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NINA Report

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NINA

Norwegian Institute for Nature Research

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Abstract

Linnell, J. D. C., Kaltenborn, B., Bredin, Y. & Gjershaug, J. O. (2016) Biodiversity assessment of the Fagaras Mountains, Romania - NINA Report 1236. 86 pp.

This report aims to summarise the existing knowledge concerning the biodiversity of the Fagaras Mountains, in the southern Carpathians of Romania. It is intended to provide a basis for an assessment of the ecosystem services that are being provided, and that could be provided, by the area. The Fagaras Mountains consist of an uninterrupted 70-80 km long ridge that reaches to over 2500 m in altitude, with many side ridges branching off, creating a highly variable topography. As well as containing Romanian's highest mountain, it also contains the largest area of continuous alpine zone habitat in Romania. The slopes are covered with spruce forests at higher altitudes and mixed deciduous forests at lower altitudes. At lower altitudes land-use gives way extensive low-intensity agriculture at the forest-farmland interface, and then more intensive agriculture where soils permit. Most of the mountain range is protected within two Natura 2000 sites that combine to an area of 2436 km^2, and these adjoin several other Natura 2000 sites, and other Romanian protected areas.

Our biodiversity assessment consisted of collecting existing data from published and unpublished sources. Over 72% of the area is forested, with the rest consisting of alpine grasslands (25%) and rock, scree and bogs. Some patches of virgin forest have been identified along the northern slopes of the mountain range, and many areas have not been surveyed. The biodiversity of the Fagaras Mountains has not been as well studied as in many of the neighbouring regions, however, it was still possible to build up a good preliminary species of species diversity for some species groups, including mammals (57 species), birds (130 species), amphibians (17 species), reptiles (13 species), fish (12 species), freshwater crayfish (2 species), butterflies and moths (563 species), beetles (125 species), dragonflies (15 species), spiders (40 species), water-bugs (22 species), water-mites (28 species), lichens (144 species) and plants (895 species). For other species groups such as fungi (19 species), snails (6 species) and crickets (2 species) there is clearly a lot more registration to do before these species lists will become complete. Of these species, a total of 107 are of EU community interest, being listed on either the Habitats Directive or the Birds Directive. Many of the species are also on the national Romanian red list. In terms of its size, species diversity, and ecological integrity the Fagaras Mountains are clearly an area with a very high biodiversity value. The majority of the records we found come from only two areas that have been comparatively well studied (Sinca Noua and the Upper Dambovita river basin). As a result, further studies of new areas andother species groups are clearly going to lead to an increase in the areas known diversity.

Most of the area is subject to multiple human land uses, such as forestry, hunting, livestock grazing, the gathering of berries and mushrooms and low-intensity agriculture. These have formerly been conducted with low intensity and in ways that have been largely compatible with biodiversity conservation. However, recent trends have been towards an intensification of all human activities in recent years, most visibly shown by the introduction of poorly regulated clear-cutting of forests. In addition, the area has been subject to a lot of poorly planned development, such as small scale hydro-electric plants, second homes and tourist infrastructure. There is therefore a desperate need to establish land-use zoning plans and guidelines for practices (forestry, hunting, livestock grazing, gathering of non-timber forest products, infrastructure development, agriculture) that are compatible with the conservation objectives of the Natura 2000 site. While the urgency of the situation requires that this work start at once to avoid irreversible changes, a great deal of further work to map habitats and species is needed in order to fine tune management guidelines for the specific human activities and land-uses.

Sammendrag

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Sammendrag

Denne rapporten oppsummerer eksiterende kunnskap om det biologisk mangfoldet i Fagaras fjellene, i de sørlige Karpatene, Romania. Rapporten har til hensikt å fungere som et grunnlag for å vurdere både de økosystemtjenestene som er utnyttet, og de som kan bli utnyttet i området. Fagaras fjellene består av en 70-80 km lang uavbrutt fjellkjede som strekker seg til over 2500 meter over havet, som har mange siderygger som forgreiner seg. Dette skaper en svært variabel topografi. Her finnes det høyeste fjellet i Romania, og det største sammenhengende området med alpint habitat i Romania. Fjellsidene er dekket med granskog i høyereliggende områder og blandet lauvskog i lavereliggende områder. I de lavereliggende områdene er det både lavintensivt landbruk, og et mer intensivt jordbruk der jordsmonnet tillater det. Størsteparten av fjellkjeden er vernet i to Natura 2000 områder.

Vår evaluering av biodiversiteten bestod av å samle eksisterende data fra publiserte og upubliserte kilder. Mer enn 72 % av arealet er skogkledd, og det resterende arealet består av gressletter (25 %), stein, ur og myrer. Noen flekker av urskog er identifisert langs de nordlige skråningene av fjellkjeden, men store områder har ikke blitt kartlagt. Biodiversiteten har ikke blitt like godt studert i Fagaras fjellene som i mange av naboregionene. Det var likevel mulig å lage en god oversikt over artsmangfoldet for enkelte artsgrupper, inkludert pattedyr (57 arter), fugler (130 arter), amfibier (17 arter), reptiler (13 arter), fisk (12 arter), ferskvannskreps (2 arter), sommerfugler og møll (563 arter), biller (125 arter), øyenstikkere (15 arter), edderkopper (40 arter), teger (22 arter), vannmidder (28 arter), lav (144 arter) og planter (895 arter). For andre artsgrupper som sopp (19 arter), snegler (6 arter) og sirisser (2 arter), så er det behov for mye mer registrering før artslistene er komplette. Av artene som er funnet i området, er 107 listet på enten EUs habitatdirektivet eller fugledirektivet. Mange av artene er også på den nasjonale rumenske rødlista. I forhold til sin størrelse, artsmangfold og økologisk integritet så er Fagaras fjellene uten tvil et område med høy verdi for biologisk mangfold. Flertallet av artsregistering som vi fant kommer fra to områder som er relativt godt undersøkt (Sinca Noua og Upper Damouvitavassdraget). Dersom det utføres lignende undersøkelser i andre områder i fjellkjeden, kan det forventes store forbedringer i artslisten for området. Ved nyregistreringer bør det også fokuseres på andre taksonomiske grupper av stor betydning som for eksempel bier, veps og maur

Landskapet i området er i stor grad påvirket av mennesker i form av skogbruk, jakt, beite, høsting av bær og sopp og lavintensivt landbruk. Dette har tidligere blitt utført med lav intensitet og på måter som i stor grad er forenelig med bevaring av biologisk mangfold. I de senere år har trenden gått mot en økning av menneskskapt aktiviteter. Dette er er mest synlig i form av dårlig regulering av hogstflater. I tillegg har utviklingen , som for eksempel småskala vannkraftanlegg, fritidsboliger og infrastruktur i forbindelse med turisme, i området vært dårlig planlagt og har ført til negativ innvirkning på biodiversiteten. Det er et stort behov for å etablere reguleringsplaner for arealene og retningslinjer for ulike aktiviteter (skogbruk, jakt, husdyr beite, innsamling av sopp og bær, konstruksjon, landbruk), som er forenlige med verneformålet i Natura 2000 områdene. Alvoret i situasjonen krever at dette arbeidet starter med en gang for å unngå irreversible endringer. Det gjenstår også mye arbeid i å kartlegge naturtyper og arter, som er nødvendig for å kunne utvikler detaljert retningslinjer for forvaltningen av de spesifikke menneskelige aktivitetene og arealbruken.

