimenez Luque & Gomez Mercado 2002, Marsili et al. 2009, Maroulis & Georgiadis 2005, Mucina et al.1990, Nicoletti et al. 2012, Oberdorfer 1977, Ortiz & Rodríguez-Oubiña 1993 Pavlin et al. 2015, Surina & Martinčič 2014, Swierkosz 2012 Terzi & D'Amico 2008, Terzi et al. 2018, Tomaselli et al. 2018, Wagensommer et al. 2015, Wagensommer 2016, Wikipedia, Info Flora 2020, EcoDB 2020, EDIT 2020, HBS 2020, SPB 2020
8220	Siliceous rocky slopes with chasmophytic vegetation	
9130	Asperulo-Fagetum beech forests	Willner 2001, Willner et al. 2017
9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	Willner 2001, Willner et al. 2017

Additionally, three categories were attributed to each plant species regarding their typical abundance in the respective habitat types, in order to weight their importance for pollinators: (1) dominant; (2) abundant; (3) rare. The weighting is carried out by multiplying dominant species by 2, abundant species by 1 and rare plant species by 0.33.

It was also necessary to harmonize and clean the combined list in several ways.

2.2 Harmonisation of species lists

The *Euro+Med PlantBase* (Euro+Med Plantbase 2019) provides an on-line database and information system for the vascular plants of Europe and the Mediterranean region, up-to-date and with a critically evaluated consensus taxonomic core for the concerned species. This consensus taxonomic plant list was used to identify synonyms and doublets and to harmonize the species compilation.

Since the *Interpretation Manual* includes plant, animal and fungi species characterizing the European habitat types, we used several regional, national and continent-wide species lists (e.g. European Red Lists of animals, Fauna Europaea, national checklists of butterflies, beetles, grasshoppers or dragonflies, etc.; see references for the complete list) to filter out non-vascular plant species as well as animal species, which were not considered for our analyses.

Finally, taxa other than species (e.g. genus like *Sesleria* sp. or Families) as well as plant species of submerse vegetation have been excluded from the compiled data set.

2.3 Data sources for pollination mechanism

BiolFlor (UFZ 2019) is a comprehensive database of morphology, flowering phenology, floral and reproductive biology or pollination mechanisms. The database contains almost 3.660 species and more than 60 traits of e.g. morphology, flowering phenology or floral and reproductive biology and was used as one main source to get sound information on pollination mechanisms of plant species relevant for the Habitats Directive.

The following parameters provided by the database BiolFlor were used to decide on the pollination mechanism and to select the plant species used as food sources by pollinators:

- Pollination by insects;
- Pollination by other animal species;
- Pollination by wind;
- Self-pollination;
- Production of nectar and production of pollen.

The information provided by the BiolFlor database allowed to assess the importance for pollinators of about 20% of the plant species from the harmonized dataset. 59% of the pollination mechanism assessments were based on expert judgement, additionally supported by other references (peer reviewed papers for approx. 6% and internet references for about 3%). These references correspond for example to reference books on different kinds of pollinating insects dealing with their food sources, or peer reviewed papers on pollinators inhabiting Natura 2000 sites and other relevant habitat types in Europe including the Mediterranean (see list of References).

Species from the following families, mainly pertaining to ferns and grasses, have been classified as not important for pollinators because of their way of reproduction: *Aspleniaceae*, *Athyriaceae*, *Blechnaceae*, *Culcitaceae*, *Cystopteridaceae*, *Davalliaceae*, *Dennstaedtiaceae*, *Dryopteridaceae*, *Equisetaceae*, *Hymenophyllaceae*, *Lycopodiaceae*, *Marsileaceae*, *Onocleaceae*, *Ophioglossaceae*, *Osmundaceae*, *Poaceae*, *Polypodiaceae*, *Pteridaceae*, *Salviniaceae*, *Selaginellaceae*, *Thelypteridaceae*, *Woodsiaceae*. In contrast, all species allocated to *Asteraceae*, *Fabaceae*, *Ericaceae* and *Lamiaceae* have been classified as important for pollinators. Those decisions are well supported by literature (e.g. Westrich 2018, Zurbuchen & Müller 2012).

2.4 Flowering phenology

Phenology is the study of the timing of recurring biological events and their relationship to seasonal climatic changes (Lieth 1974). The seasonality in the flowering behaviour of plants is important for many ecological aspects, including plant-animal interactions like pollination. In general, information on phenology are provided as:

- The months when the flowering season of a plant species starts and ends;
- How long it lasts;
- The numbers of flowering phases if more than one.

As the start or end of the flowering season largely depends on external abiotic factors, mainly climatic, the exact time may change a bit from year to year (Trefflich et al 2002). Additionally, Dierschke (1995) classified plants into symphenological groups, i.e. groups of plants that bloom together (see Table 2).

Table 2: Character states of flowering phases (after Dierschke 1995 in BiolFlor -UFZ 2019)

Season
pre-spring
start of early spring
end of early spring
start of mid spring
end of mid spring
start of early summer
end of early summer
midsummer
early autumn
autumn

This phenology information is incorporated into the BiolFlor database (UFZ 2019) but it is not available for all the plant species of the habitat types of European interest. Analysis were therefore done with the subset of species where phenology information is available. Furthermore, the spatial focus of the BiolFlor phenology data being on the region of Central Europe, phenology may vary in other European (bio)geographical regions.

Existing climatic differentiations in a broader geographical area have a considerable influence on the phenology. Therefore, phenological information on species with large distribution always have to include some kind of fuzziness.

As the weather patterns vary from year to year, the flowering behaviour also varies between years. Furthermore, population differences can be expected due to the genetic fixation of the flowering behaviour. These two factors must also be included in the phenological information. In summary, relatively wide flowering periods are given in most floras.

2.5 Decision making for habitat types important for pollinators

Step 1: Selection of plant species important for pollinators

As mentioned above, the fact that a plant species is used as food sources for pollinating insects was the decisive criterion to classify it as important for pollinators. This assessment was based on the information related to the pollination mechanism of the plant species, and on whether the pollen of wind pollinated plant species serves as a food source for pollinating insects.

Step 2: Habitat groups important for pollinators

Based on the compilation of plant species of the habitat types of European interest, the following parameters were calculated per habitat group of the Habitats Directive Annex I (Natural and semi-natural grassland formations, Sclerophyllous scrub (matorral), Temperate heath and scrub, Raised bogs and mires and fens, Forests, Coastal sand dunes and inland dunes, Coastal and halophytic habitats, Freshwater habitats, Rocky habitats and caves):

- Minimum total count of species;
- Maximum total count of species;
- Mean and median total count of species;
- Mean and median count and percentage of species classified as important for pollinators.

In order to get a balanced view on the species pool, these parameters were calculated for 3 different data subsets: (1) vascular plants listed in the Interpretation Manual EU 28, (2) typical plant species reported by the Member States for the period 2007-2012 of the Article 17 report and (3) all species of the compiled and harmonized database. Ranking of the habitat groups is done according to the mean total count of important species for pollinators, using the combined species list (revised, harmonized and weighted, by considering the findings from the analysis steps of revised and weighted species lists).

As the analysis are based on aggregated numbers of vascular plant species listed in the different sources, a particular attention is needed on Rocky habitats and caves. Indeed, some rocky habitat types are species rich with a high proportion of local, regional endemic or specialised species, sharing only a subset of common species at the level of the habitat group. Moreover, some rocky habitat types are represented by a high number of subtypes, like 8130 Western Mediterranean and thermophilous scree (11 subtypes), 8140 Eastern Mediterranean (3 subtypes), 8210 Calcareous rocky slopes with chasmophytic vegetation (10 subtypes), 8220 Siliceous rocky slopes with chasmophytic vegetation (10 subtypes) and 8320 Fields of lava and natural excavations (6 subtypes). Therefore, the average of 3.6 subtypes was used as a weighting factor for the ranking of this habitat group (division of the mean total species count of the rocky habitat group with the factor).

Step 3: Habitat types important for pollinators

In a third step, analyses were conducted to assess the importance for pollinators of each habitat types under the Habitats Directive. The ranking is done, within each habitat groups, considering: (1) the absolute number of characteristic plant species assessed as important for pollinators; and (2) the proportion of plant species classified as important food sources for pollinating insect compared to the total number of characteristic plant species.

3 Results

3.1 Plant species important for pollinating insects

3.1.1 Overview

The compilation of typical species reported by Member States under their 2013 Art. 17 reports (EEA 2019a) is the most important species habitat membership data source, with about approx. 6.600 species. The interpretation manual contains on his side 1.961 species, with an overlap of approximately 21% of species mentioned in these main species lists.

According to the data used and the combination of these two data sets (see chapter 2.1-2.3), a list of 6.693 vascular plant species relevant for the habitat types under the Habitats Directive have been compiled. Among them, 4.700 plant species (70%) could be classified according to their importance for pollinators regarding their pollination mechanism: 3.764 plant species were assessed as important (80% of the classified species, 56 % of all relevant species) and 936 as not important (20% of the classified species, 14% of all identified plant species) (see Table 3).

Table 3: Number of plant species classified regarding to their importance for pollinators

	Number of plant species	Percent of plant species
1. Plant species identified for Annex I habitat types	6.693	100%
2. Plant species classified:	4.700	70%
2.1 Important for pollinators	3.764	56%
2.2 Not important for pollinators	936	14%
3. Plant species not yet classified	1.993	30%

For plant species where no classification of their importance for pollinators could be found in databases or published literature, relevant information had to be searched species by species using information provided in the internet. Expert judgement was also used to define the importance for pollinators for some groups of plants. But despite a very thorough literature search for many plant species, 1.993 plant species could not be classified yet (30%) as no information on their importance for pollinators could be found in the course of this project.

The compilation of typical species identified by Member States (EEA 2019a) is the data source with the highest number of species classified as important (3.557) as well as not important for pollinators (885) followed by the species of the interpretation manual (respectively 1.140 and 286) (see Table 4).

Table 4: Number of plant species classified according to their importance for pollinators, in relation to the source of information about habitat membership

Classification of plant species	Species habitat membership source		
	Links between species listed in Annex II and Annex IV of the Habitat Directive and habitat types (Halada et al. 2010)	Interpretation manual	Typical species (reporting period 2007-2012)
Important for pollinators	157	1.123	3.557
Not important for pollinators	18	286	885
Not yet classified	145	482	1.783

The Member States typical species compilation is related to the assessment of the parameter "Specific structure and functions (including typical species)" for the reporting period 2007-2012. Depending on the habitat type (occurring in several member states and biogeographical regions), the difference of reported species is between 0 (all MS reported the same number of typical specie for the same habitat type in the same biogeographic region) and 341 (one MS reported 341 more typical species than another MS for the same habitat in the same biogeographic region).

As an example, for habitat 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates, Germany reported 344 typical species, while Estonia reported only 3. In this data set provided by the Member States, the average difference between minimum and maximum reported species is 44, with a median of 28. In several habitat types of the groups Natural and semi-natural grassland formations and Forests, the minimum-maximum difference is higher than 100. In summary, there is a big imbalance between the reported typical species by the Member States.

3.1.2 Detailed analysis

In summary, 726 *Asteracae* species have been classified as important for pollinators. The family of *Fabaceae*, with 447 evaluated species, includes the second highest number. In decreasing order, *Lamiaceae* (278), *Rosaceae* (182), *Brassicaceae* (182), *Ranunculaceae* (170), *Caryophyllaceae* (124) and *Campanulaceae* (104) are the other plant families with high numbers of plant species (more than 100) classified as important for pollinators. The importance of these families for pollinating insects is very well proved in the literature (e.g. Zurbuchen et Müller 2012, Westrich 2018).

The 1.993 species that could not be assessed regarding their importance for pollinators are linked to 121 families. Main plant families in this group are *Caryophyllaceae* (252 species), *Plumbaginaceae* (160), *Apiaceae* (138), *Brassicaceae* (121), *Plantaginaceae* (111), *Chenopodiaceae* (86), *Rubiaceae* (91), *Orchidaceae* (63), *Crassulaceae* (64), *Saxifragaceae* (63), *Rosaceae* (41), *Euphorbiaceae* (49), *Orobanchaceae* (41), *Polygonaceae* (39), *Asparagaceae* (39), *Potamogetonaceae* (34), *Boraginaceae* (34), *Fagaceae* (33), *Ranunculaceae* (26), *Juncaceae* (29), *Dipsacaceae* (28), *Gentianaceae* (24), *Primulaceae* (27), *Pinaceae* (26), *Valerianaceae* (20), *Cupressaceae* (19).

3.2 Habitat groups important for pollinating insects

3.2.1 Mean total count of important plant species per habitat group

The different sets of species list (combined species list from MS typical species and Interpretation manual, phytosociologically harmonised and revised species list, revised species list weighted by abundance and weighted by the subtypes factor for rocky habitats) were analysed by calculating the median % and mean % of important species for pollinators, as well as the median of total number of relevant plant species.
As a result of this analyse, **the mean total count of important species for pollinators calculated from the habitat types allocated to a habitat group provides reliable results**.

According to this ranking, the habitat group "Natural and semi-natural grassland" is the most important for pollinators, followed by "Sclerophyllous scrub" and "Temperate heath and scrub". The habitat group "rocky habitats and caves" would have been also ranked very high for pollinators, but due to the fact explained under chapter 2.55 it is placed at the very end of the ranking when applying the weighted factor by subtypes (compare Table 5).

Table 5: Analysis of different species number characteristics and ranking of the habitat groups important for pollinators based upon the overall compiled species list

Habitat group	Mean total count important species	Median % total count important species	Mean % total count important species	Minimal total count relevant species*	Maximal total count relevant species*	Mean total count relevant species*	Median total count relevant species*
Natural and semi-natural grassland formations	**111,6**	66,4%	65,1%	15	605	158,9	118
Sclerophyllous scrub (matorral)	**77,6**	76,3%	71,0%	13	504	106,5	41
Temperate heath and scrub	**71,8**	72,3%	68,6%	8	242	98,9	79
Raised bogs and mires and fens	**67,1**	74,8%	74,1%	6	225	89,7	62

Forests	**59,2**	70,5%	70,2%	1	404	81,5	52
Coastal sand dunes and inland dunes	**49**	68,8%	61,9%	26	227	79,6	61
Coastal and halophytic habitats	**36,4**	44,5%	42,6%	1	153	75,2	82
Freshwater habitats	**38,5**	48,4%	50,9%	3	216	70,9	64
Rocky habitats and caves	**80,6 (~22**)**	55,8%	54,1%	4	404	146,4 (~41**)	122

* results based upon the list with all compiled vascular plant species
**weighted by the rocky habitat subtype factor

3.2.2 Additional evidence for Habitat type ranking

In order to verify the further ranking of the habitat types listed in Annex I of the Habitat Directive according to the number of important plant species for pollinators, literature was screened to find out if published literature provides additional evidence for the habitat type ranking, or the habitat group ranking, proposed in this report. Based on the results of this literature search, there are some general findings:

- There are only few papers published dealing with the importance of specific habitat types of European interest for pollinating insects, as considered in this report;
- There is however quite a high number of papers supporting the proposed ranking for the grassland habitat group, but literature is scarce for other habitat groups;
- As bees are the most important pollinators worldwide (Kearns et al. 1998), most of the papers and other literature found are dealing with this group of pollinating insects;
- Published data on the importance of habitat types for pollinators do not allow a precise ranking of these habitats, but provide additional evidence to support the proposed ranking.

The relevant results found in the literature are summarized in a concise way in Table 6. Additionally, a summary of more detailed findings of the respective publications are presented in the Annex. As far as possible, we tried to quote the terms used by the different authors for the respective habitat types to the habitat type code (in brackets). The literature found referred to almost all habitat groups of the ranking.