Contents

Foreword

This report is one of a series resulting from a project funded by the EEA Grants mechanism through the Romanian Government. The project is entitled "*A study into the economic and ecological potential of conservation enterprises to enhance the local economy, ecosystem services, and biodiversity in the Fagaras Mountains Natura 2000 site (ECOSS)*". The project was coordinated by the Foundation Conservation CARPATHIA and we are grateful to Christoph and Barbara Promberger, Daniel Bucur and Raluca Barbu for assistance at all stages of the project. Neil Bernie from Conservation Capital has been involved in many stimulating discussions along the way. George Iordachescu and Monica Vasile organised the fieldwork of a parallel survey of the socio-economic status of the region which provided many valuable insights that helped our work.

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1 Introduction

The Carpathian mountains have long been recognised as an area rich in biodiversity (Kozak et al. 2013). This biodiversity stems from the fact that the region has historically not been subject to the same intensity of human land use and habitat modification that reduced much of western Europe's biodiversity during the 20th century. The extensive, but low intensity, human land uses like small scale agriculture, forestry, hunting and livestock grazing allowed many species and biodiverse habitats which had been lost in other parts of Europe to persist in this region. Furthermore, many areas remained relatively untouched by human actions due to their remoteness, Accordingly, the region contains many protected areas, including both national parks and nature reserves protected under Romanian law, and Natura 2000 sites established under the European Union's Habitat Directive. However, the region has been undergoing rapid political, social, institutional and economic changes following the end of the communist period in 1989. These changes have put heavy pressure on the natural resources of the Carpathian mountains, which has many potential consequences for the regions biodiversity.

The region is currently facing many of the social and economic challenges common to all of southeastern Europe, such as the closure of communist-era factories, widespread rural-urban migration, and the recent fluctuations in the European economy (Kuemmerle et al. 2009). Rural development is an issue constantly on the political agenda. The biodiversity and natural resources of the Carpathians can potentially provide a very broad platform on which to base rural development. However, these resources can be exploited in many different ways, i.e. through forestry, livestock grazing, energy production, hunting, biodiversity conservation. and diverse types of tourism. Not all of these land uses are compatible with each other, they likely differ in their ecological and economic sustainability, and each is expected to have a different flow of benefits to different stakeholders, as well as different impacts on biodiversity. Careful planning is essential to ensure that multiple goals are met in the best possible way.

The Ecosystem Services framework is useful for exploring these complexities as it can help visualise the different costs and benefits (both economic and non-economic) associated with different development paths. In order to begin such an assessment it is essential to have as much information as possible about the ecosystem in question, including the status of its natural capital (biodiversity and associated natural resources) and the present way in which the ecosystem is being exploited, as well as the socio-economic context of the region.

The Fagaras mountains in the southern Carpathians of Romania are a microcosm of these issues. An area believed to contain many natural resources and a rich biodiversity that can potentially support multiple development paths (Milcu et al. 2014). However, the exact status of the natural capital, as well as the current forms of human activity in the region are not known in detail. This motivated the initiation of the current project "*A study into the economic and ecological potential of conservation enterprises to enhance the local economy, ecosystem services, and biodiversity in the Fagaras Mountains Natura 2000 site*". The project seeks to develop a detailed overview of (1) the status of the area's natural capital, (2) the way in which this is already being utilised by the surrounding communities, and (3) produce business models for potential enterprises that can contribute to rural development without compromising the regions biodiversity and other natural values.

As a first step in this process, this report presents a broad overview of the general habitat types and inventories of the species present, for the species groups where we could find data. As such this represents a first attempt to summarise the natural capital (biodiversity) of the site with a scope to utilising this information in (1) an assessment of its potential to deliver various ecosystem services, and (2) to identify potential values that might constrain the appropriateness of particular forms of land use. Accordingly, our objective was not specifically to place the information within the formal framework of Natura 2000 classifications and priority species from the Habitats and Birds directives as this is adequately covered in the Management Plans for the respective Natura 2000 sites (Anonymous 2015). Rather, we aimed to build up a more holistic

overview over the structure of the ecosystem with respect to its ability to provide a variety of ecosystem services. However, the status of the region within the Natura 2000 network is of course a vital part of the context within which future development paths must be considered.

2 Study area

The Fagaras mountains consist of an uninterrupted 75 - 80 km long ridge orientated in an east-west direction (Fig 1). The ridge that runs at over 2000 m is topped by a series of peaks that reach up to over 2500 m, including Romania's highest mountain (Moloveanu 2544 m). Six peaks exceed 2500 m and 33 reach above 2400 m. Many secondary ridges branch off perpendicularly to the north and south. Those to the north are short, and drop more sharply down to the Fagaras depression (around 500 m in altitude). To the south, the secondary ridges extend much further and even branch, creating a more complex topography. Glacial geology is evident, in the form of glacial valleys, cirque lakes and morraines. The underlying geology is mainly metaphoric in origin, consisting of crystalline schists (Nedelea & Comanescu, 2011). This contrasts with the limestone dominated mountains to the east, for example in neighbouring Piatra Craiului National Park. The western edge is clearly defined by the Olt river which cuts a path through the range.

The Fagaras depression which lies to the north is largely flat and devoted to various forms of agriculture. The mountain slopes are largely forested, with mixed deciduous forests in the lower reaches, followed by a coniferous zone, and then an upper sub-alpine zone of dwarf pine and juniper. The alpine zone (above 2200 m) is largely composed of grasslands. The Fagaras mountains have the largest continuous area of alpine zone habitats in the Romanian Carpathians (Hurdu et al. 2012). The southern slopes have the same altitudinal progression, but the difference in topography creates a more complicated transition, especially with respect to the lower edge where forest gradually gives way to agricultural land. Further details of habitats are presented in the results.

Streams descend through the valleys on both sides. Those on the north and west slopes flow into the Olt river, while those on the south slopes converge on the Arges river. Both rivers ultimately flow south and join the Danube. Streams of the north are generally short, fast and shallow, whereas the waters in the south are longer and richer. Only a few natural lakes are present. These are mainly high altitude corrie lakes of glacial origin. One of the laregst is Balea Lake which covers 4.5 ha. In the south there are several large artificial lakes (Vidraru and Pecineagu) created for hydro-energy production.