Table 6: Habitats and habitat types described in literature to be of great importance for pollinating insects

Habitats/Habitat type	Country	Kind of insects observed	Reference
Grasslands			
Semi-dry pastures	Sweden	Bees	Westphal et al. 2008
Wet meadows	Poland	Bees	Westphal et al. 2008
Chalk grassland	UK	Bees	Westphal et al. 2008
Calcareous grassland	Germany	Bees	Westphal et al. 2008
Western-pontic petrophytic steppes (= 62C0 Ponto-Sarmatic steppes)	Bulgaria	Bees, wasps, flies, beetles	Kozuharova 2018
Subalpine meadow	Bulgaria	Bees, bumble bees, butterflies, flies, moths	Kozuharova 2000

Semi-dry basiphilous grassland	Romania, Czech Republic	Very high richness in vascular plants --> high species richness of insects/pollinators	Wilson et al. 2012
Semi-natural dry grassland and abandoned lowland hay meadows (6210, 6510)	Germany	Different bee species	Kratochwil 1983, 1984
Semi-natural grassland, mown or grazed	Germany	Different bee species	Westrich 2018; Flügel 2007
Loess steppic grassland (6250)	Germany	Different bee species	Westrich 2018
Mountain hay meadows (6520)	Germany	Different bee species	Westrich 2018
Lowland hay meadows (6510)	Germany	Different bee species	Westrich 2018
Sclerophyllous scrubs			
Phrygana (54**)	Greece	Bees	Nielsen et al. 2011; Potts et al. 2006; Petanidou 1991; Petanidou & Lamborn 2005
Garrigue	Spain	Bees, bumble bees, syrphids, small beetles	Herrera 1988
Heath & scrub			
Fixed dunes and sand steppes (21**)	Germany	Different bee species	Westrich 2018; Risch 1994; Riemann & Melber 1990 ; Heide & Witt 1990
Juniperus communis formations on heaths or calcareous grasslands (5130)	Germany	Different bee species	Westrich 2018
Bogs, mires & fens			
Halophilous salt marshes	Spain	Not mentioned	Manso & Andres 1993
Forests			
Oak woodland	Greece	Different bee species	Potts et al. 2006; Petanidou & Lamborn 2005
Managed olive groves	Greece	Different bee species	Nielsen et al. 2011; Potts et al. 2006
Pine forests	Greece	Different bee species	Potts et al. 2006; Petanidou & Lamborn
Dunes			
Inland dunes (23**)	Germany	Different bee species	Riemann 1987; Saure 2011; Schmidt & Westrich 1987
Coastal dunes (21**, 22**)	Germany		Westrich 2018

Grassland habitats are by far the habitat group gathering the highest number of publications proving their capacity of providing food sources and nesting sites for diverse insect groups. This is mainly due to the high plant species diversity in grassland habitats: grasslands have much higher plant species counts compared to other habitats and are therefore considered as the most important habitat group for pollinators.

Sclerophyllous scrubs are characteristic of the Mediterranean region and are contributing to the very diverse Mediterranean plant-pollinator communities. Indeed, up to 25.000 species of flowering plants providing best conditions for all kinds of pollinating insects (hoverflies, butterflies, beetles and wasps) are inventoried within the Mediterranean basin. It has also been proved that scrub habitats (phrygana, garrigue, tomillares) are especially rich in bee species.

Pine forests, oak woodlands and managed olive groves have also been shown to have a very great value for plant-pollinator communities and provision of pollination service, in the Mediterranean landscape.

Heathlands are characterised by diverse vegetational structure, bar ground as areas for nesting and annuals as well as ruderal plants providing pollen and nectar for adult insects. Different bee and fly species, wasps, hoverflies and beetles are restricted to this habitat group.

Fixed dunes and sand steppes, both coastal and inland, are outstanding habitats for wild bees. Although the variety of plant species producing nectar and pollen is not very high, the abundance of individual plant species flowering is often very high (e.g. *Calluna vulgaris*). This high abundance of some plants species allows high densities of specialized pollinators.

Regarding **Bogs, mires & fens**, we found evidence that halophilous salt marshes are providing a high percentage of entomophilous plant species.

3.3 Habitat types important for pollinating insects

3.3.1 List of all habitat types

In a further analysis step, the classification of plant species according to their importance for pollinators was assigned to each of the habitat types of European interest. The results for all habitat types are presented in the Annex of this report. Absolute numbers of relevant species for each habitat type are given, in combination with the proportion of important for pollinators / not important / not yet classified species.

3.3.2 Ranking of habitat types per habitat group

The ranking of habitat types according to their importance for pollinators within their respective habitat group is presented in the following tables. This ranking is based on the absolute number of plant species classified as important for pollinating insects for all habitat types with more than 50% of their relevant plant species classified as so.

In most cases, high numbers of important plant species for pollinating insects correlate with an overall high number of relevant plant species of the respective habitat type. This is due to the fact that most of the relevant plant species for habitat types of European interest are food sources for insects. For the same reason, it can be argued that habitat types with a high percentage of plant species that could not be classified regarding their importance for pollinators could be of greater importance than actually ranked by the number of plant species classified as important. In a few cases, this fact led to a slight revision of the ranking.

For all habitat groups, the “Top 5 habitat types” (presented in the tables below) are selected according to:

- The total number of relevant plant species;
- The total number of plant species classified as important for pollinators and;
- A high percentage of plant species that could be classified.

For some groups (e.g. Grasslands, Forests, etc.), more habitat types are listed in addition to the Top 5 as they also provide remarkable food sources due to their high number of important plant species.

Grassland habitat types appear to be of outstanding importance for all kinds of pollinating insects. The species richest habitat types (**6210, 6430, 6170, 6510 and 6230**) have been Top 5 ranked, although there are many other habitat types important to pollinators. Westrich (2018) published an estimation of grassland habitats important for wild bees, which is supporting the ranking of this report. According to Westrich´s estimation, habitat types 6420 and 6120 are also classified as important for wild bees, together with to 6210, 6430 and 6510.

The percentage of plant species that could be classified regarding their importance for pollinators is very high for the Top 5 ranked habitat types (between 83% to 95%). Also, for the other important habitat types, this percentage is higher than 75% (with one exception for 6220) (see Table 7).

Table 7: Natural and semi-natural grasslands habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)	605	466	77,0%	10,7%	89,3%
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	447	355	79,4%	10,3%	89,7%
6170	Alpine and subalpine calcareous grasslands	396	262	66,2%	16,7%	83,3%
6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	305	240	78,7%	5,9%	94,1%
6230	Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	316	220	69,6%	10,1%	89,9%
Other habitat types important for pollinators						
6520	Mountain hay meadows	287	223	77,7%	9,4%	90,6%
6240	Sub-Pannonic steppic grasslands	268	196	73,1%	9,7%	90,3%
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	238	195	81,9%	8,0%	92,0%
6110	Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi*	235	152	64,7%	23,8%	76,2%
6220	Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*	191	89	46,6%	28,3%	71,7%
6150	Siliceous alpine and boreal grasslands	170	112	65,9%	12,4%	87,6%
6190	Rupicolous pannonic grasslands (*Stipo-Festucetalia pallentis*)	157	101	64,3%	19,1%	80,9%
6440	Alluvial meadows of river valleys of the *Cnidion dubii*	151	125	82,8%	5,3%	94,7%
62A0	Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)	149	98	65,8%	18,8%	81,2%

6120	Xeric sand calcareous grasslands	148	102	68,9%	12,2%	87,8%
6420	Mediterranean tall humid grasslands of the *Molinio-Holoschoenion*	129	75	58,1%	20,2%	79,8%
6250	Pannonic loess steppic grasslands	107	72	67,3%	17,8%	82,2%
6130	Calaminarian grasslands of the *Violetalia calaminariae*	96	56	58,3%	18,8%	81,2%
62C0	Ponto-Sarmatic steppes	96	44	45,8%	20,8%	79,2%
6260	Pannonic sand steppes	93	63	67,7%	10,8%	89,2%
6530	Fennoscandian wooded meadows	87	74	85,1%	5,7%	94,3%

Among the **Sclerophyllous scrub** habitat types, **5130** is by far the top ranked habitat type with a number of important plant species comparable to grassland habitats and a very low percentage of not classified plant species. This habitat 5130 *Juniperus communis* formations on heaths or calcareous grasslands, occurs often in a spatial mosaic with 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates. Other habitat types (**5330, 5110**) are also characterized by a very high or high number of entomophilous plant species. The Top 5 habitat types is completed by **5210** and **5420**.

The percentage of plant species classified according to their importance is very high (between 84% to 94%) for three of the Top ranked habitat types, and quite acceptable for 5330 and 5210 (about 60-70%) (see Table 8).

Table 8: Sclerophyllous scrubs (matorral) habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
5130	*Juniperus communis* formations on heaths or calcareous grasslands	504	404	80,2%	6%	94,0%
5330	Thermo-Mediterranean and pre-desert scrub	218	141	64,7%	29,8%	70,2%
5110	Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (*Berberidion* p.p.)	131	100	76,3%	14,5%	85,5%
5210	Arborescent matorral *with Juniperus spp.*	133	78	58,6%	28,6%	71,4%
5420	Sarcopoterium spinosum phryganas	88	68	77,3%	15,9%	84,1%
Other habitat types important for pollinators						
5430	Endemic phryganas of the *Euphorbio-Verbascion*	81	62	76,5%	14,8%	85,2%

Many total numbers of important plant species for pollinators found in the Top 5 **Temperate heath and scrub** habitat group are comparable with those of the Sclerophyllous scrubs and the group of "other important grassland habitat types" (except the Top 5 ranked grassland habitat types).

The percentage of classified plant species is quite high (between 81% and 94%). **4030**, **40A0**, **4060**, **4090** and **4070** are the top 5 habitat types in this group (see Table 9). Top ranking of 4030 is supported by an estimation of European dry heath as important for wild bees (Westrich 2018).

Table 9: Temperate heath and scrubs habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
4030	European dry heaths	242	174	71,9%	9,1%	90,9%
40A0	Subcontinental peri-Pannonic scrub	175	144	82,3%	8,6%	91,4%
4060	Alpine and Boreal heaths	203	136	67,0%	15,3%	84,7%
4090	Endemic oro-Mediterranean heaths with gorse	164	118	72,0%	18,9%	81,1%
4070	Bushes with *Pinus mugo* and *Rhododendron hirsutum* (*Mugo-Rhododendretum hirsuti*)	103	80	77,7%	5,8%	94,2%
Other habitat types important for pollinators						
4080	Sub-Arctic *Salix spp.* scrub	103	79	76,7%	5,8%	94,2%
4010	Northern Atlantic wet heaths with *Erica tetralix*	55	40	72,7%	7,3%	92,7%

The numbers of entomophilous plant species characteristic of the top three habitat types related to **Raised bogs, mires and fens** are comparable to those presented above for temperate heath and scrubs (see Table 10). The number of plant species classified according to their importance for pollinating insects is very high for **7140**, **7210** and **7120** (more than 90%) and high for **7230** and **7220** (equal or more than 80%).

Table 10: Raised bogs, mires and fens habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
7230	Alkaline fens	225	167	74,2%	15,1%	84,9%
7140	Transition mires and quaking bogs	199	150	75,4%	9,0%	91,0%
7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	129	101	78,3%	9,3%	90,7%
7220	Petrifying springs with tufa formation (*Cratoneurion*)	119	82	68,9%	20,2%	79,8%
7120	Degraded raised bogs still capable of natural regeneration	80	65	81,3%	7,5%	92,5%

The Top 5 ranked **Forest habitat types** (**91E0, 9180, 91F0, 9150 and 9170**) have a high number of entomophilous plant species, comparable to some of the grassland habitats (see Table 11). But it is necessary to keep in mind that those value of plant species richness are in most cases restricted to forest edges, glades and clearings. Dense forest areas are indeed of less species richness.

Furthermore, same as for some rocky habitats (e.g. 8210), several forest habitat types include a high number of sub-types. For example, 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* covers Ash-alder woods of springs and their rivers, Ash-alder woods of fast-flowing rivers, Ash-alder woods of slow-flowing rivers, Montane grey alder galleries, Sub-montane grey alder galleries or White willow gallery forests. Therefore, the high number of characteristic species (404) reflects some kind of an aggregated species pool over all subtypes. The same situation can be assumed with 9180 *Tilio-Acerion* forests of slopes, screes and ravines, as well as with 91F0 Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia* along the great rivers. The latter habitat type forms often mosaic vegetation with pioneer or stable forests of soft wood trees.

The percentage of classified plant species is very high for the Top 5 ranked habitat types (equal or more than 90%) and high for all other listed important forest habitat types (between 77% and 95%).

Table 11: Forests habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)	404	317	78,5%	9,4%	90,6%
9180	*Tilio-Acerion* forests of slopes, screes and ravines	301	232	77,1%	8,3%	91,7%
91F0	Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmenion minoris*)	249	199	79,9%	10,0%	90,0%
9150	Medio-European limestone beech forests of the *Cephalanthero-Fagion*	233	196	84,1%	7,7%	92,3%
9170	*Galio-Carpinetum* oak-hornbeam forests	236	195	82,6%	7,2%	92,8%
Other habitat types important for pollinators						
91I0	Euro-Siberian steppic woods with *Quercus spp.*	217	171	78,8%	11,1%	88,9%
9130	*Asperulo-Fagetum* beech forests	208	171	82,2%	4,3%	95,7%
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the *Carpinion betuli*	206	169	82,0%	4,9%	95,1%
91U0	Sarmatic steppe pine forest	176	144	81,8%	4,5%	95,5%
91G0	Pannonic woods with *Quercus petraea* and *Carpinus betulus*	170	138	81,2%	11,8%	88,2%
91H0	Pannonian woods with *Quercus pubescens*	155	125	80,6%	10,3%	89,7%
9260	*Castanea sativa* woods	143	112	78,3%	11,9%	88,1%
9530	(Sub-) Mediterranean pine forests with endemic black pines	163	108	66,3%	22,7%	77,3%

The Top 5 habitat types of **Coastal sand dunes and inland dunes** (**2190, 2130, 2330, 2260, 2180**) are as plant species rich as raised bogs and mires, or some heath and scrub habitat types. In the literature, it is stated that habitat types 2130 and 2310 are important habitat types for wild bees (Westrich

(2918), which is partly supporting the ranking of this report. The percentage of classified plant species according to their importance for pollinating insects is high (between 77% and 93%) (see Table 12).

Table 12: Coastal sand dunes and inland dunes habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
2190	Humid dune slacks	202	139	68,8%	13,9%	86,1%
2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes')	227	131	57,75	22,5%	77,5%
2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands	139	100	71,9%	6,5%	93,5%
2260	*Cisto-Lavenduletalia* dune sclerophyllous scrubs	107	85	79,4%	14,0%	86,0%
2180	Wooded dunes of the Atlantic, Continental and Boreal region	100	69	69,0%	10,0%	90,0%
Other habitat types important for pollinators						
2310	Dry sand heaths with *Calluna* and *Genista*	71	50	70,4%	4,2%	95,8%
2170	Dunes with *Salix repens ssp. argentea* (*Salicion arenariae*)	55	42	76,4%	0%	100,0%

Coastal and halophytic habitat types have a lower richness of entomophilous plants than the other habitat types discussed above. The Top 5 ranked habitat types in this group are **1230**, **1240**, **1130**, **1330**, and **1410**. But, for some of them, the percentage of plant species classified is lower than for the habitat types of other groups. Therefore, it can be assumed that the numbers of important plant species would rise if more plant species could be classified according to their importance for pollinating insects. Nevertheless, coastal and halophytic habitat types should be described as not as species rich as the other habitat types mentioned above (see Table 13).

Table 13: Coastal and halophytic habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	153	116	75,8%	13,1%	86,9%
1240	Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium spp.*	149	56	37,6%	56,4%	43,6%
1130	Estuaries	126	60	47,6%	30,2%	69,8%
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	97	55	56,7%	18,6%	81,4%
1410	Mediterranean salt meadows (*Juncetalia maritimi*)	132	55	41,7%	25,8%	74,2%
Other habitat types important for pollinators						

1160	Large shallow inlets and bays	152	54	35,5%	48,7%	51,3%
1340	Inland salt meadows	98	54	55,1%	18,4%	81,6%
1530	Pannonic salt steppes and salt marshes	100	50	50,0%	22,0%	78,0%

Richness of entomophilous plant species in **Freshwater** habitat types is comparable to coastal and halophytic habitat types, which is lower than for the other habitat groups represented above. The percentage of classified plant species for the Top 5 ranked habitat types (**3130**, **3220**, **3270**, **3240**, and **3160**) is moderate (between 75% and 89%) (see Table 14).

Table 14: Freshwater habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
3130	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	216	111	51,4%	27,8%	72,2%
3220	Alpine rivers and the herbaceous vegetation along their banks	100	76	76,0%	12%	88,0%
3270	Rivers with muddy banks with *Chenopodion rubri p.p.* and *Bidention p.p.* vegetation	113	72	63,7%	22,1%	77,9%
3240	Alpine rivers and their ligneous vegetation with *Salix elaeagnos*	88	63	71,6%	11,4%	88,6%
3160	Natural dystrophic lakes and ponds	74	51	68,9%	24,3%	75,7%

The Top 5 ranked **Rocky habitat types** are **8210**, **8220**, **8240**, **8120** and **8230**. The high rank of 8210 is supported by an estimation of Calcareous rocky slopes with chasmophytic vegetation as important for wild bees (Westrich 2018) (see Table 15). The richness of entomophilous plant species according to the numbers of classified plants in these habitats seems to be comparable to that of heath and scrub habitats.