The region has a long history of human land use (Cioaca & Dinu 2010). These traditional land uses include forestry (timber, firewood, crafts), hunting, gathering of non-timber forest products like mushrooms and berries, livestock grazing (especially in the alpine grasslands during summer with sheep being moved to lower areas in winter), and agriculture (in the lower lying regions). In recent years these practices have been added to with the development of tourism (including hiking) and hydro- energy production (several large and many small instalations). Forestry practices have also changed, with poorly regulated clear-cutting becoming widespread during the post-communist land restitution processes.

Historically these mountains formed the boundary between the northern area of Transylvania and the southern Wallachia. As this was Europe's boundary with the Ottoman empire the constant tensions and conflicts in the area also probably hindered its occupation and development in the pre-20th century period. However, the rugged terrain has also limited the extent of human impacts. There are no villages present in the central mountains, and only one seasonal road (open in summer), the Transfagrian highway, crosses the entire range. However, extensive networks of forest roads penetrate the valleys on all sides. The topography has led to the northern area being better developed and better serviced by transport infrastructure, while the south areas remain more isolated and less developed.

The Fagaras mountains are currently are largely protected by two large Natura 2000 sites. To the north is Piemontul Fagaras (ROSPA0098), protected as a Special Protection Area (SPA) under the Birds Directive and extending over 71.256 ha. This area covers the interface between the agriculture areas in the Fagaras depression and the lower northern slopes of the Fagaras range. The 198.495 ha Munti Fagaras Site of Community Interest (SCI)(ROSCI0122) covers the

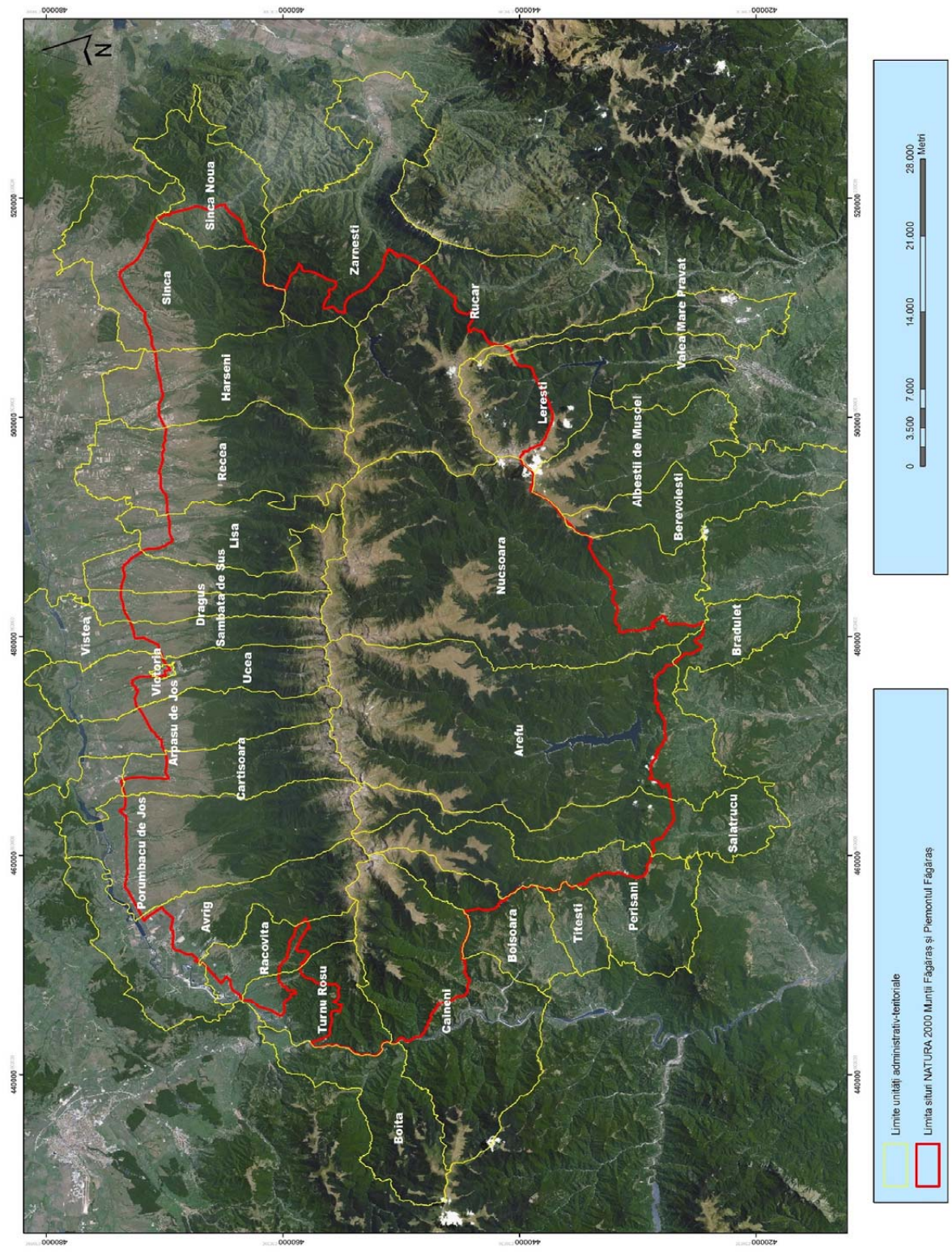
entire ride of the Fagaras range and the slopes on all sides, and is protected under the Habitats Directive. The Piemontul Fagaras SPA and the Munti Fagaras SCI overlap – such that the total protected area is 243.627 ha (Anonymous 2015)

These Natura 2000 sites directly adjoin other sites (all data from http://natura2000.eea.europa.eu/). To the east is 15.867 ha Piatra Craiului National Park (ROSCI0194). To the south east is 13.213 ha Raul Targului – Argesel – Rausor SCI (ROSCI0381). To the northeast is the 2.261 ha Persani SCI (ROSCI0352), while to northwest is the 22.726 ha Hartibaciu Sud-vest SCI (ROSCI0304). To the west the area adjoins the 137.358 ha Frumoasa SCI (ROSCI0085).

This study was mainly limited to the Munti Fagaras and Pirmontul Fagaras sites, although we drew on some supporting information from the adjoining parts of Persani and Hartibaciu Sud-vest sites to include information on these low-lying areas which form integral parts of the Fagaras ecosystem.

Administratively, the study area is shared by four counties (Arges, Brasov, Sibiu and Valcea) and 27 municipalities; Turnu Rosu, Racovita, Avrig, Porumbacu de Jos, Cartisoara, Arpasu de Jos (in Sibiu county), Ucea, Vistea, Sambata de Sus, Dragus, Lisa, Recea, Harseni, Sinca, Sinca Noua, Victoria, Zarnesti (in Brasov county), Rucar, Valea Mare Pravat, Leresti, Nucsoara, Arefu, Bradulet, Salatrucu (in Arges county), Perisani, Boisoara, Caineni (in Valcea, county) (Fig 1).