This species richness is due to a high proportion of local or regional endemic plant species, or plants restricted to specific biotopes. Since some rocky habitats (e.g. 8210, 8220 and 8130) are represented by a high number of subtypes, the richness of entomophilous plant species need to be allocated to different spatial areas. This leads to a lower plant species richness in the local habitats. Therefore, the numbers of plant species classified as important for pollinators displayed for some of the habitat types in Table 15 are overestimating the species richness in certain habitat types.

Table 15: Rocky habitats

Habitat Code	Description	Total number plant species	Total number important plant species	% important plant species	% plant species not yet classified	% plant species classified
Top 5 habitat types						
8210	Calcareous rocky slopes with chasmophytic vegetation	404	227	56,2%	30,2%	69,8%

8220	Siliceous rocky slopes with chasmophytic vegetation	356	148	41,6%	36,2%	63,8%
8240	Limestone pavements	179	129	72,1%	9,5%	90,5%
8120	Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)	216	123	56,9%	25,0%	75,0%
8230	Siliceous rock with pioneer vegetation of the *Sedo-Scleranthion* or of the *Sedo albi-Veronicion dillenii*	189	116	61,4%	21,7%	78,3%
Other habitat types important for pollinators						
8130	Western Mediterranean and thermophilous scree	208	103	49,5%	40,4%	59,6%
8110	Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)	148	82	55,4%	18,2%	81,8%

3.4 Reviewing the habitat type ranking with improved species lists

3.4.1 Improvement of habitat type species lists

After a thorough examination of the list of typical species of Annex I habitat types used by the EU MS, it appears that many of the species cannot be defined as “typical”. Therefore, we assessed the effect of the revision of the compiled data set under phytosociological aspects for some selected habitat types. After this revision, the species list was reduced by about 30 % (habitat 8210) up to 65 % (habitat 6210), with species that were not identified as “typical”. However, some additional species showing a high constancy and a close link to the habitats had to be added (see Table 16).

Additionally, a weighting factor related to species abundance was assigned to the revised species in these selected habitat types. There is a reduction of 46% (habitat 6510) up to 73% (habitat 8220) compared to the original complete list of all vascular plants. In such a weighted analysis, near-natural grassland (6210, 6510) show a higher species number than rocky and forest habitats. Habitat 8220 and 9150 dropped down under 100 whereas all others are above this number.

Table 16: Selected habitat types with a revised and weighted species list

Habitat Code	Name	Previous number of species	Revised number of species	Revised and weighted number of species
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	605	208	168
6510	Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	305	168	165
8210	Calcareous rocky slopes with chasmophytic vegetation	404	283	133
8220	Siliceous rocky slopes with chasmophytic vegetation	356	194	97
9130	Asperulo-Fagetum beech forests	208	115	101
9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	233	93	82

In all three analysis steps (complete list, revised, revised and weighted), **near-natural grassland** (6210, 6510) as well as **forests** (9130, 9150) show a high proportion of plant species classified as important for pollinators, and a small proportion of not yet classified species.

On the other hand, **rocky habitat type**s (8210, 8220) show a medium proportion of species classified as important for pollinators, and a high proportion of not yet classified species (see Table 17). Indeed, Calcareous and Siliceous rocky slopes with chasmophytic vegetation are characterized by regional endemic species with unknown status for pollinator importance, as well as by fern richness which are generally not important for pollinator insects due to their way of reproduction.

Table 17: Comparison of importance for pollinator classes share in the complete species list, revised species list and revised and weighted species list

Habitat code	Total count	Plant species classified as important for pollinators		Plant species classified as not important for pollinators		Species not yet classified	
		number	%	number	%	number	%
Complete species list							
6210	605	466	77,0%	74	12,2%	65	10,7%
6510	305	240	78,7%	47	15,4%	18	5,9%
8210	404	227	56,2%	55	13,6%	122	30,2%
8220	356	148	41,6%	79	22,2%	129	36,2%
9130	208	171	82,2%	28	13,5%	9	4,3%
9150	233	196	84,1%	19	8,2%	18	7,7%
Revised species list							
6210	208	183	88,0%	22	10,6%	3	1,4%
6510	168	134	79,8%	30	17,9%	4	2,4%
8210	283	152	53,7%	45	15,9%	86	30,4%
8220	194	58	29,9%	61	31,4%	75	38,7%
9130	115	95	82,6%	18	15,7%	2	1,7%
9150	93	84	90,3%	7	7,5%	2	2,2%
Revised and weighted species list							
6210	168	83	83,9%	13	14,7%	1	1,4%
6510	165	66	76,5%	18	21,5%	2	2,0%
8210	133	56	52,4%	20	20,0%	31	27,7%
8220	97	23	31,3%	26	36,1%	27	32,6%
9130	101	45	82,2%	9	15,8%	1	2,0%
9150	82	40	90,6%	4	8,6%	1	0,8%

In summary, based on analysis using the 3 species list (complete species list, revised species list and revised and weighted species list):

- **Near-natural grasslands habitat types** importance for pollinator is confirmed by high proportion of plant species classified as important, high vascular plant richness and a medium to high abundance of these species.
- **Rocky habitats** are species rich with a high proportion of local endemic plants, mostly with a low abundance.

- **Forest habitats** show a medium species richness, but with a high proportion of plant species classified as important for pollinators.

Therefore, it can be concluded that using only the complete compiled species data of Annex I habitat types provides acceptable results for classifying the importance of habitat types for pollinators, despite the heterogeneity of the typical species reported by the MS in the Article 17 report in the period 2007 - 2012.

Figures 1-4 display a comparison of total species counts, percentages of important and not important species, and percentages of species not classified, for selected habitat types based on the data derived from the “all species list”, “revised species list”, and “revised and weighted species list” as described in the table above.

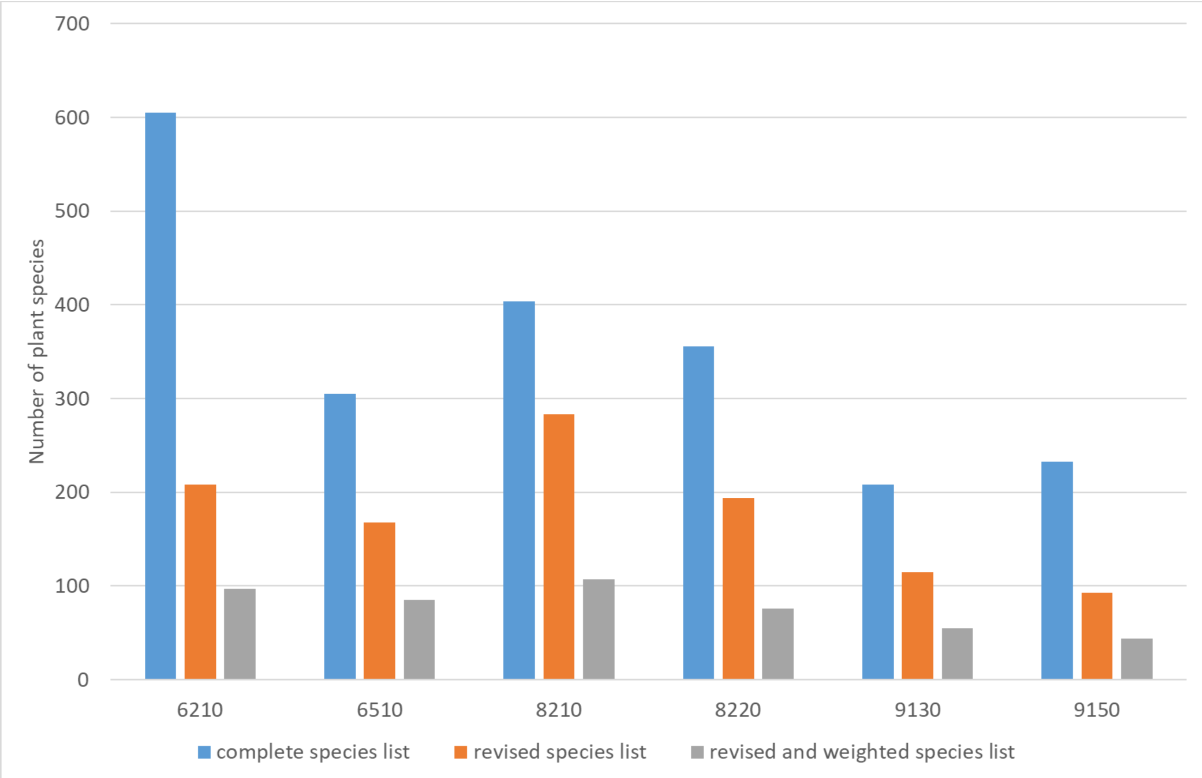

Figure 1: **Comparison of total species count of selected habitat types: all species, revised species, revised and weighted species**

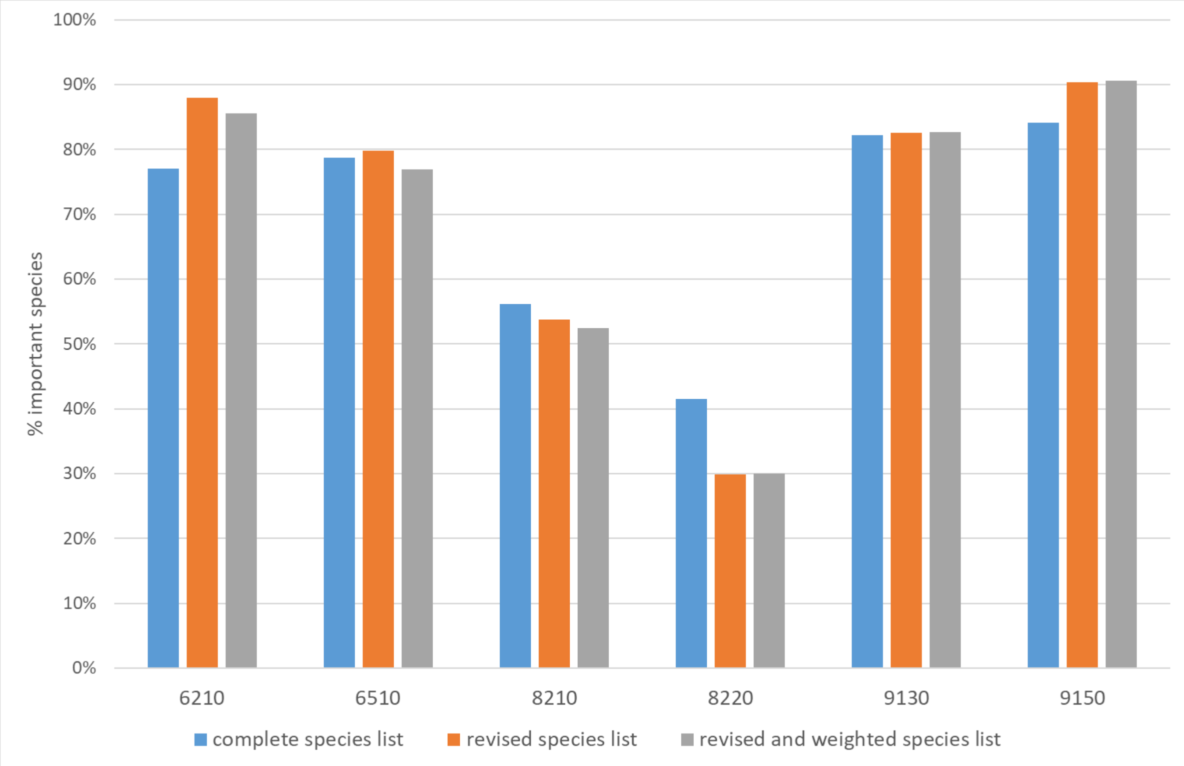

Figure 2: **Comparison of the percentage of important for pollinators: all species, revised species, revised and weighted species**

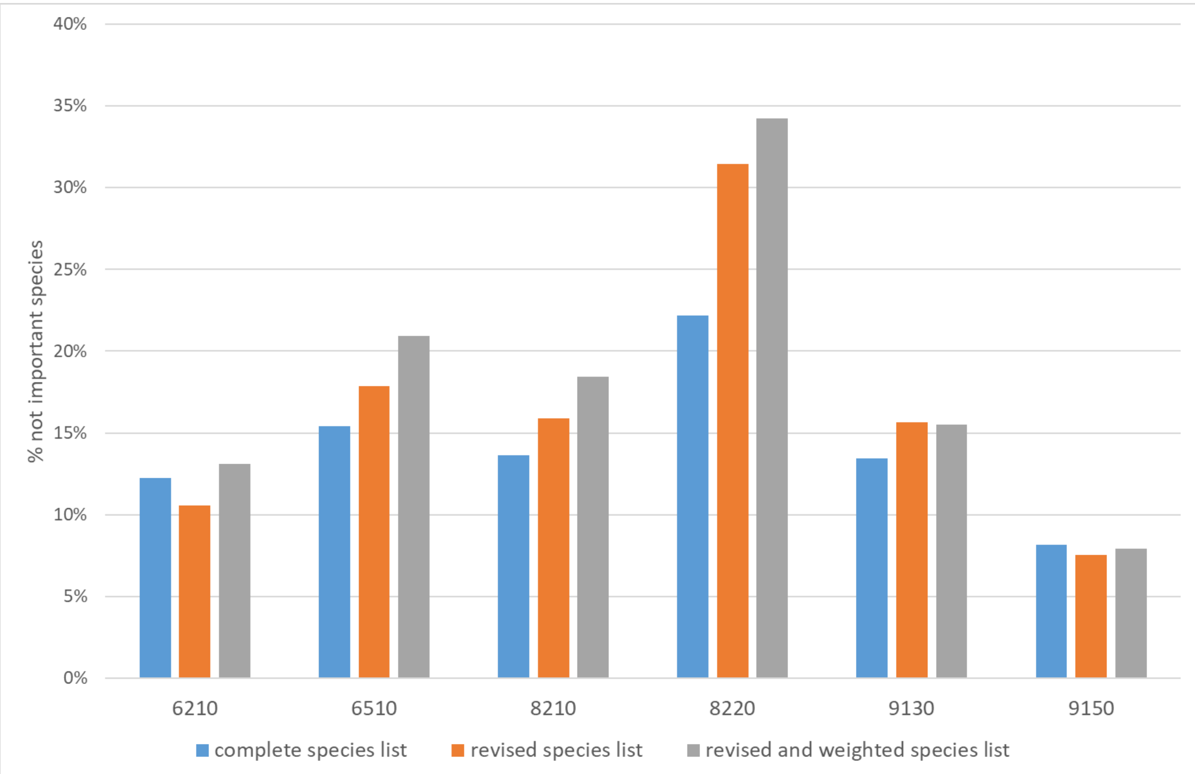

Figure 3: **Percentage of species classified as not important for pollinators: all species, revised species, revised and weighted species**

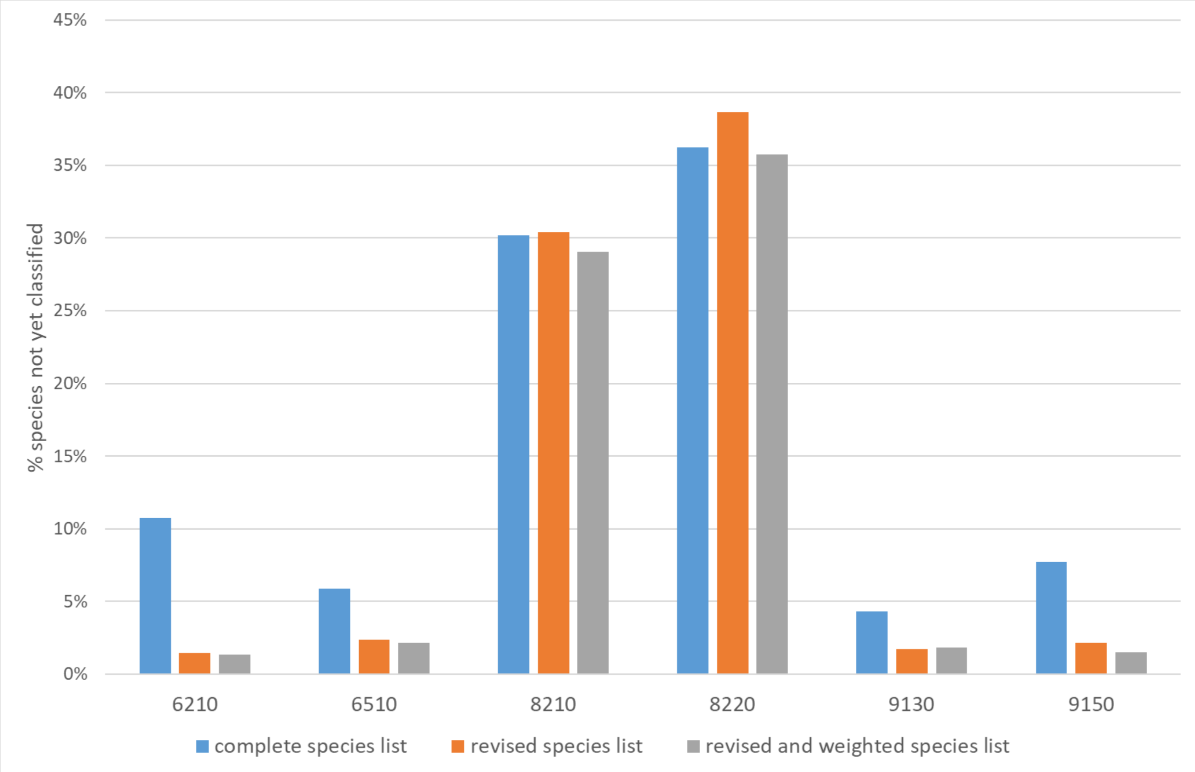

Figure 4: **Percentage of species not yet classified: all species, revised species, revised and weighted species**

3.5 Additional parameters to assess the importance of habitat types of European Interest for pollinating insects

In addition to the number of plant species providing food sources for pollinators and their abundance in a certain habitat type, there are further parameters which should be considered to decide about the importance of a habitat type for pollinating insects. In the following paragraphs, two of these parameters are shortly highlighted: Flowering and phenology, and spatial distribution of habitat types.

3.5.1 Flowering and phenology

Plants and their pollinators can interact only when their “active stages” (open flowers, active visitors) co-occur spatially and temporally. Because the active stages of species are not distributed homogeneously throughout the activity season, the impact of species on network structure and dynamics will depend on their temporal position. In most systems, few flowering plant species and few animal species are active at the beginning and the end of the activity season, with an activity peak in the middle (Ramos–Jiliberto et al. 2018).

To illustrate the differences between different habitat types, we selected some of them as examples. However, not enough data are available about the flowering period of all the important plant species for a wider inclusion of this parameter in a thorough assessment of habitat types importance for pollinators. That is the reason why this parameter was not integrated into our assessment.

Table 18 gives an overview of the median and average of the month in which the blossom of species starts or ends per habitat group. Related information is provided by BiolFlor database.

Table 18: **Parameters of blossom start and end per habitat group (numbers are related to month; e.g. 2 as February), based upon Biolflor database**

Habitat group	median minimum blossom start	mean blossom start	mean blossom end	median maximum blossom end
Coastal and halophytic habitats	5	6,1	8,5	10
Coastal sand dunes and inland dunes	3	5,5	7,7	10
Freshwater habitats	4	5,8	8,2	10
Temperate heath and scrub	3	5,5	7,5	10
Sclerophyllous scrub (matorral)	3	5,4	7,8	10
Natural and semi-natural grassland formations	3	5,5	7,5	10
Raised bogs and mires and fens	3	5,5	7,1	10
Rocky habitats and caves	3	5,5	7,9	10
Forests	2	5,0	6,4	10

Existing climatic differentiations in a larger geographical area have a considerable influence on the phenology. Thus, plants can be classified into symphenological groups, i.e. groups of plants that bloom together. Figures 5-9 show examples of symphenological species groups percentage in selected habitat types, where phenology information is available for more than 50 % of the species.

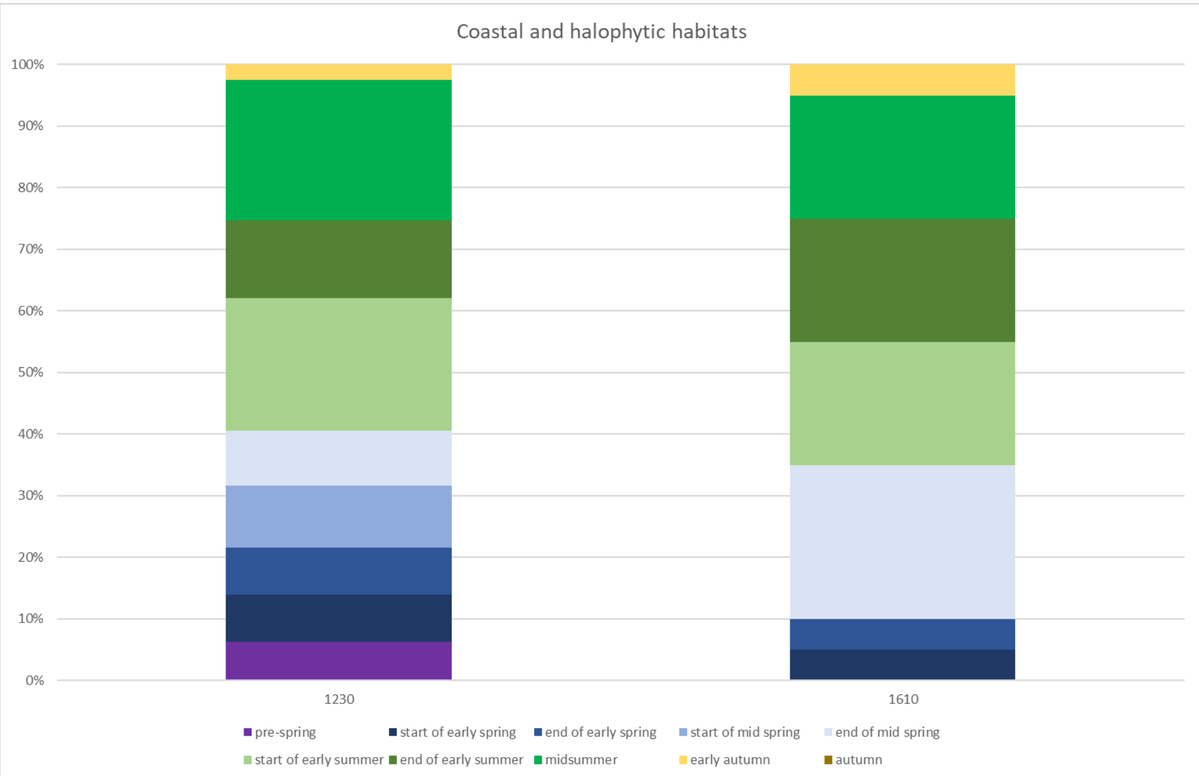

Figure 5: **Symphenological groups in coastal and halophytic habitat type examples**

Some of the **Coastal and halophytic** habitat types have mainly species flowering in the summer season. The main symphenological groups are “Start of early summer” up to “midsummer”. This habitat group almost does not provide any pollination service in autumn. Some of the habitat types have a significant share of species in the respective early spring season (e.g. 1130, 1150, 1210, 1220, 1230, 1240 and 1530). This habitat group covers a high variety of different ecosystems, like open sea and tidal areas, sea cliffs and shingle or stony beaches, Atlantic and Continental salt marshes and salt meadows, Mediterranean and thermo-Atlantic saltmarshes and salt meadows, salt and gypsum inland steppes as well as boreal Baltic archipelago, coastal and land upheaval areas.

For example, the habitat type 1230 Vegetated sea cliffs of the Atlantic and Baltic coasts correspond to the most exposed cliffs. There is a zonation from crevice and ledge communities of the steepest slopes beside the sea, through to closed maritime grasslands on upper cliff slopes, cliff tops and cliff ledges where there is deeper accumulation of soils. Further inland and on more sheltered cliffs, these grade into a complex assemblage of maritime and para-maritime types of heath, calcareous grassland, acid grassland, therophyte, tall herb, scrub and wind-pruned woodland vegetation, each enriched by floristic elements characteristic of coastal habitats. On soft coasts with much active movement, complex assemblages of maritime and non-maritime vegetation occur.

Up to 40 % of the species belong to the Spring symphenological group, equally distributed between pre and early-spring groups, and mid spring groups. About 60% of the vascular species of this habitat are part of the summer symphenological groups, and only a small portion belong to the early autumn group.

The habitat type 1610 Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation includes glaciofluvial islands consisting mainly of relatively well sorted sand, gravel or less commonly of till. The vegetation of esker islands is influenced by the brackish water environment and often by the ongoing land upheaval, which causes a succession of different vegetation types. In comparison to 1230, there is a shift to a higher share of mid spring species. The symphenological groups Start of early summer, End of early summer and Midsummer are equally distributed with a proportion of approx. 20%.

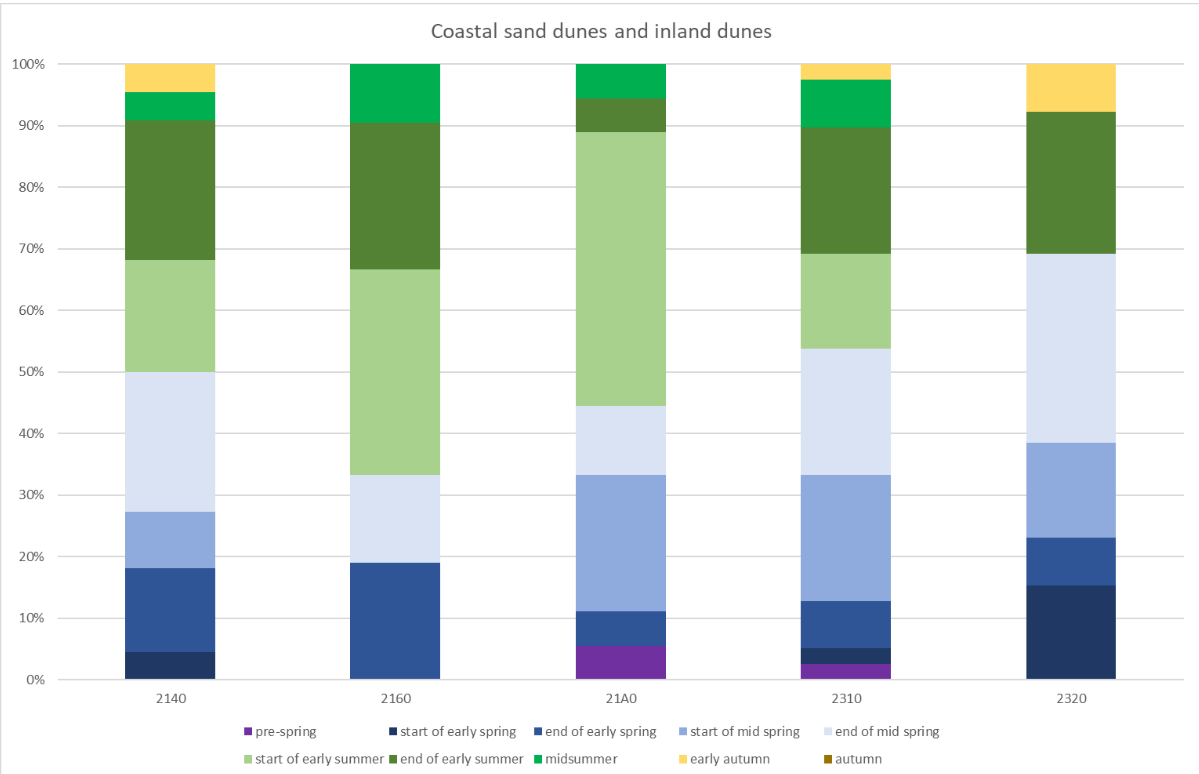

Figure 6: Symphenological groups in coastal sand dunes and inland dunes examples

Within the examples of **Coastal sand dunes and inland dunes** (habitat types 2140 Decalcified fixed dunes with *Empetrum nigrum*, 2160 Dunes with *Hippophae rhamnoides*, 21A0 Machairs, 2310 Dry sand heaths with *Calluna and Genista* and 2320 Dry sand heaths with *Calluna* and *Empetrum nigrum*), the share of the spring symphenological groups cover a range from about 30% to 70%. Habitat type 2320 is characterized by a strong representation of annuals. This habitat group covers coastal dunes of the Atlantic, North Sea and Baltic coasts, coastal dunes of the Mediterranean Sea as well as old and decalcified inland dunes.

The habitat types 2140, 2310, 2320 show a small share of species in the Early autumn group. *Calluna vulgaris* of the Ericaceae family, which is well known as important for pollinators, is one of these species with a flowering period later in the vegetation period. *Empetrum nigrum*, another Ericaceae species, is also a characteristic species for 2140 and 2320.

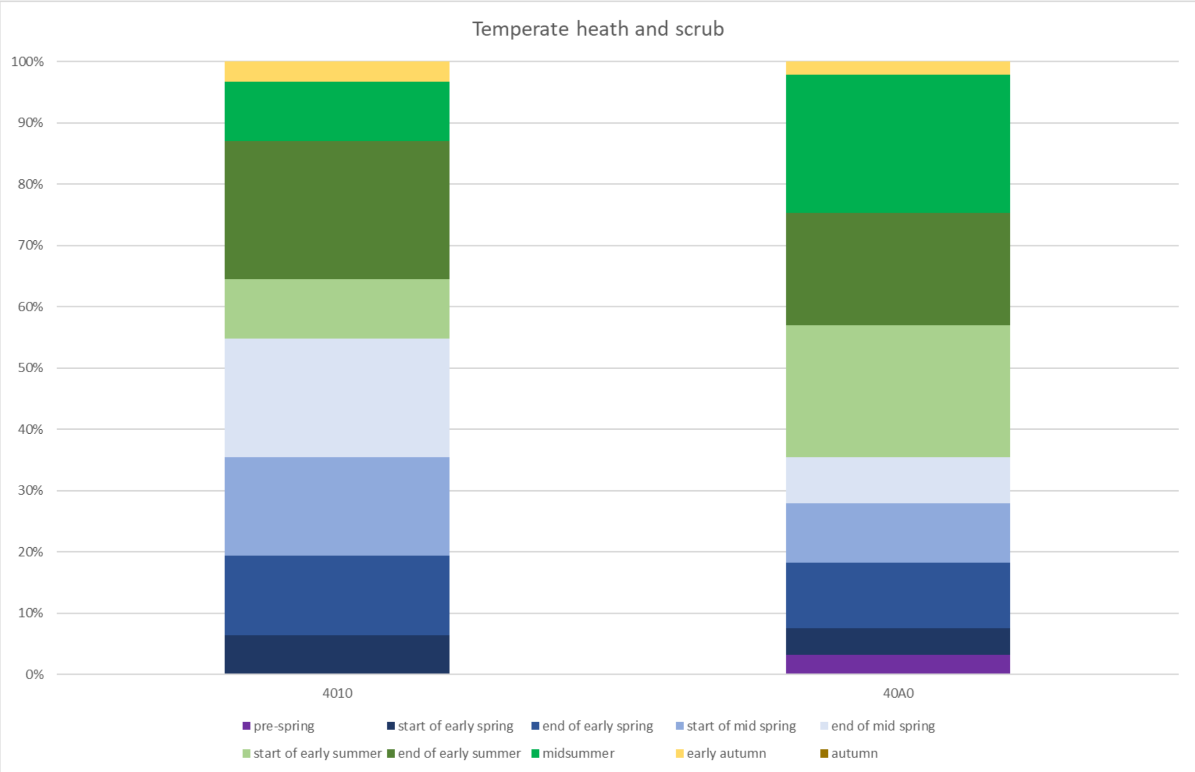

Figure 7: Symphenological groups in temperate heath and scrub examples

Habitat types of the **Temperate heaths and scrub** group present a high percentage of spring flowering species. There is also a significant percentage of autumn flowering species, which provide pollination service in the late period of the year.

4010 Northern Atlantic wet heaths with *Erica tetralix* includes humid, peaty or semi-peaty heaths, other than blanket bogs, of the Atlantic and sub-Atlantic domains. *Erica tetralix* forms the structural vegetation matrix of 4010. Besides Pre-spring and Autumn flowering species, all symphenological groups in spring and summer are represented in a more or less even share.

40A0 Subcontinental peri-Pannonic scrub covers low deciduous scrub with continental and sub mediterranean affinities of the Pannonic basin and neighbouring regions including the eastern Alpine periphery, the southern periphery of the Northwestern Carpathians, the Transylvanian plateau and the adjacent foothills and valleys of the Eastern and Southern Carpathians and the Apuseni mountains, the southern periphery of the Pannonic basin, the Moravian plateau and to the hills and valleys of the northern Balkan peninsula. It forms mosaic-like vegetation with steppe grassland (6210) and forest-steppe elements or plants of the rupicolous Pannonic grasslands (6190) often along the fringes of woodlands. Besides species in the autumn flowering phase, all symphenological groups in spring and summer are present. In comparison to 4010, there is a shift to a higher share of the summer symphenological groups.