Figure 1. Map of the study area, showing the borders of the 27 municipalities (in yellow) and the combined outline of the Piemontul Fagaras and Muntii Fagaras Natura 2000 sites (in red).



3 Methods

This assessment was based exclusively on existing information as the project's budget and time frames did not permit original ecological fieldwork. Data was primarily gathered by conducting searches of the scientific literature available online (ISI Web of Science and Google Scholar search engines). Searches were conducted very broadly, for biodiversity in general and for a wide range of taxonomic groups. Search terms using the name of the site and the latin names of species groups reduced any language bias. The management plan (Anonymous 2015) for the two main Natura 2000 sites in the study area (Munti Fagaras ROSCI0122 and Piemontul Fagaras ROSPA0098) became available towards the end of our study and was examined in detail, along with the relevant dataforms accessed from the Natura 2000 website (http://natura2000.eea.europa.eu/). The Global Biodiversity Information Facility (www.gbif.org) was searched for species records from the relevant area (GBIF 2015). Official hunting bag data was downloaded from the internet site of the Ministry of Environment and Climate Change (http://www.mmediu.ro/beta/domenii/paduri/vanatoare/fonduri-de-vanatoare/).

Supporting information on bird distributions was obtained from the EBCC European Atlas of Breeding Birds (http://s1.sovon.nl/ebcc/eoa/), although we did not include any birds solely on the basis of this coarse scale atlas data. In fact, no species were included on the basis of atlas data, as the resolution of atlas data is too low to be sure that the observation is from within the site. A database of game warden observations of various mammals and birds was made available from the southeastern part of the study area which is under management by Foundation Conservation CARPATHIA. Finally, a range of books and technical reports were manually searched for relevant information, including those produced by a LIFE project in the Upper Dambovita river basin (Nicolae 2012, 2013, Kovacs et al. 2014, 2015) and a major biodiversity assessment in the Sinca Noua area (Promberger 2006, Danciu et al. 2008).

In order to represent the present situation we only categorised species as being present if there was at least one record from after 1980. This excluded several older museum records from publications and from GBIF. Because the information was collected from many sources and over more than 30 years, there were many inconsistences in species nomenclature and taxonomic placement. This was especially a problem for the plants and Lepidoptera. Accordingly, we harmonised species lists for these groups and updated nomenclature using up-to-date authorities. For plants we used The Plant List (http://www.theplantlist.org/) as the definitive authority, for Lepidoptera we used http://www.leps.it/ and http://www.lepidoptera.eu/. Taxonomy for other species was mainly sourced from http://eunis.eea.europa.eu/, http://www.faunaeur.org/ and http://www.araneae.unibe.ch/. In the tables we retained the Latin names provided in the original publications in parenthesis to facilitate reconstruction of our work and the link to the original sources. English common names were extracted from internet sources, including Wikipedia and the Encyclopaedia of Life (www.eol.org).

Information on the threats facing the ecosystem and its associated biodiversity was collected from the published scientific literature, the Natura 2000 site management plans, the results of the parallel socio-economic survey being conducted in the study area (Iordachescu & Vasile 2016), and through discussions with project partners.

4 Results

4.1 Assessment of data availability and quality

The Natura 2000 dataforms contained some information on species presence in Munti Fagaras in addition to the species of European interest, although these lists did not include any birds. The dataforms from Piemontul Fagaras in contrast only listed the birds of European interest and no other species. The Munti Fagaras dataforms listed habitats within that area, but the Piemontul Fagaras dataforms did not list any habitats within the site. A problem with this material is that it is not possible to link species reports with either a geographic location or a specific source of the information (although a general reference list is provided). The management plan contained some supplementary information on species and habitats, and the locations of some records of species of community interest were mapped in the various annexes. It was however not possible to determine to what extent data was based on chance observations, systematic and original field surveys, from literature, or from other sources, such that the representativeness of these maps cannot be assessed.

The published scientific literature on the Fagaras Mountains was relatively thin and highly fragmented, compared to other sites in the Southern Carpathians such as the neighbouring Piatra Craiului National Park, Bucegi Mountain and the Parang-Retezat Mountains. Records of single species (e.g. Andronescu 2010, Bacila et al. 2010), or species groups, were found in many different published sources, including publications from natural history museums and national species lists. Much of the information only contained vague geographical descriptions of where it was located, although it appears that much of the work has been centred on the Transfăgărășan highway because of the access it provides. The GBIF database only contained a limited amount of material, mainly Lepidoptera and Coleoptera. Many of the records were also undated, or old.

One interesting finding from this material shows how hard it is to build up a picture of the structure of an ecosystem based only on published sources within the scientific literature. Records of many key species that make up the ecosystem were lacking or hard to find. For example, there were no records of common mammal species like wild boar or red foxes, or very obvious species of interest such as marmots or beavers. The only taxonomic groups that were well assessed in the published literature were amphibians and reptiles which had been the subject of multiple and well reported field surveys. Only two regions of the Fagaras Mountains have been subject to very intensive biodiversity surveys with well described. These were the area around Sinca Noua in the northeast of the study area, and the Upper Dambovita river basin in the southeast of the study area. In both of these studies intensive efforts were made to inventory all vertebrates, plants, fungi and key invertebrate groups such as Lepidoptera. Between them, these two studies more than doubled the number of species records from the whole region. When combined with the observations from the game wardens in the SE of the region and the hunting statistics these studies gave us a fair description of the biodiversity within the Fagaras ecosystem, bothinterms of the common and the rare species. As such, a great deal of our understanding of the ecosystem is based on these two study areas. It is highly likely that many more species will be found if surveys are conducted in other parts of the Fagaras Mountains. It will be especially important to survey the old growth forests that have been identified along the north slopes of the mountains.

Because of the lack of spatial references for much of the data it has proven to be very difficult to produce maps of the distribution of biodiversity or to link species records to specific habitat types. There is also a great deal of variation in the extent to which different species groups have been covered.

Information about a number of taxonomic groups is comprehensive, including;

Mammals, birds, reptiles, amphibians, freshwater fish, butterflies and moths (Lepitdoptera), flowering plants.

For several other groups some very fragmented records exist, but are likely to significantly underrepresent the full species diversity present;

Fungi, lichens, beetles (Coleoptera), spiders (Araneae), snails, dragonflies and damselflies, bush crickets (Orthoptera), freshwater invertebrates such as water mites (Hydrachnidiae) and water bugs (Hemiptera).

Of particular note was an absence of any surveys of functionally important species groups such as bees, wasps and ants (Hymenoptera) or invertebrates associated with freshwater streams, leaf litter or soil. Some surveys of species have been conducted in immediately adjacent areas (e.g. Czekes et al. 2012, Marko & Csosz 2001, Marko et al. 2006 for ants, Blaga 2004 & Murariu et al. 2009 for bats) which indicates that the species could occur in the Fagaras Mountainsas well.