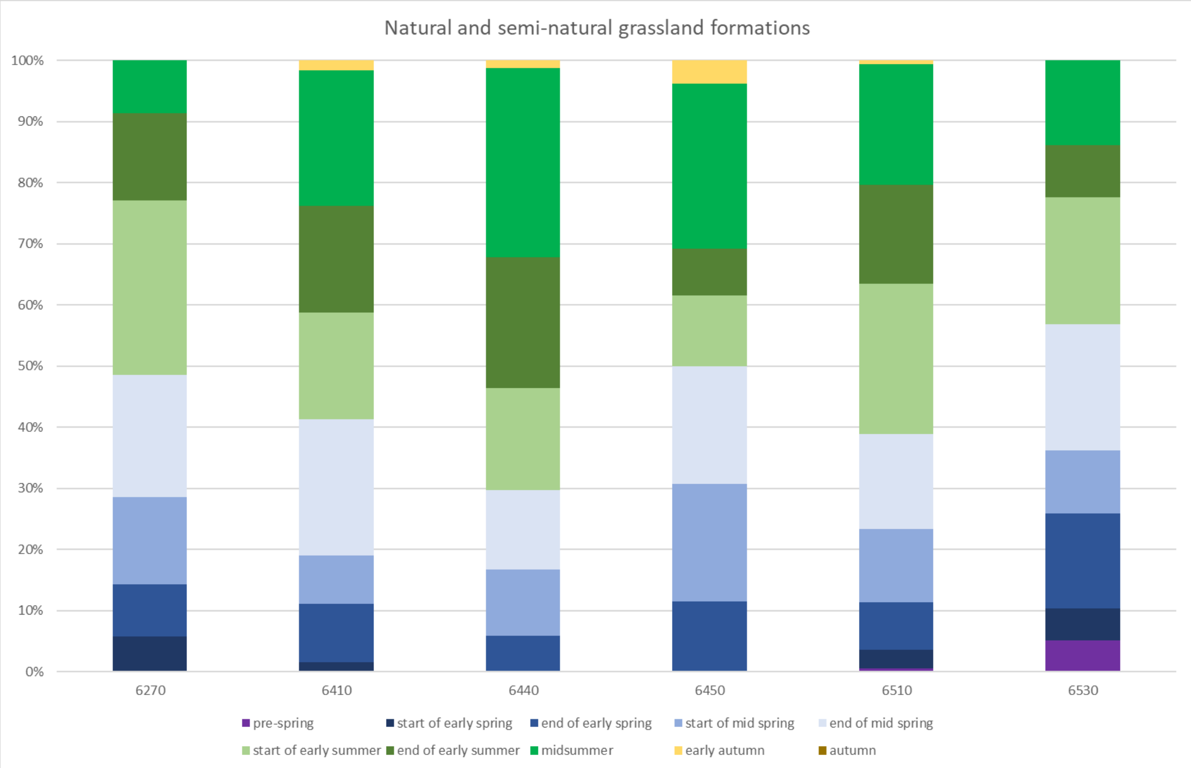

Figure 8: Symphenological groups in natural and semi-natural grassland formation examples

The habitat group of **Natural and semi-natural grassland formations** covers a wide range of sup-groups (natural grassland, semi-natural dry grasslands and srubland facies, sclerophyllous grazed forest (dehesas), semi-natural tall-herb humid meadows, mesophile grassland) situated from the lowlands up to the alpine belt in the European mountain ranges.

6270 Fennoscandian lowland species-rich dry to mesic grasslands occurs in the Fennoscandian lowlands varying from dry to mesic grasslands mainly on siliceous substrates. The vegetation is formed by long-term continuous grazing and/or mowing. The habitat type often supports species-rich vascular plant communities. 6410 *Molinia* meadows on calcareous, peaty or clayey-siltladen soils (*Molinion caeruleae*) includes meadows of plain to montane levels, on more or less wet nutrient poor soils. 6440 Alluvial meadows of river valleys of the *Cnidion dubii* includes alluvial meadows with natural flooding regime belonging to the *Cnidion dubii* alliance, under continental to subcontinental climatic conditions.

6450 Northern boreal alluvial meadows occurs along large rivers with placid river sections which are frozen every winter; the type is affected by flooding in spring. 6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) includes species-rich hay meadows on slightly to moderately fertilised soils of the plain to submontane levels, belonging to the Arrhenatherion and the Brachypodio-Centaureion nemoralis alliances. These extensive grasslands are rich in flowers. 6530 Fennoscandian wooded meadows is built by a vegetation complex consisting of small copses of deciduous trees and shrubs and patches of open meadows. These meadows are species-rich vegetation complexes with rare and threatened species.

For these grassland examples, important symphenological groups are Mid spring as well as Early and Midsummer. The share of autumnal symphenological species groups is in the most cases zero or very low.

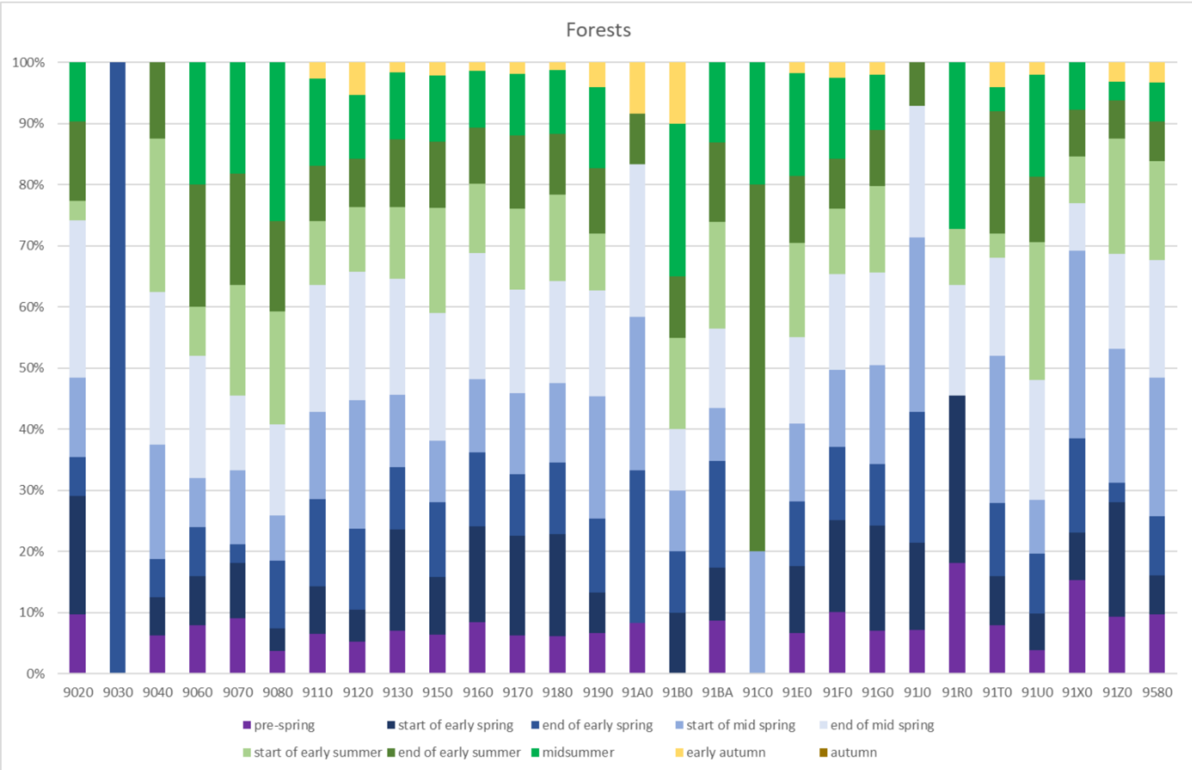

Figure 9: Symphenological groups in forest examples

The **Forest** habitat group has a big proportion of species, which are flowering in the (early) spring season. The summer blossom of forest species is less compared to other habitat groups, but there is also a significant autumn blossom in some of the forest habitats.

3.5.2 Spatial distribution of habitats

Since the availability of habitat types for pollinators is not only a matter of presence but also of the geographical distribution, we have plotted maps for the three high ranked habitat groups.

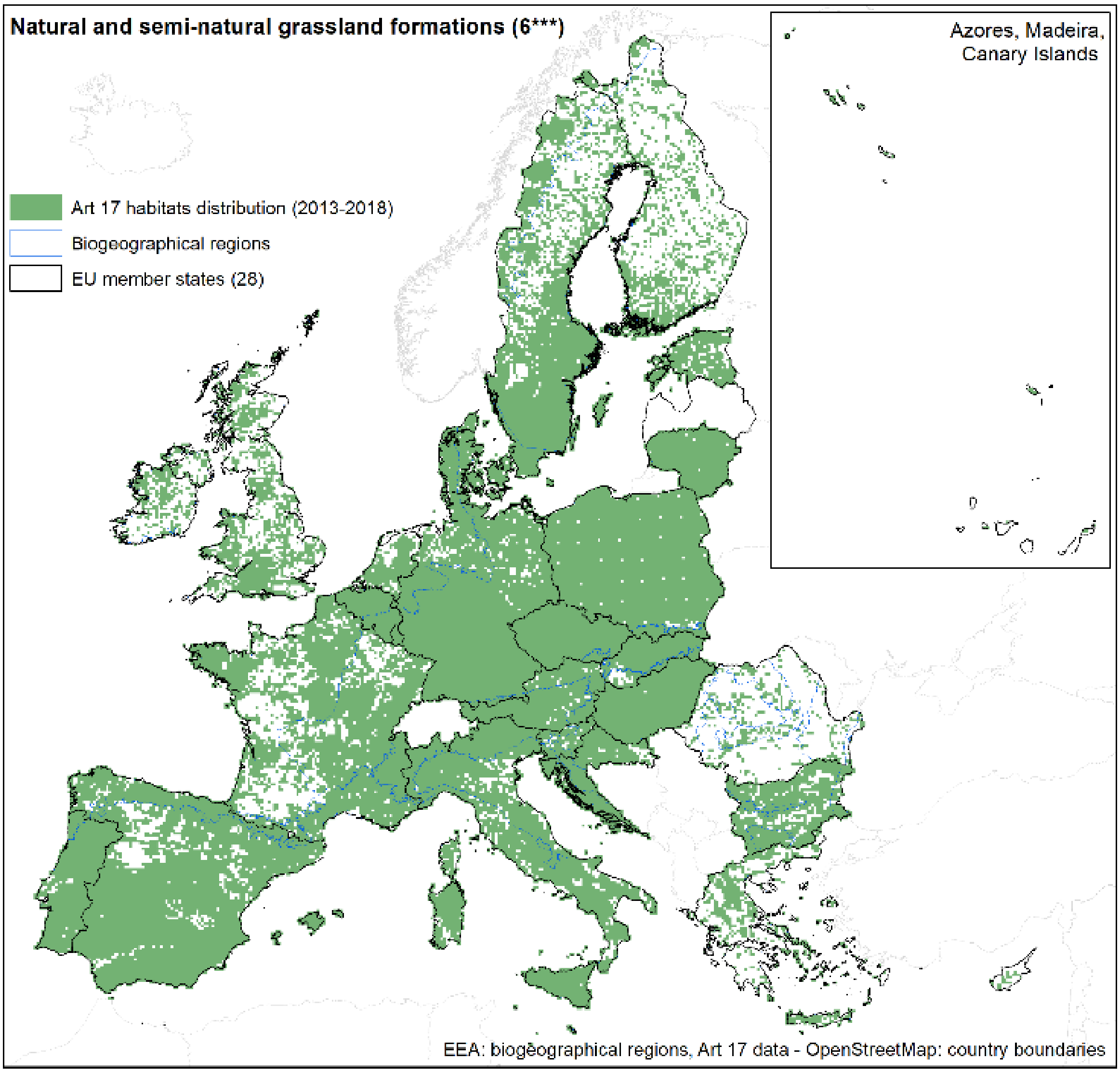

Figure 10: Aggregated distribution of habitats of the top ranked group "Natural and semi-natural grassland formations"

The top ranked "Natural and semi-natural grassland formations" group is widely distributed over Europe and all biogeographical regions providing pollination service over a vast geographical range.

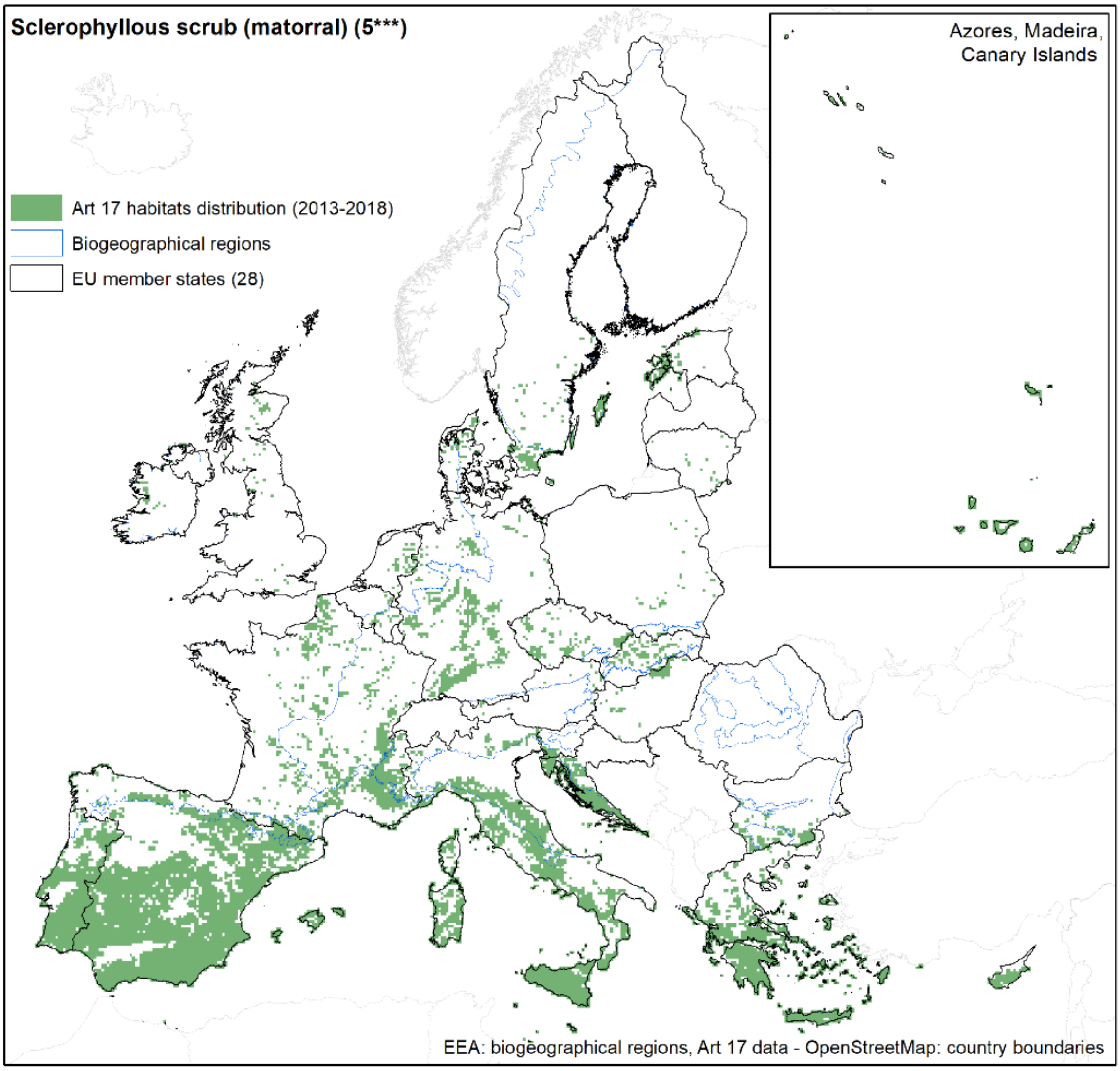

Figure 11: Distribution of habitats of the second ranked group "Sclerophyllous scrub"

The 2nd ranked habitat group "Sclerophyllous scrub (matorral)" (with its subgroups Sub-Mediterranean and temperate scrub, Mediterranean arborescent matorral, Thermo-Mediterranean and pre-steppe brush and Phrygana) has its spatial core area on the Southern part of Europe, with some dispersed occurrences also in Central Europe.