While the flora and fauna of Romania has been well studied, and a wealth of scientific publications, including species lists, are available in specialised naturalist, taxonomic and museum journals; few of the surveys appear to have covered the Fagaras Mountains. There is therefore, considerable knowledge about what is likely to occur within the site, although its presence within the site, and its association with different habitat types need to be researched. It can be expected that the species lists which we present here (Tables A1-A13) will grow dramatically as further surveys are conducted that include under-studied habitat types, such as old growth forest.

We could find virtually no ecological studies concerning ecological processes, habitat associations of species, or the impacts of human activity from the area. Furthermore, there are no reliable repeated censuses or indices of abundance for any species (official estimates of game species abundance exist, but these are notoriously inaccurate). This makes it impossible to assess the real conservation status of any species, or to assess their trends over time. The information on most species occurrence that is already published and which forms the basis of this report is usually not presented in a way that would allow follow-up surveys to assess changes.

Furthermore, there were very few biogeographic reviews (although see Rakosy et al. 2012 and Roniker 2011) that could be used to put the Fagaras Mountains site into context with other sites in the region. A final challenge concerns the state of taxonomy within the region. On one level this only concerns the use of different Latin names, many of which are out-dated, for certain species. In addition, we met the problem of of uncertainty about species taxonomy throughout southeastern Europe due in part to few genetic studies that have been conducted in the region to validate morphology-based systematics (e.g. Solano et al. 2013).

4.2 Habitats

Quantitative habitat data is only available from within the Muntii Fagaras SCI. Over 72% is covered by forests, 25% consists of alpine grasslands / shrublands and 1% consists of rocks and scree. The remaining areas include bogs; including a small (3.6 ha) outlying patch of the SCI that is located in the Fagaras depression. Broadly speaking, the forests types fall into three zones: i) Mixed-deciduous forests (European beech *Fagus silvatica* with some birch *Betula pendula*, hornbeam *Carpinus betulus* and Pedunculate oak *Quercus robur*) in the lower altitudes. ii) A band of coniferous forest (Norway spruce *Picea abies* and silver fir *Abies alba*) at intermediate altitudes, and iii) a zone of dwarf pine and juniper forest (*Pinus mugo, Juniperus nana*) below the alpine grasslands (Griffiths et al. 2012; Mihai et al. 2007) and rocky slopes of the peaks. Some sections of alluvial forest follow watercourses and patches with a greater diversity of deciduous trees occur in patches. Details of the habitat types according to standard Natura 2000 classification are presented in Table 1. It should be noted that the management plan (Anonymous 2015) identified a number of discrepancies with the information on the site's

Natura 2000 dataform. It turned out that some habitats were excluded because they fell outside the boundaries of the site, and fieldwork revealed some habitat types that had not been previously known.

Unfortunately, there was a lack of any systematic inventory of the age and condition of the forest habitats in the management plan. In a region were forests are managed for multi-use this is crucial information as the conservation status of a plot will be heavily determined by the way that the plot is managed, rather than by its general habitat classification. This is especially important considering that the region has been subject to large scale unregulated clear-cutting in recent decades (Knorn et al. 2012a, b). Some areas along the northern slopes that may contain virgin forest were identified in earlier surveys (Veen et al. 2010) and in the management plan (Anonymous 2015), but there are large areas that have not been subject to any surveys, and even the identified patches have not been recently monitored to ensure that they are still intact.

The part of Piemontul Fagaras that does not overlap with Muntii Fagaras mainly consists of agricultural lands used for crop production, livestock grazing and hay meadows. The hay meadows in particular are associated with very rich biodiversity (Promberger 2006). No quantitative overview of the relative presence of different habitat types, crop types or land uses was available.

Table 1 Habitat types *present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania; classified using Natura 2000 habitat classes. Habitats marked with an asterix are those discovered recently and do not feature on the standard site dataform from the time of establishment. Information is based on the Natura 2000 dataforms and the management plan for the site.*

	Habitat type	**Natura 2000 code**	**Area (ha)**	**% area**
Freshwater				
Freshwater	Alpine rivers and the herbaceous vegetation along their banks	3220	2	0.00
Freshwater	Petrifying springs with tufa formation (*Cratoneurion commutati*)*	7220	0.001	0.00
Alpine and meadows				
Alpine heath & shrubs	Alpine and Boreal heaths	4060	20000	11.11
Alpine heath & shrubs	Bushes with *Pinus mugo* and *Rhododendron hirsutum* (*Mugo-Rhododendretum hirsuti*)	4070	6000	3.33
Alpine heath & shrubs	Sub-Arctic *Salix* spp. scrub	4080	120	0.07
Alpine grasslands	Siliceous alpine and boreal grasslands	6150	13500	7.50
Alpine grasslands	Alpine and subalpine calcareous grasslands	6170	195	0.11
Alpine grasslands	Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas	6230	2500	1.39
Alpine grasslands	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	6410	13	0.01
Alpine grasslands	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	6430	250	0.14
Alluvial meadows	Alluvial meadows of river valleys of the Cnidion dubii*	6440	175	0.10
Alpine grasslands	Mountain hay meadows	6520	1250	0.69
Rock, scree, snowbed	Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)	8110	2000	1.11
Rock, scree, snowbed	Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)	8120	3	0.00

Rock, scree, snowbed	Calcareous rocky slopes with chasmophytic vegetation	8210	1.5	0.00
Rock, scree, snowbed	Siliceous rocky slopes with chasmophytic vegetation	8220	275	0.15
Rock, scree, snowbed	Caves not open to the public	8310	2.5	0.00
Bogs				
Bogs	Transition mires and quaking bogs*	7140	0.01	0.01
Peat bog	Depressions on peat substrates of the *Rhynchosporion*	7150		
Peat bog	Active raised bogs*	7110		
Forests				
Beech forest	*Luzulo-Fagetum* beech forests	9110	26000	14.44
Beech forest	*Asperulo-Fagetum* beech forests	9130	6300	3.50
Oak & hornbeam forest	*Galio-Carpinetum* oak-hornbeam forests	9170	300	0.17
Ash, elm, lime forest	*Tilio-Acerion* forests of slopes, screes and ravines	9180	70	0.04
Bog Woodland	Bog Woodland*	91D0	40	0.02
Alluvial forests	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)	91E0	410	0.23
Deciduous	Illyrian Fagus sylvatica forests (*Aremonio-Fagion*)*	91K0	3800	2.11
Deciduous	Illyrian oak –hornbeam forests (*Erythronio-Carpinion*)*	91L0	975	0.54
Beech forest	Dacian Beech forests (*Symphyto-Fagion*)	91V0	53000	29.44
Spruce forest	*Acidophilous Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*)	9410	45700	25.39
Larch	Alpine *Larix decidua* and/or *Pinus cembra* forests*	9420	210	0.12

4.3 Species

Even with the fragmented information that was available, it was possible to construct some impressively long species lists for several taxonomic groups based on observations from the Fagaras Mountains. The full range of species are listed in Tables A1 – A 13.