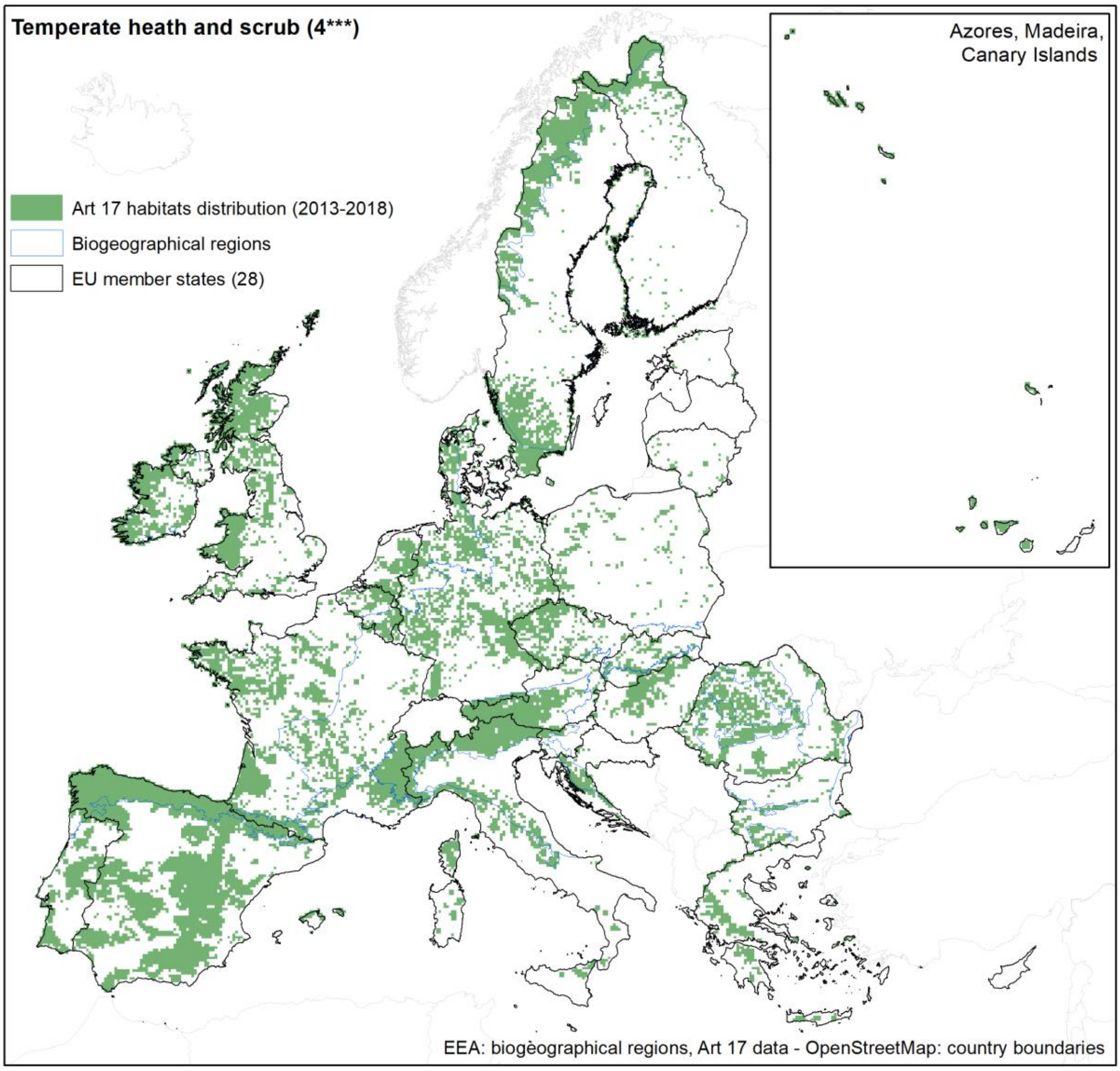

Figure 12: Distribution of habitats of the third ranked group "Temperate heaths and scrub"

The 3rd ordered habitat group of "Temperate heath and scrub" is distributed over the whole of Europe, but in a less spatial density than the "Natural and semi-natural grassland formations". Some clusters can be found in mountain regions like the Alps, Pyrenees or Scandinavian mountains and in coastal regions of Western Europe.

4 Overall conclusions

- 6.693 plant species were identified as relevant for Annex I habitat types, based on the compilation of the species lists from the *Interpretation manual of European Union Habitats* (European Commission 2013) and the *compilation of typical species used by Member States to assess the parameter 'Specific structure and functions (including typical species)' for the reporting period 2007-2012*.
- Among the 4.700 vascular plant species classified in terms of their importance for pollinators, 3.764 (80 % of classified plant species, 56% of all 6.693 plant species) are identified as important for pollinators.
- Most relevant for habitat types importance for pollinators is its ability to provide food sources (pollen and nectar) and nesting sites, as those are the two essential parameters governing the life cycles of pollinating insects. However, given the difficulty of gathering information about nesting sites abilities, and according to the correlation between plant species richness and pollinating insect species richness in habitats shown in the literature, plant species richness is the best suitable proxy variable to assess the habitat type importance for pollinators.
- Additionally, abundance of entomophilous plant species and data on flowering periods are valuable parameter to get more refined results in assessing the importance of habitat types for pollinators.
- Grassland, Sclerophyllous scrubs and Temperate heath are the top three ranked habitat groups according to their importance for pollinating insects.
- Both the distribution (10x10km grid cells) and the overall habitat type area (km^2), within a given biogeographical region or within the whole EU, may be used as additional indicators to decide the ranking of habitat types regarding their importance for pollinating insects.
- In order to get a better database for deciding on the richness of entomophilous plant species of certain habitat types, the compilation of typical species of Annex I habitats should be improved.

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Annex 1

Importance of Annex I Habitat Types for Pollinators
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Supplement

Prepared by / compiled by: Helmut Kudrnovsky, Thomas Ellmauer, Martin Götzl, David Paternoster, Gabriele Sonderegger
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3.0	13/07/2020	Kudrnovsky Ellmauer Götzl Paternoster Schwaiger Sonderegger	Final version for EEA	

Contents

1 Supplement

1.1 Why is the richness of plant species pollinated by insects a good indicator to identify important habitats for pollinators?

Although there are many different pollinating insect species in Europe, like honeybees, bumblebees, solitary bees, hoverflies, butterflies, wasps and some species of beetles (Williams, 2002), there is strong evidence in literature that **richness and abundance of flowering plant species are positively correlated with richness of all pollinating insects**.

Flowering plants provide essential resources as pollen and nectar for all kinds of pollinating insects. This had been shown for example for different species of **bees, the most important group of pollinating insects in Europe** (Hatfield et LeBuhn, 2007; Carvell, 2002; Steffan-Dewenter and Tscharntke, 2001). These findings are confirmed by other studies (e.g. by Ebeling et al., 2008 who conducted a study in Germany), revealing that the **frequency of pollinator visits is linearly increasing with both the blossom cover and the number of flowering plant species** and that **the number of those flowering plant species was closely related to the total number of plant species**, whereas the number of pollinator species followed a saturation curve. Bee species richness is also secondarily affected by the **diversity of nectar sources, the ratio of pollen to nectar energy content, and floral morphology** (Potts et al., 2003).

Almost all of these positive relationships were found across different pollinator guilds (honey bees, solitary bees, bumble bees, hover flies, butterflies, beetles and flies) with some exceptions: visitation rate of solitary bees and hoverflies was only influenced by increasing blossom cover. Therefore, **both plant species richness and strong flowering plant communities appear to be critical factors for pollinators.** Plant species richness will support a diverse community of pollinating insects, including insects specialized to use food sources only from certain plant species or families, while high abundance of a lower number of flowering plant species will benefit particularly generalists.

These results are in line with findings by Fenster et al. (2004) which revealed that **higher floral diversity creates a wider array of foraging niches for functional groups of visitors**. All these prerequisites are responsible for a diverse and abundant pollinator community, which is the basis of pollination stability (Klein et al., 2007). On the other hand, if pollinator functional groups visit different plant species, this enhances the overall visitation and pollination of plant communities (Hoehn et al., 2008; Albrecht et al., 2012; Brittain et al., 2013), which has stabilizing effects on these communities.

Availability of nesting sites is another important determinant of pollinator community composition. Bee nesting habits include tunneling in bare ground, using pre-existing cavities, excavating dead wood and constructing nests inside larger cavities. The quantity and quality of nesting resources greatly influence bee community composition (Potts et al., 2005). Knight et al. (2009) showed that bumblebee nest density was linked to the quantity of floral resources within 1000m of their sample site.

Therefore, **availability and diversity of flowering plants are the main prerequisite to enable stable and diverse pollinator communities, as they are the necessary conditions for pollinators to search for appropriate nesting sites in adjacent areas.**

1.2 Habitat types providing essential preconditions to support pollinators

In order to verify the ranking of the habitat types according to the number of important plant species for pollinators, literature was screened to find out if published literature provides additional evidence for the habitat ranking or the habitat group ranking proposed in this report. The results of this literature search are summarized in the following text.

1.2.1 Grassland habitats

For grassland, Orford et al. (2016) could show that **increasing plant richness was associated with significant enhancement in the functional diversity of pollinator communities** (i.e. ability to use different nectar sources and habitat conditions according to their different morphology, activity patterns, visitation rates, etc.), which was detected by higher visitation frequency and pollinator richness. Similar results were reported for a wide range of insect species, showing that **increasing the diversity of grassland plants is associated with increases in the diversity of insect taxa** (Manning et al., 2015).

Calcareous grasslands (like habitat type 6210) **are considered to belong to the most species-rich habitats in central Europe** (WallisDeVries et al., 2002). They offer a rich supply of floral resources from early spring to late fall and further provide diverse microhabitats for nesting and larval development.

Semi-natural grasslands (i.e. hay meadows, like habitat types 6510 and 6520) **and pastures** that are not intensely cultivated or fertilized, and mainly with spontaneously established flora, **are also very species-rich ecosystems** (Wilson et al., 2012). The authors could show that managed semi-natural temperate grasslands (semi-dry basiphilous grassland) from Eastern Central Europe (Romania and Czech Republic) have a very high richness in plant species, and thus are important habitats for pollinating insects. In addition to plant species richness, **semi-natural grasslands are essential habitats for pollinators as they provide a high diversity of flower resources**, both in time and space, as well as nesting sites (Holzschuh et al., 2007).

Another study (Carvell, 2002), conducted on an **unimproved chalk grassland** (calcareous grassland like habitat type 6210) in north-west Europe, proved that both the overall abundance and species richness of bumblebees were strongly influenced by the different grassland management regimes, and that high number of flowers and flowering plant species (high floristic diversity) supported high numbers of bumblebees.

High species richness was observed in **Loess steppic grassland** (like habitat type 6250) (Westrich, 2018). Kratochwil (1983, 1984) found 132 bee species in a complex of **abandoned semi-natural dry grassland** (habitat type 6210) and **lowland hay meadows** (habitat type 6510) (Nördlicher Kaiserstuhl, Germany). Similar numbers of bee species were detected in abandoned, mowed and grazed **semi-natural dry grassland** (110 bee species, Westrich 2018). Comparable figures (98 bee species) were published for **Semi-natural dry grassland** in Nordhessen (Germany, Flügel 2007).

Westphal et al. (2008) published data on bee species richness of different temperate grassland types: **Semi-dry pasture** (Sweden) with 73 bee species (1220 individuals), **wet meadows** (Poland) with 99 bee species (2253 individuals), **chalk grassland** (UK) with 70 bee species (2886 individuals) and **calcareous grassland** (Germany) with 122 bee species (8813 individuals) to be observed.

Westrich (2018) described the following grassland habitats to be especially rich in pollinating insects: **6510** (**Lowland hay meadows**) and **6520** (**Mountain hay meadows**). Similar results are published by Boller and Schindler (2013) for the Eifel in Germany.

Plant-pollinator relationships have been studied in **subalpine meadows** on the Northern slopes of Mount Vitosa in south-west Bulgaria, at an altitude of 1.800-2.200 meters, to reveal the distribution of the insects on the blossoms according to their functional morphology (Kozuharova, 2000). As a result, 114 different insect species were observed as visitors (bees, bumble bees, butterflies, flies and moths) on plant species allocated to several families proving the importance of this habitat for pollinating insects.

Another paper published by the same author investigated the complex of entomophilous plants in Cape Kaliakra Nature Reserve (08E1 Western-pontic petrophytic steppes Natura 2000 habitat, representing habitat type **62C0 "Ponto-Sarmatic steppes"**) (Kozuharova, 2018). Although a high percentage of the flora of this Nature reserve is wind pollinated, entomophilous plants outnumber wild pollinated plants. Nectar and pollen produced by entomophilous plants were mainly accessible to short tongued pollinators such as small bee species, wasps, anthophilous flies and beetles.

1.2.2 Bogs, mires & fens

Halophilous salt marshes in the region Dehesa de la Albufera (Valencia, Spain) were investigated to address the question whether a correlation exists between the pollination mechanism and palynological characters of selected plant species (Manso & Andres 1993). From 50 taxa considered, about 50% were entomophilous plant species, showing that salt marshes provide relevant food sources for pollinating insects.

1.2.3 Sclerophyllous scrubs and forests

Studies on pollination ecology in **Mediterranean communities** by Petanidou and Lamborn (2005) proved the importance of Mediterranean habitats for bees. According to the climatic conditions, Mediterranean regions are a biodiversity hotspot and have remarkable species richness in pollinating insects.

3.000 to 4.000 bee species are estimated to live in the Mediterranean Basin, as part of very diverse plant-pollinator communities together with approximately **25.000 species of flowering plants.** This is another evidence of the positive correlation between the number of flowering plant species and the diversity of pollinating insects (Potts et al. 2003), and proves the great importance of Mediterranean habitats for bees and other pollinators as hoverflies, butterflies, beetles and wasps. Different scientific publications proved that **scrub habitats** (phrygana, garrigue, tomillares) are very rich in bee species. For example, Petanidou (1993) observed more than 600 different insect species in a mature **phrygana** near Athens, including about 260 bee species. Also Herrera (1988) observed 180 flower-visiting insect species (thereof 55 bee species) in a Spanish **garrigue** near Donana.

In another paper on plant-pollination biodiversity and pollination services in a complex Mediterranean landscape dealing with different habitats on the Greek island, Lesvos Potts et al. (2006) concluded that **pine forests**, **oak woodland** and **managed olive groves** have the greatest value for plant-pollinator communities and provision of pollination service. The highest bee species richness in oak woodlands and managed olive groves fits to the high floral diversity recorded (flower species richness as well as flower abundance) in these habitats. There, **the abundance of common bee species is strongly associated with the overall abundance of flowers** and of energy availability in the form of nectar. **Overall bee and flower species richness were highly significantly correlated** (Potts et al. 2006).

Another study to assess bee species richness in the Mediterranean compared **semi-natural scrub habitats** (**phrygana**) and **managed olive groves** (Nielsen, 2011). The study sites were selected on the island of Lesvos, Greece. About 203 bee species were found at all phrygana study sites together (with about 3480 individuals) and about 221 bee species (more than 4200 individuals) at all of the olive grove study sites. The quite similar number of bee species in managed olive groves compared to the phrygana study sites is due to a high diversity of wild flower resources and an open floor which is the results of light plowing applied only every 2-3 years.

1.2.4 Heathlands

Lowland heathland (below 300m) are characterized by sandy mineral soils of low nutrient status (buglife.org.uk: https://www.buglife.org.uk/resources/habitat-management/lowland-heathland/, access 25.03.2020). Many heathlands are a mosaic of habitats providing also important invertebrate habitats. Different bee and fly species, wasps, hoverflies and beetles are confined to this habitat. This is due to the diverse vegetational structure, bar ground as areas for nesting and annual as well as ruderal plants providing pollen and nectar for adult insects.

There is however little knowledge on the specific bee fauna of **Mountain heaths** (Westrich 2018). As bee species are thermophilic insects, they avoid climate conditions of high altitudes and high precipitation.

1.2.5 Dunes

Fixed dunes and **sand steppes** near the coast and in the land are outstanding habitats for wild bees (Westrich 2018). Although variety of nectar and pollen producing plant species is not very high, there is very high abundance of individual plant species flowering (e.g. *Calluna vulgaris*). This high abundance of some plants allows high densities of pollinators specialized on these plant species.