Mammals were represented with 57 species, consisting of 19 rodents, 12 bats, 12 carnivores (including all 3 large carnivores = brown bear, wolf, Eurasian lynx), 9 insectivores, 4 ungulates and 1 lagomorph (Table A1).

Birds were represented by 130 species, notably including 13 species of raptors, 5 owls, 6 woodpeckers, 2 storks and 3 shrike species (Table A2).

Seventeen species of amphibians were recorded, consisting of 12 species of frogs or toads, 4 newts, 1 salamander, along with 13 reptiles consisting of 6 snakes, 5 lizards, 1 freshwater turtle and 1 slow worm species (Table A3).

In freshwater habitats, 12 species of fish and 2 species of crayfish were recorded (Table A4).

Lepidoptera were represented with 563 species, including 113 butterfly species (Table A6) and 450 moth species (Table A7). A total of 125 beetle (Coleoptera) species were identified (Table A9), as well as 40 spider species (Table A8).

Odonata were represented by 15 species of dragonflies / damselflies (Table A5). In addition, we were able to find records of 22 species of water-bug (Ilie & Olosutea 2012), 28 species of water-mites (Cimpeen 2014), 6 snails, and 2 bush crickets (Table A5).

Eight hundred and ninety five plants were identified, including 30 species of moss (Table A10), 16 species of fern (Table A12) and 849 flowering plants (Table A13).

Lichens were represented by 144 species (Maliceau et al. 2015), and macro-fungi by 19 species (Table A11).

Of these species, 107 are listed (Table 2) as species of European interest on either the EU's Habitats Directive (Annexes II, IV and V) or Bird Directive (Annex I). This includes 20 mammals, 30 birds, 10 amphibians, 9 reptiles, 6 fish, 2 freshwater crustaceans, 2 snails, 1 bush cricket, 1 dragonfly, 6 beetles, 8 butterflies, 5 mosses and 7 flowering plants.

In addition, many of the plant species (for which there is the best overview of the wider distribution and status in Romania) are of importance from a national or regional (Carpathian) perspective. These include over 70 Carpathian endemics like *Hypericum richeri*, *Campanula serrata*, *Gypsophila petraea*, *Doronicum carpaticum* and *Thymus pulcherrimus* (Baur et al. 2007; Hurdu et al. 2012). The Fagaras are the only known site in Romania for *Ranunculus glacialis*, *Rhabdoweisia crenulata* (Ronikier 2010), and one of only two known sites for *Silene zawadzk* and *Silene dinarica* (Ronikier 2011, Hurdu et al. 2012). The moss, *Aneura maxima*, is also only found in a few sites in Romania outside of the Fagaras (Stefanut 2012). The butterfly *Erebia sudetica* is only found in four other sites in Romania outside the Fagaras (Cuvelier & Dinca 2007).

***Table 2 Species of European community interest**. This includes birds on Annex I (species that are particularly threatened and that require establishment of Special Protected Areas) of the Birds Directive and other species on Annexes II (species of community interest whose conservation requires the designation of Special Areas of Conservation), IV (species of community interest in need of strict protection) and V (species of community interest whose taking in the wild and exploitation may be subject to management measures) of the Habitats Directive.*

Higher taxa	Family	Scientific name	Common name	Hab Dir	Bird Dir
				Annex	Annex
Mammals	Canidae	*Canis lupus*	Wolf	II,IV	
Mammals	Felidae	*Lynx lynx*	Lynx	II,IV	
Mammals	Mustelidae	*Lutra lutra*	Otter	II,IV	
Mammals	Mustelidae	*Martes martes*	Pine marten	V	
Mammals	Mustelidae	*Mustela putorius*	Polecat	V	
Mammals	Ursidae	*Ursus arctos*	Brown bear	II	
Mammals	Rhinolophidae	*Rhinolophus ferrumequinum*	Common bent-wing	II,IV	
Mammals	Rhinolophidae	*Rhinolophus hipposideros*	Lesser horseshoe bat	II,IV	
Mammals	Vespertilionidae	*Barbastella barbastellus*	Western barbastelle	II,IV	
Mammals	Vespertilionidae	*Eptesicus serotinus*	Serotine bat	IV	
Mammals	Vespertilionidae	*Myotis bechsteinii*	Bechstein's bat	II,IV	
Mammals	Vespertilionidae	*Myotis blythi*	Lesser mouse-eared bat	II,IV	
Mammals	Vespertilionidae	*Myotis daubentoni*	Daubenton's bat	IV	
Mammals	Vespertilionidae	*Myotis emarginatus*	Geoffroy's bat	II,IV	
Mammals	Vespertilionidae	*Myotis myotis*	Greater mouse-eared bat	II,IV	
Mammals	Vespertilionidae	*Myotis mystacinus*	Whiskered bat	IV	
Mammals	Vespertilionidae	*Nyctalus noctula*	Noctule bat	IV	
Mammals	Vespertilionidae	*Pipistrellus pipistrellus*	Common pipistrelle	IV	
Mammals	Castoridae	*Castor fiber*	Beaver	II,IV	
Mammals	Gliridae	*Muscardinus avellanarius*	Common dormouse	IV	
Birds	Accipitridae	*Aquila chrysaetos*	Golden Eagle		I
Birds	Accipitridae	*Circaetus gallicus*	Short-toed Eagle		I
Birds	Accipitridae	*Circus aeruginosus*	Marsh Harrier		I
Birds	Accipitridae	*Circus cyaneus*	Hen Harrier		I
Birds	Accipitridae	*Clanga (Aquila) pomarina*	Lesser Spotted Eagle		I
Birds	Accipitridae	*Milvus migrans*	Black kite		I
Birds	Accipitridae	*Pernis apivorus*	Honey Buzzard		I
Birds	Alaudidae	*Lullula arborea*	Woodlark		I
Birds	Ardeidae	*Egretta alba*	Great egret		I
Birds	Caprimulgidae	*Caprimulgus europaeus*	Nightjar		I
Birds	Ciconidae	*Ciconia ciconia*	White Stork		I
Birds	Ciconidae	*Ciconia nigra*	Black Stork		I

Birds	Emberizidae	*Emberiza hortulana*	Ortolan Bunting		I
Birds	Falconidae	*Falco peregrinus*	Peregrine Falcon		I
Birds	Laniidae	*Lanius collurio*	Red-backed Shrike		I
Birds	Laniidae	*Lanius minor*	Lesser Grey Shrike		I
Birds	Muscicapidae	*Ficedula albicollis*	Collared Flycatcher		I
Birds	Muscicapidae	*Ficedula parva*	Red-breasted Flycatcher		I
Birds	Phasianidae	*Bonasa bonasia*	Hazel Grouse		I
Birds	Phasianidae	*Tetrao urogallus*	Capercaillie		I
Birds	Picidae	*Dendrocopos leucotos*	White-backed Woodpecker		I
Birds	Picidae	*Dendrocopos medius*	Middle Spotted Woodpecker		I
Birds	Picidae	*Dendrocopos syriacus*	Syrian Woodpecker		I
Birds	Picidae	*Dryocopus martius*	Black Woodpecker		I
Birds	Picidae	*Picoides tridactylus*	Eurasian three-toed woodpecker		I
Birds	Picidae	*Picus canus*	Grey-headed Woodpecker		I
Birds	Rallidae	*Crex crex*	Corncrake		I
Birds	Strigidae	*Bubo bubo*	Eagle owl		I
Birds	Strigidae	*Strix uralensis*	Ural Owl		I
Birds	Sylviidae	*Sylvia nisoria*	Barred Warbler		I
Amphibians	Bombinatoridae	*Bombina bombina*	Red-bellied toad	II,IV	
Amphibians	Bombinatoridae	*Bombina variegata*	Yellow-bellied toad	II,IV	
Amphibians	Hylidae	*Hyla arborea*	European tree frog	IV	
Amphibians	Pelobatidae	*Pelobates fuscus*	common spadefoot	IV	
Amphibians	Ranidae	*Rana arvalis*	Moor frog	IV	
Amphibians	Ranidae	*Rana dalmatina*	Agile frog	IV	
Amphibians	Ranidae	*Rana ridibunda*	Lake frog	V	
Amphibians	Ranidae	*Rana temporaria*	Common frog	V	
Amphibians	Salamandridae	*Triturus (Lissotriton) montandoni*	Montandon's (Carpathian) newt	II,IV	
Amphibians	Salamandridae	*Triturus cristatus*	Crested (warty) newt	II,IV	
Reptiles	Colubridae	*Coronella austriaca (coronella))*	Smooth snake	IV	
Reptiles	Colubridae	*Elaphe longissima (Zamenis longissimus)*	Aesculapian snake	IV	
Reptiles	Colubridae	*Natrix tessellate*	Dice snake	IV	
Reptiles	Emydidae	*Emys orbicularis*	Pond turtle	II,IV	
Reptiles	Lacertidae	*Lacerta agilis*	Sand lizard	IV	
Reptiles	Lacertidae	*Lacerta viridis*	Green lizard	IV	
Reptiles	Lacertidae	*Podarcis muralis*	Common wall lizard	IV	
Reptiles	Lacertidae	*Podarcis taurica*	Balkan wall lizard	IV	
Reptiles	Viperidae	*Vipera ammodytes*	Nose horned viper	IV	

Fish	Cottidae	*Cottus gobio*	Freshwater sculpin (bullhead)	II	
Fish	Cyprinidae	*Barbus meridionalis*	Mediterranean barbel	II	
Fish	Cyprinidae	*Barbus petenyi*	Romanian barbel	V	
Fish	Cyprinidae	*Romanogobio (Gobio) uranoscopus*	Danube Gudgeon	II	
Fish	Petromyzontidae	*Eudontomyzon mariae*	Ukrainian lamprey	II	
Fish	Salmonidae	*Thymallus thymallus*	European grayling	V	
Decapoda	Astacidae	*Astacus astacus*	Noble crayfish	V	
Decapoda	Astacidae	*Austropotamobius torrentium*	Stone crayfish	V	
Gastropoda	Helicidae	*Chilostoma banaticum (Drobacia banatica)*		II ,IV	
Gastropoda	Vertiginidae	*Vertigo angustior*	Narrow-mouthed whorl snail	II	
Orthoptera	Tettigoniidae	*Pholidoptera transsylvanica*	Transylvanian busch cricket	II,IV	
Odonata	Gomphidae	*Ophiogomphus cecilia*	Green gomphid dragonfly	II,IV	
Coleoptera	Carabidae	*Carabus (Morphocarabus)hampei*		II,IV	
Coleoptera	Lucanidae	*Lucanus cervus*	Stag beetle	II	
Coleoptera	Cerambycidae	*Morimus funereus (asper)*	Longhorn beetle	II	
Coleoptera	Scarabaeidae	*Osmoderma eremita*	Russian leather beetle	II,IV	
Coleoptera	Cerambycidae	*Rosalia alpina*	Longhorn beetle	II,IV	
Coleoptera	Bostrichidae	*Stephanopachys substriatus*	Powder post beetle	II	
Lepidoptera	Lycaenidae	*Lycaena dispar*	Large Copper	II,IV	
Lepidoptera	Lycaenidae	*Maculinea arion*	Large blue	IV	
Lepidoptera	Lycaenidae	*Maculinea teleius*	Scarce large blue	II,IV	
Lepidoptera	Nymphalidae	*Erebia sudetica*	Sudeten Ringlet	IV	
Lepidoptera	Nymphalidae	*Euphydryas aurinia*	Marsh Fritillary	II	
Lepidoptera	Papilionidae	*Parnassius mnemosyne*	Clouded Apollo	IV	
Lepidoptera	Pieridae	*Leptidea morsei major*	Fenton's Wood White	II,IV	
Lepidoptera	Eribidae	*Euplagia (Callimorpha) quadripunctaria*	Jersey Tiger	II	
Bryophyte	Amblystegiaceae	*Hamatocaulis (Drepanocladus) vernicosus*	Slender green feather moss	II	
Bryophyte	Meesiaceae	*Meesia longiseta*	Long seta hump moss	2	
Bryophyte	Sphagnaceae	*Sphagnum compactum*	Moss	V	
Bryophyte	Sphagnaceae	*Sphagnum corymbosum*	Moss	V	
Bryophyte	Sphagnaceae	*Sphagnum magellanicum*	Magellan's peatmoss	V	
Angiosperm	Campanulaceae	*Campanula serrata*	Bell flower	II	
Angiosperm	Compositae	*Arnica montana*	Leopards's bane / Mountain tobacco	V	

Angiosperm	Compositae	*Artemisia eriantha*		V	
Angiosperm	Cyperaceae	*Eleocharis carniolica*		II	
Angiosperm	Gentianaceae	*Gentiana lutea*	Great yellow gentian	V	
Angiosperm	Orchidaceae	*Liparis loeselii*	Fen orchid	II	
Angiosperm	Orobanchaceae	*Tozzia carpathica*		II	

4.4 Threats

A wide range of present and potential threats were identified. These can be categorised under the following headings; those linked to forestry, hydro-energy production, unsustainable use of non-timber forest products, development, livestock grazing and agriculture.

Forestry. Traditional forestry practices (for timber and firewood) in the Carpathian mountains have been generally associated with moderate to low impacts, apart from a tendency to promote spruce monocultures at lower altitudes. However, since the end of thecommunist era there has been a chaotic period in the forestry sector, due to poor institutional regulation and the ongoing process of land restitution that has been complicated by widespread corruption. This has created a space for large scale clearcutting which is poorly planned at best, and illegal at worst (Bouriaud 2005; Knorn et al. 2012a,b; Griffiths et al. 2012; Merce 2012). The Fagaras Mountains have not been immune to this activity. These clearcuts represent a dramatic threat to the areas biodiversity and a reduction in the ecological sustainability of the forest production system. Furthermore, recent years have seen an increase in forest road construction which is facilitating logging of previously uncut virgin forests (informally protected due to their isolation in remote areas) which are expected to be of great value for biodiversity conservation. While there are some indications that the worst of the unregulated clearcutting is coming to an end, there is still much uncertainty about the compatibility of present / future forestry practices and biodiversity.