For example, Risch (1995) found 66 bee species in this kind of habitat (near Storkow in Germany. Similar results were published by Haeseler in 2005 (“Steller Heide” near Bremen in Germany: 113 bee species). Further results of other authors (Riemann & Melber, 1990; Heide & Witt, 1990) support these findings.

1.3 Number of plant species per family classified regarding to their importance for pollinators

Family	Number of		
	Plant species classified as important for pollinators	Plant species classified as not important for pollinators	Plant species not yet classified
Acanthaceae	2		
Acoraceae			1
Aizoaceae			4
Alismataceae	7		3
Amaranthaceae			5
Amaryllidaceae	45		17
Anacardiaceae	1	2	5
Apiaceae	90		138
Apocynaceae	5		13
Aquifoliaceae	1		4
Araceae	3		12
Araliaceae	5		
Arecaceae		1	2
Aristolochiaceae	2		7
Asparagaceae	29		39
Aspleniaceae		34	
Asteraceae	726		
Athyriaceae		8	
Balsaminaceae	2		
Berberidaceae	6		1
Betulaceae	16		
Blechnaceae		2	
Boraginaceae	56		34
Brassicaceae	182		121
Butomaceae	1		
Buxaceae	1		1
Cactaceae	1		
Campanulaceae	104		2
Cannabaceae	1		
Capparaceae	2		
Caprifoliaceae	8		4
Caryophyllaceae	124	1	252
Celastraceae	3		3

Family	Number of		
	Plant species classified as important for pollinators	Plant species classified as not important for pollinators	Plant species not yet classified
Ceratophyllaceae		2	
Chenopodiaceae	21	5	86
Cistaceae	52		7
Clethraceae			1
Clusiaceae	28		1
Cneoraceae			1
Colchicaceae	3		7
Convolvulaceae	23		2
Coriariaceae		1	
Cornaceae	3		
Corylaceae	3		3
Crassulaceae	20		64
Cucurbitaceae	1		2
Culcitaceae		1	
Cupressaceae		2	19
Cymodoceaceae		1	
Cynomoriaceae			1
Cyperaceae	135	111	1
Cystopteridaceae		6	
Cytinaceae			2
Datiscaceae			1
Davalliaceae		1	
Dennstaedtiaceae		1	
Diapensiaceae			1
Dioscoreaceae	1		4
Dipsacaceae	10		28
Droseraceae	4		1
Drosophyllaceae	1		
Dryopteridaceae		22	
Elaeagnaceae	2		1
Elatinaceae		6	1
Ephedraceae	1	4	1
Equisetaceae		14	
Ericaceae	74	2	
Eriocaulaceae			1
Euphorbiaceae	18		49

Family	Number of		
	Plant species classified as important for pollinators	Plant species classified as not important for pollinators	Plant species not yet classified
Fabaceae	447	1	
Fagaceae	8	1	33
Frankeniaceae	8		
Gentianaceae	33		24
Geraniaceae	26		14
Gesneriaceae			3
Grossulariaceae	6		
Haloragaceae	2		2
Hamamelidaceae			1
Hydrocharitaceae	2	7	6
Hymenophyllaceae		3	
Iridaceae	41		2
Isoetaceae			14
Juglandaceae			1
Juncaceae	42	2	29
Juncaginaceae	1	1	2
Lamiaceae	278		
Lauraceae	3		3
Lemnaceae		2	4
Lentibulariaceae	7		15
Liliaceae	17		4
Linaceae	14		8
Linderniaceae			3
Linnaeaceae	1		
Loranthaceae	2		2
Lycopodiaceae		18	
Lythraceae	5		9
Malvaceae	8		4
Marsileaceae		5	
Melanthiaceae	2		2
Meliaceae			1
Menyanthaceae	1		1
Molluginaceae			2
Montiaceae	1		2
Moraceae	1		
Morinaceae			1

Family	Number of		
	Plant species classified as important for pollinators	Plant species classified as not important for pollinators	Plant species not yet classified
Myricaceae			2
Myrsinaceae			5
Myrtaceae	1		
Nartheciaceae	1		
Nyctaginaceae			1
Nymphaeaceae	4		1
Oleaceae	6	3	9
Onagraceae	23	1	6
Onocleaceae		1	
Ophioglossaceae		10	
Orchidaceae	72		63
Orobanchaceae	57		41
Osmundaceae		1	
Oxalidaceae	2		1
Paeoniaceae	3		4
Papaveraceae	21		3
Parnassiaceae	1		1
Phyllanthaceae			2
Pinaceae	2	1	26
Pittosporaceae			2
Plantaginaceae	68		111
Platanaceae			1
Plumbaginaceae	5		160
Poaceae		621	
Polemoniaceae	1		1
Polygalaceae	10		4
Polygonaceae	34		39
Polypodiaceae		5	
Portulacaceae	1		
Potamogetonaceae			34
Primulaceae	62		27
Pteridaceae		15	
Ranunculaceae	170		26
Resedaceae	5		3
Rhamnaceae	11		6
Rosaceae	182		41

Family	Number of		
	Plant species classified as important for pollinators	Plant species classified as not important for pollinators	Plant species not yet classified
Rubiaceae	13	1	91
Ruppiaceae			4
Rutaceae	2		3
Salicaceae	63		
Salviniaceae		2	
Santalaceae	9		3
Sapindaceae	16		
Saxifragaceae	20	2	63
Scheuchzeriaceae	1		
Scrophulariaceae	21		15
Selaginellaceae		3	
Simaroubaceae	1		
Smilacaceae			5
Solanaceae	5		8
Staphyleaceae	1		
Styracaceae			1
Tamaricaceae	2		11
Taxaceae	1		
Theaceae			1
Thelypteridaceae		7	
Thymelaeaceae	9		15
Tofieldiaceae	2		
Typhaceae	5		12
Ulmaceae	3		7
Urticaceae	2	1	2
Valerianaceae	12		20
Verbenaceae			1
Viburnaceae	7		2
Violaceae	57		4
Vitaceae	2		1
Woodsiaceae		4	
Xanthorrhoeaceae	8		1
Zosteraceae		2	
Zygophyllaceae			7

1.4 Minimum and maximum number of typical species reported by member states for the period 2007 to 2012 and difference between min and max

Habitat code	min	max	diff
6210	3	344	341
5130	1	341	340
91E0	1	220	219
9180	1	207	206
6430	3	208	205
6510	2	197	195
6520	4	177	173
9150	5	167	162
6410	3	157	154
9130	6	157	151
91F0	2	151	149
6230	3	147	144
6240	13	157	144
9170	6	143	137
6170	9	144	135
9160	3	137	134
7230	2	135	133
91I0	6	135	129
7140	1	125	124
40A0	3	120	117
1160	2	118	116
2190	2	116	114
6190	5	116	111
8130	12	121	109
8240	3	111	108
6440	5	104	99
9110	5	103	98
1230	3	100	97
3130	2	99	97
2330	1	97	96
5330	5	100	95
6110	5	99	94
9190	1	95	94
91G0	8	102	94
6120	5	94	89
4030	3	91	88
8230	1	88	87

Habitat code	min	max	diff
1510	1	87	86
1130	1	85	84
8210	4	86	82
8220	1	83	82
6220	5	83	78
91D0	3	80	77
3150	1	74	73
7210	1	74	73
3270	1	73	72
2310	1	70	69
5110	1	70	69
1330	2	68	66
2130	1	66	65
6150	4	69	65
7120	1	63	62
9260	1	62	61
9340	1	62	61
5210	10	69	59
91U0	78	137	59
4060	5	63	58
4070	5	63	58
91H0	3	61	58
7220	1	58	57
8160	4	58	54
9410	3	56	53
9140	5	57	52
9560	7	59	52
1410	2	53	51
3160	2	53	51
91K0	7	58	51
9580	1	52	51
4090	1	51	50
91M0	5	55	50
9530	3	52	49
2260	8	55	47
62C0	5	52	47
6530	2	49	47

Habitat code	min	max	diff
91L0	7	54	47
1240	2	47	45
1340	13	58	45
1420	2	47	45
3260	1	46	45
92A0	6	51	45
2180	1	45	44
6130	1	44	43
6420	3	45	42
1430	1	42	41
91T0	1	42	41
9430	4	45	41
6270	2	41	39
9540	13	52	39
1150	1	39	38
4010	1	39	38
7310	10	48	38
8120	9	47	38
6250	5	41	36
3280	4	39	35
8150	4	38	34
91Q0	3	37	34
1530	7	40	33
2220	5	38	33
7150	1	34	33
9420	6	39	33
6260	6	38	32
9230	8	40	32
3220	1	32	31
1220	5	35	30
3290	3	33	30
5310	1	31	30
5430	10	40	30
9360	6	35	29
1250	4	32	28
1310	1	29	28
3230	1	29	28
4080	3	31	28
8110	3	31	28
8320	1	29	28
2250	2	29	27
3250	4	31	27
62D0	7	34	27

Habitat code	min	max	diff
7110	2	29	27
92B0	9	36	27
2160	1	27	26
91AA	19	45	26
1630	4	29	25
3170	12	37	25
7240	5	30	25
9120	4	29	25
91CA	21	46	25
91N0	3	28	25
9290	2	27	25
2110	2	26	24
2270	2	26	24
3110	2	26	24
3240	3	27	24
9020	4	28	24
95A0	7	31	24
1610	5	28	23
2120	1	24	23
2230	4	27	23
5420	12	35	23
6280	11	34	23
9010	6	29	23
9070	3	26	23
3140	1	23	22
92C0	16	38	22
9370	2	24	22
2210	8	29	21
2340	2	23	21
9080	3	24	21
91BA	11	32	21
5120	1	21	20
5230	3	23	20
2170	1	20	19
5320	1	20	19
9240	2	21	19
9350	1	20	19
2140	1	19	18
4020	6	24	18
7130	1	19	18
9040	1	19	18
92D0	3	21	18
1210	2	19	17

Habitat code	min	max	diff
3120	4	21	17
4050	4	21	17
91B0	1	18	17
2150	1	17	16
40C0	4	20	16
6450	3	19	16
9050	15	31	16
9330	1	17	16
9380	1	17	16
2240	10	25	15
62A0	33	48	15
9060	3	18	15
8340	3	17	14
9320	7	21	14
4040	8	21	13
5410	5	18	13
7160	3	16	13
1320	1	13	12
1620	1	13	12
1650	2	14	12
6310	4	16	12
8310	1	13	12
8140	23	34	11
2320	2	11	9
3180	10	18	8
1110	1	8	7
1520	11	18	7
1140	1	7	6
6160	23	29	6
9250	18	24	6
3190	1	6	5
9570	15	18	3
1640	6	8	2
5220	16	18	2
6140	13	15	2
8330	1	3	2
91A0	11	12	1
9270	28	29	1
1120	1	1	0
21A0	24	24	0
3210	7	7	0
40B0	1	1	0
5140	6	6	0

Habitat code	min	max	diff
6180	34	34	0
62B0	9	9	0
6460	8	8	0
9030	1	1	0
91J0	17	17	0
91P0	37	37	0
91R0	8	8	0
91S0	15	15	0
91V0	21	21	0
91W0	19	19	0
91X0	13	13	0
91Y0	25	25	0
91Z0	57	57	0
9210	30	30	0
9220	25	25	0
9280	37	37	0
9310	25	25	0
9390	10	10	0
93A0	13	13	0
9510	8	8	0
9520	17	17	0
9550	4	4	0
9590	11	11	0

1.5 Habitats with absolute number of assigned species and proportions of classified as “important”, “not important” and “not yet classified” for pollinators

habitat group	habitat code	description	number of plants	% plant species classified as		
				important for pollinators	not important for pollinators	not yet classified
Coastal habitats	1110	Sandbanks which are slightly covered by sea water all the time	26	3,8%	38,5%	57,7%
	1120	Posidonia beds (Posidonion oceanicae)	1	0,0%	100,0%	0,0%
	1130	Estuaries	135	44,4%	22,2%	33,3%
	1140	Mudflats and sandflats not covered by seawater at low tide	15	6,7%	46,7%	46,7%
	1150	Coastal lagoons	101	37,6%	18,8%	43,6%
	1160	Large shallow inlets and bays	165	33,3%	16,4%	50,3%
	1170	Reefs	0			
	1180	Submarine structures made by leaking gases	0			
	1210	Annual vegetation of drift lines	83	49,4%	7,2%	43,4%
	1220	Perennial vegetation of stony banks	77	63,6%	22,1%	14,3%
	1230	Vegetated sea cliffs of the Atlantic and Baltic Coasts	159	73,6%	11,3%	15,1%
	1240	Vegetated sea cliffs of the Mediterranean coasts with endemic Limonium spp.	154	36,4%	5,8%	57,8%
	1250	Vegetated sea cliffs with endemic flora of the Macaronesian coasts	58	55,2%	6,9%	37,9%
	1310	Salicornia and other annuals colonizing mud and sand	115	34,8%	22,6%	42,6%
	1320	Spartina swards (Spartinion maritimae)	19	26,3%	52,6%	21,1%
	1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	98	57,1%	23,5%	19,4%
	1340	Inland salt meadows	101	55,4%	25,7%	18,8%
	1410	Mediterranean salt meadows (Juncetalia maritimi)	134	41,0%	31,3%	27,6%
	1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	84	31,0%	15,5%	53,6%
	1430	Halo-nitrophilous scrubs (Pegano-Salsoletea)	95	45,3%	8,4%	46,3%

habitat group	habitat code	description	number of plants	% plant species classified as		
				important for pollinators	not important for pollinators	not yet classified
	1510	Mediterranean salt steppes (Limonietalia)	135	24,4%	15,6%	60,0%
	1520	Iberian gypsum vegetation (Gypsophiletalia)	31	71,0%	3,2%	25,8%
	1530	Pannonic salt steppes and salt marshes	109	47,7%	25,7%	26,6%
	1610	Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation	42	54,8%	14,3%	31,0%
	1620	Boreal Baltic islets and small islands	25	36,0%	16,0%	48,0%
	1630	Boreal Baltic coastal meadows	54	55,6%	24,1%	20,4%
	1640	Boreal Baltic sandy beaches with perennial vegetation	22	50,0%	40,9%	9,1%
	1650	Boreal Baltic narrow inlets	20	40,0%	20,0%	40,0%
Dunes habitats	2110	Embryonic shifting dunes	77	41,6%	26,0%	32,5%
	2120	Shifting dunes along the shoreline with Ammophila arenaria ("white dunes")	89	44,9%	23,6%	31,5%
	2130	Fixed coastal dunes with herbaceous vegetation ("grey dunes")	233	57,1%	20,2%	22,7%
	2140	Decalcified fixed dunes with Empetrum nigrum	42	71,4%	26,2%	2,4%
	2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	51	72,5%	25,5%	2,0%
	2160	Dunes with Hippophae rhamnoides	39	71,8%	20,5%	7,7%
	2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	55	76,4%	23,6%	0,0%
	2180	Wooded dunes of the Atlantic, Continental and Boreal region	104	67,3%	20,2%	12,5%
	2190	Humid dune slacks	205	67,3%	18,0%	14,6%
	21A0	Machairs (* in Ireland)	28	78,6%	14,3%	7,1%
	2210	Crucianellion maritimae fixed beach dunes	48	50,0%	10,4%	39,6%
	2220	Dunes with Euphorbia terracina	51	52,9%	17,6%	29,4%
	2230	Malcolmietalia dune grasslands	92	34,8%	20,7%	44,6%
	2240	Brachypodietalia dune grasslands with annuals	56	33,9%	37,5%	28,6%

habitat group	habitat code	description	number of plants	% plant species classified as		
				important for pollinators	not important for pollinators	not yet classified
	2250	Coastal dunes with Juniperus spp.	72	52,8%	9,7%	37,5%
	2260	Cisto-Lavenduletalia dune sclerophyllous scrubs	111	77,5%	6,3%	16,2%
	2270	Wooded dunes with Pinus pinea and/or Pinus pinaster	68	61,8%	8,8%	29,4%
	2310	Dry sand heaths with Calluna and Genista	72	69,4%	25,0%	5,6%
	2320	Dry sand heaths with Calluna and Empetrum nigrum	27	74,1%	22,2%	3,7%
	2330	Inland dunes with open Corynephorus and Agrostis grasslands	141	70,9%	22,0%	7,1%
	2340	Pannonic inland dunes	55	50,9%	25,5%	23,6%
Freshwater habitats	3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	64	48,4%	17,2%	34,4%
	3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with Isoetes spp.	37	27,0%	21,6%	51,4%
	3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea	229	48,5%	19,7%	31,9%
	3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	55	40,0%	10,9%	49,1%
	3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	129	36,4%	14,7%	48,8%
	3160	Natural dystrophic lakes and ponds	76	67,1%	6,6%	26,3%
	3170	Mediterranean temporary ponds	121	42,1%	16,5%	41,3%
	3180	Turloughs	27	66,7%	11,1%	22,2%
	3190	Lakes of gypsum karst	7	28,6%	28,6%	42,9%
	31A0	Transylvanian hot-spring lotus beds	3	33,3%	33,3%	33,3%
	3210	Fennoscandian natural rivers	16	31,3%	31,3%	37,5%
	3220	Alpine rivers and the herbaceous vegetation along their banks	101	76,2%	11,9%	11,9%

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	3230	Alpine rivers and their ligneous vegetation with Myricaria germanica	53	77,4%	9,4%	13,2%
	3240	Alpine rivers and their ligneous vegetation with Salix elaeagnos	89	71,9%	16,9%	11,2%
	3250	Constantly flowing Mediterranean rivers with Glaucium flavum	68	63,2%	4,4%	32,4%
	3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	110	38,2%	8,2%	53,6%
	3270	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation	121	59,5%	13,2%	27,3%
	3280	Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba	72	51,4%	29,2%	19,4%
	3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	44	31,8%	31,8%	36,4%
	32A0	Tufa cascades of karstic rivers in the Dinaric Alps	0			
Heath & scrub	4010	Northern Atlantic wet heaths with Erica tetralix	58	69,0%	20,7%	10,3%
	4020	Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	37	73,0%	13,5%	13,5%
	4030	European dry heaths	250	70,0%	19,6%	10,4%
	4040	Dry Atlantic coastal heaths with Erica vagans	26	76,9%	7,7%	15,4%
	4050	Endemic macaronesian heaths	41	51,2%	9,8%	39,0%
	4060	Alpine and Boreal heaths	211	64,9%	19,0%	16,1%
	4070	Bushes with Pinus mugo and Rhododendron hirsutum (Mugo-Rhododendretum hirsuti)	103	77,7%	16,5%	5,8%
	4080	Sub-Arctic Salix spp. scrub	108	74,1%	18,5%	7,4%
	4090	Endemic oro-Mediterranean heaths with gorse	163	68,7%	9,2%	22,1%
	40A0	Subcontinental peri-Pannonic scrub	180	78,9%	8,9%	12,2%

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	40B0	Rhodope Potentilla fruticosa thickets	8	37,5%	25,0%	37,5%
	40C0	Ponto-Sarmatic deciduous thickets	25	60,0%	4,0%	36,0%
Sclerophyllous scrubs	5110	Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	135	75,6%	8,9%	15,6%
	5120	Mountain Cytisus purgans formations	26	80,8%	11,5%	7,7%
	5130	Juniperus communis formations on heaths or calcareous grasslands	527	75,7%	14,6%	9,7%
	5140	Cistus palhinhae formations on maritime wet heaths	12	83,3%	0,0%	16,7%
	5210	Arborescent matorral with Juniperus spp.	136	58,8%	12,5%	28,7%
	5220	Arborescent matorral with Zyziphus	35	48,6%	2,9%	48,6%
	5230	Arborescent matorral with Laurus nobilis	42	64,3%	14,3%	21,4%
	5310	Laurus nobilis thickets	34	76,5%	14,7%	8,8%
	5320	Low formations of Euphorbia close to cliffs	41	68,3%	2,4%	29,3%
	5330	Thermo-Mediterranean and pre-desert scrub	217	64,1%	5,5%	30,4%
	5410	West Mediterranean clifftop phryganas (Astragalo-Plantaginetum subulatae)	42	64,3%	0,0%	35,7%
	5420	Sarcopoterium spinosum phryganas	89	76,4%	6,7%	16,9%
	5430	Endemic phryganas of the Euphorbio-Verbascion	85	74,1%	8,2%	17,6%
Grasslands	6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	253	62,1%	11,9%	26,1%
	6120	Xeric sand calcareous grasslands	149	67,8%	18,8%	13,4%
	6130	Calaminarian grasslands of the Violetalia calaminariae	97	56,7%	22,7%	20,6%
	6140	Siliceous Pyrenean Festuca eskia grasslands	24	66,7%	16,7%	16,7%
	6150	Siliceous alpine and boreal grasslands	171	64,9%	22,2%	12,9%
	6160	Oro-Iberian Festuca indigesta grasslands	47	34,0%	36,2%	29,8%

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	6170	Alpine and subalpine calcareous grasslands	402	64,7%	17,9%	17,4%
	6180	Macaronesian mesophile grasslands	45	37,8%	26,7%	35,6%
	6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)	162	62,3%	16,7%	21,0%
	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	629	70,1%	13,0%	16,9%
	6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	208	44,7%	26,0%	29,3%
	6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	324	68,2%	20,7%	11,1%
	6240	Sub-Pannonic steppic grasslands	281	68,3%	16,7%	14,9%
	6250	Pannonic loess steppic grasslands	112	64,3%	17,0%	18,8%
	6260	Pannonic sand steppes	95	67,4%	20,0%	12,6%
	6270	Fennoscandian lowland species-rich dry to mesic grasslands	69	72,5%	20,3%	7,2%
	6280	Nordic alvar and precambrian calcareous flatrocks	61	78,7%	11,5%	9,8%
	62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)	160	61,9%	16,3%	21,9%
	62B0	Serpentinophilous grasslands of Cyprus	18	61,1%	5,6%	33,3%
	62C0	Ponto-Sarmatic steppes	94	46,8%	31,9%	21,3%
	62D0	Oro-Moesian acidophilous grasslands	37	62,2%	27,0%	10,8%
	6310	Dehesas with evergreen Quercus spp.	24	62,5%	8,3%	29,2%
	6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	249	79,9%	10,8%	9,2%
	6420	Mediterranean tall humid grasslands of the Molinio-Holoschoenion	129	57,4%	20,9%	21,7%

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	6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	459	77,8%	10,2%	12,0%
	6440	Alluvial meadows of river valleys of the Cnidion dubii	158	81,0%	12,0%	7,0%
	6450	Northern boreal alluvial meadows	52	67,3%	23,1%	9,6%
	6460	Peat grasslands of Troodos	21	42,9%	42,9%	14,3%
	6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	328	76,8%	15,2%	7,9%
	6520	Mountain hay meadows	294	76,9%	12,9%	10,2%
	6530	Fennoscandian wooded meadows	90	81,1%	8,9%	10,0%
	6540	Sub-Mediterranean grasslands of the Molinio-Hordeion secalini	13	46,2%	30,8%	23,1%
Bogs, mires & fens	7110	Active raised bogs	67	76,1%	17,9%	6,0%
	7120	Degraded raised bogs still capable of natural regeneration	83	78,3%	12,0%	9,6%
	7130	Blanket bogs (* if active bog)	51	62,7%	19,6%	17,6%
	7140	Transition mires and quaking bogs	203	73,9%	16,7%	9,4%
	7150	Depressions on peat substrates of the Rhynchosporion	57	75,4%	8,8%	15,8%
	7160	Fennoscandian mineral-rich springs and springfens	37	75,7%	5,4%	18,9%
	7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	130	78,5%	12,3%	9,2%
	7220	Petrifying springs with tufa formation (Cratoneurion)	120	69,2%	10,8%	20,0%
	7230	Alkaline fens	233	73,0%	11,2%	15,9%
	7240	Alpine pioneer formations of Caricion bicoloris-atrofuscae	56	66,1%	17,9%	16,1%
	7310	Aapa mires	58	75,9%	15,5%	8,6%
	7320	Palsa mires	6	66,7%	33,3%	0,0%
Rocky habitats	8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	149	55,0%	26,8%	18,1%

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	8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	217	56,7%	18,0%	25,3%
	8130	Western Mediterranean and thermophilous scree	207	48,8%	10,1%	41,1%
	8140	Eastern Mediterranean screes	63	44,4%	9,5%	46,0%
	8150	Medio-European upland siliceous screes	73	61,6%	24,7%	13,7%
	8160	Medio-European calcareous scree of hill and montane levels	100	70,0%	17,0%	13,0%
	8210	Calcareous rocky slopes with chasmophytic vegetation	408	50,7%	14,0%	35,3%
	8220	Siliceous rocky slopes with chasmophytic vegetation	360	40,0%	22,8%	37,2%
	8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	193	59,1%	17,1%	23,8%
	8240	Limestone pavements	192	66,7%	19,8%	13,5%
	8310	Caves not open to the public	34	17,6%	58,8%	23,5%
	8320	Fields of lava and natural excavations	61	54,1%	24,6%	21,3%
	8330	Submerged or partially submerged sea caves	4	25,0%	25,0%	50,0%
	8340	Permanent glaciers	24	87,5%	4,2%	8,3%
Forests	9010	Western Taïga	52	55,8%	30,8%	13,5%
	9020	Fennoscandian hemiboreal natural old broad-leaved deciduous forests (Quercus, Tilia, Acer, Fraxinus or Ulmus) rich in epiphytes	47	74,5%	21,3%	4,3%
	9030	Natural forests of primary succession stages of landupheaval coast	1	100,0%	0,0%	0,0%
	9040	Nordic subalpine/subarctic forests with Betula pubescens ssp. czerepanovii	31	80,6%	16,1%	3,2%
	9050	Fennoscandian herb-rich forests with Picea abies	56	64,3%	25,0%	10,7%
	9060	Coniferous forests on, or connected to, glaciofluvial eskers	44	79,5%	11,4%	9,1%
	9070	Fennoscandian wooded pastures	49	81,6%	14,3%	4,1%

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	9080	Fennoscandian deciduous swamp woods	47	63,8%	34,0%	2,1%
	9110	Luzulo-Fagetum beech forests	151	70,2%	18,5%	11,3%
	9120	Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion)	71	67,6%	21,1%	11,3%
	9130	Asperulo-Fagetum beech forests	224	78,1%	13,8%	8,0%
	9140	Medio-European subalpine beech woods with Acer and Rumex arifolius	99	84,8%	9,1%	6,1%
	9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	247	81,4%	8,5%	10,1%
	9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	213	80,8%	13,6%	5,6%
	9170	Galio-Carpinetum oak-hornbeam forests	245	80,4%	10,2%	9,4%
	9180	Tilio-Acerion forests of slopes, screes and ravines	313	75,1%	15,3%	9,6%
	9190	Old acidophilous oak woods with Quercus robur on sandy plains	130	70,0%	22,3%	7,7%
	91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	17	70,6%	23,5%	5,9%
	91AA	Eastern white oak woods	74	64,9%	10,8%	24,3%
	91B0	Thermophilous Fraxinus angustifolia woods	35	80,0%	8,6%	11,4%
	91BA	Moesian silver fir forests	39	76,9%	10,3%	12,8%
	91C0	Caledonian forest	10	70,0%	10,0%	20,0%
	91CA	Rhodopide and Balkan Range Scots pine forests	58	65,5%	17,2%	17,2%
	91D0	Bog woodland	153	67,3%	22,2%	10,5%
	91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	425	75,5%	12,2%	12,2%

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	91F0	Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia, along the great rivers (Ulmenion minoris)	260	76,9%	10,4%	12,7%
	91G0	Pannonic woods with Quercus petraea and Carpinus betulus	178	77,0%	7,3%	15,7%
	91H0	Pannonian woods with Quercus pubescens	161	77,0%	8,7%	14,3%
	91I0	Euro-Siberian steppic woods with Quercus spp.	224	76,8%	9,8%	13,4%
	91J0	Taxus baccata woods of the British Isles	20	80,0%	15,0%	5,0%
	91K0	Illyrian Fagus sylvatica forests (Aremonio-Fagion)	115	74,8%	6,1%	19,1%
	91L0	Illyrian oak-hornbeam forests (Erythronio-Carpinion)	117	75,2%	6,8%	17,9%
	91M0	Pannonian-Balkanic turkey oak-sessile oak forests	147	66,7%	9,5%	23,8%
	91N0	Pannonic inland sand dune thicket (Junipero-Populetum albae)	46	71,7%	19,6%	8,7%
	91P0	Holy Cross fir forests (Abietetum polonicum)	51	62,7%	19,6%	17,6%
	91Q0	Western Carpathian calcicolous Pinus sylvestris forests	60	75,0%	10,0%	15,0%
	91R0	Dinaric dolomite Scots pine forests (Genisto januensis-Pinetum)	21	90,5%	0,0%	9,5%
	91S0	Western Pontic beech forests	26	53,8%	11,5%	34,6%
	91T0	Central European lichen Scots pine forests	49	65,3%	22,4%	12,2%
	91U0	Sarmatic steppe pine forest	178	80,3%	13,5%	6,2%
	91V0	Dacian Beech forests (Symphyto-Fagion)	25	80,0%	4,0%	16,0%
	91W0	Moesian beech forests	33	69,7%	12,1%	18,2%
	91X0	Dobrogean beech forests	23	78,3%	21,7%	0,0%
	91Y0	Dacian oak & hornbeam forests	36	72,2%	5,6%	22,2%
	91Z0	Moesian silver lime woods	58	84,5%	3,4%	12,1%
	9210	Apennine beech forests with Taxus and Ilex	30	76,7%	6,7%	16,7%

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	9220	Apennine beech forests with Abies alba and beech forests with Abies nebrodensis	25	80,0%	0,0%	20,0%
	9230	Galicio-Portuguese oak woods with Quercus robur and Quercus pyrenaica	57	52,6%	14,0%	33,3%
	9240	Quercus faginea and Quercus canariensis Iberian woods	22	63,6%	0,0%	36,4%
	9250	Quercus trojana woods	39	66,7%	5,1%	28,2%
	9260	Castanea sativa woods	153	74,5%	9,2%	16,3%
	9270	Hellenic beech forests with Abies borisii-regis	54	68,5%	14,8%	16,7%
	9280	Quercus frainetto woods	37	64,9%	13,5%	21,6%
	9290	Cupressus forests (Acero-Cupression)	30	50,0%	10,0%	40,0%
	92A0	Salix alba and Populus alba galleries	142	64,8%	10,6%	24,6%
	92B0	Riparian formations on intermittent Mediterranean water courses with Rhododendron ponticum, Salix and others	41	53,7%	29,3%	17,1%
	92C0	Platanus orientalis and Liquidambar orientalis woods (Platanion orientalis)	81	61,7%	17,3%	21,0%
	92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	75	46,7%	18,7%	34,7%
	9310	Aegean Quercus brachyphylla woods	27	70,4%	14,8%	14,8%
	9320	Olea and Ceratonia forests	72	51,4%	15,3%	33,3%
	9330	Quercus suber forests	30	50,0%	20,0%	30,0%
	9340	Quercus ilex and Quercus rotundifolia forests	113	62,8%	14,2%	23,0%
	9350	Quercus macrolepis forests	23	43,5%	21,7%	34,8%
	9360	Macaronesian laurel forests (Laurus, Ocotea)	69	36,2%	7,2%	56,5%
	9370	Palm groves of Phoenix	26	46,2%	19,2%	34,6%
	9380	Forests of Ilex aquifolium	29	69,0%	3,4%	27,6%
	9390	Scrub and low forest vegetation with Quercus alnifolia	15	80,0%	0,0%	20,0%

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	93A0	Woodlands with Quercus infectoria (Anagyro foetidae-Quercetum infectoriae)	34	47,1%	8,8%	44,1%
	9410	Acidophilous Picea forests of the montane to alpine levels (Vaccinio-Piceetea)	150	69,3%	17,3%	13,3%
	9420	Alpine Larix decidua and/or Pinus cembra forests	68	69,1%	16,2%	14,7%
	9430	Subalpine and montane Pinus uncinata forests (* if on gypsum or limestone)	89	68,5%	14,6%	16,9%
	9510	Southern Apennine Abies alba forests	8	87,5%	0,0%	12,5%
	9520	Abies pinsapo forests	17	41,2%	5,9%	52,9%
	9530	(Sub-) Mediterranean pine forests with endemic black pines	167	65,9%	10,8%	23,4%
	9540	Mediterranean pine forests with endemic Mesogean pines	100	63,0%	13,0%	24,0%
	9550	Canarian endemic pine forests	10	70,0%	0,0%	30,0%
	9560	Endemic forests with Juniperus spp.	154	46,1%	16,9%	37,0%
	9570	Tetraclinis articulata forests	34	47,1%	17,6%	35,3%
	9580	Mediterranean Taxus baccata woods	64	75,0%	7,8%	17,2%
	9590	Cedrus brevifolia forests (Cedrosetum brevifoliae)	12	58,3%	16,7%	25,0%
	95A0	High oro-Mediterranean pine forests	58	56,9%	12,1%	31,0%