Hydro-energy production. The area has two large artificial lakes (Vidraru and Pecineagu) that were created (in 1965 and 1984 respectively) to produce hydro-electric power. Although these dams dramatically changed the water flows in their respective rivers, they were limited to two drainages. However, in recent years more than 20 smaller hydro-electric stations with associated roads and infrastructure have been installed further upstream in smaller drainages (Mititelu 2012; Prăvălie 2011). The degree of environmental impact assessment for these developments is believed to have been poorly conducted, or not conducted at all. This poorly regulated development, especially when placed relatively high into the mountains, is likely to have large effects on the areas freshwater ecosystems.

Non-timber forest products. The major collection of non-timber forest products in the area consists of picking mushrooms and berries, as well as branches and twigs for making brooms and baskets (Iordăchescu & Vasile 2016). Although these activities are traditional and may well have been sustainable, there are recent concerns about the intensity of berry / mushroom picking in some areas because of the commercialisation of the activity. The recent trend in some areas is to switch from small-scale picking for own or local consumption to large scale picking for processing and sale outside the region, and even for export. Associated with this intensification is picking is the use of large groups of people spending extended periods of time in the forests, creating disturbance, leaving waste, locally overusing firewood and other exploitable resources.

Hunting. Hunting has a long tradition in the whole Carpathians, and when well regulated can be sustainable as demonstrated by the survival of all large mammals in the area, including the large carnivores (Micu et al. 2010). The only direct hunting related concern is the status of the chamois population in the Fagaras which appears to be much lower than expected. Although overhunting may be an issue, excessive livestock grazing in alpine pastures may also be a factor (see below).

Livestock grazing. Livestock grazing in the Carpathians is an old tradition, with traditional practices consisting of long distance transhumance movements. Under this system livestock (mainly sheep) would have been grazed in the alpine pastures during summer and then moved long distances to the lowlands during winter (Buza et al. 2009, Huband et al. 2010, Juler 2014, Mirela et al. 2013). The extent of movement is greatly decreasing throughout the southern Carpathians with many flocks undergoing shorter scale movements between the alpine pastures and adjacent lowland areas. Of main conservation concern is the potential for over-grazing and erosion in the alpine pastures which can potentially influence a wide range of species, including plants, invertebrates and chamois (e.g. Baur et al. 2007, Urdea et al. 2009) and decrease the productive capacity and the economic sustainability of livestock grazing. The extent to which grazing as opposed to wind and weather influences the upper tree line in the region is also unclear (Nedelea et al. 2009).

Agriculture. Many of the biodiversity values of the low lying parts of the site are dependent on an extensive traditional system of agriculture that centres on hay meadows and livestock grazing. The intervention from cutting and grazing has created and maintains open areas by preventing shrub and forest encroachment. These meadows and pastures typically have a very high species diversity, including flowers, butterflies and birds. However, the diversity is very dependent on the details of management, such as the absence of artificial fertilizer, the absence of ploughing, the timing of mowing with respect to plant growth and bird nesting, and the details of livestock stocking densities. In other words, the biodiversity values of these habitats can be threatened as much by the cessation of agricultural activity as by the intensification of the same activity. And both processes seem to be occurring in the region, with some meadows not having been cut in recent years, and other areas being subject to an increase in agricultural intensity. The way agriculture is conducted is likely to have dramatic impacts on the birdlife of the Peimontul Fagaras SPA and produce shifts in ecosystem services generation..

Development. In addition to the many small hydro-electric power plants and forest roads, the area has seen the expansion of unplanned development activities that can have impacts on biodiversity. These include the construction of second homes and tourism infrastructure (guest houses, hotels). There are also many plans for the development of ski slopes (Pehoiu 2010, Lesenciuc et al. 2013, Popescu 2010a,b, Prăvălie 2011).

5 Discussion and recommendations

Even based on the rather fragmented and limited published sources that we have reviewed it was possible to build up a general assessment of the structure of the Fagaras Mountains ecosystem and create an up-dated check list of its flora and fauna on which future work can build. Our work has dramatically increased the number of species known to be present. For example, the only previous published cross-taxa assessment listed 275 species of plant (Waltenkowski et al. 2013). Our present list reaches to 895 species.

Due to the variation in habitats (low intensity agriculture, different forest types, alpine pastures, alpine rocks and screes, freshwater streams, and glacial lakes), the 2000 meter altitude range, and the fact that human impact has been of low intensity until recent years it is not surprising that the area contains a very high diversity of species. There are almost no easily accessible overviews from other areas to permit comparisons, although Coldea et al. (2009) identified the Fagaras as being one of the richest areas in the whole Carpathians in terms of the diversity of high mountain vascular plants.

Although many individual species are of both national and international conservation importance, the real value of the site lies in its size and relative ecological intactness. Such large areas of continuous forest cover where virtually all large mammals and birds are present within an area of near continuous habitat are very rare in Europe. This is especially true when viewing the Fagaras Mountains within the wider context of the Southern Carpathians that form an almost continuous block of protected areas. The only vertebrate species that are known to be extinct are the four European vulture species (*Gypaetus barbatus, Gyps fulvus, Aegypius monachus, and Neophron percnopterus*)(Kelemen & Mertens date unknown). Among the mammals, only beavers and marmots have required reintroduction (Hoder & Valcu 2003, Pasca et al. 2013).

Although ecologically intact, the Fagaras Mountains are not a true wilderness because they have been subject to a diversity of human land uses for centuries, or even millennia (Cioaca & Dinu 2010). However, the impacts of these traditional activities have not degraded its biodiversity until recently. In fact, the human activity has been instrumental in the creation of some open habitats associated with exceptionally high diversity. Unfortunately, the massive institutional, social and economic changes that have occurred since the end of the communist era and with entry into the European Union have led to many changes in human activity and land use that have the potential to have negative effects on this biodiversity. If the biodiversity values of the site are going to persist into the future there is an urgent need to establish and enforce clear land use zoning guidelines and codes of practice for livestock grazing, forestry, hunting, agriculture and infrastructure development.

Current levels of knowledge from this site, and other areas within the Carpathian mountains (Keeton & Crow 2009, Kozak et al. 2013 and chapters therein, Milcu et al. 2014, van Maanen et al. 2006) are sufficient to identify the broad scale issues that need to be addressed. Ensuring connectivity to neighbouring areas, protecting whatever remnants of virgin forest remain, avoiding overgrazing of alpine pastures, clear-cutting forests, fertilizing and ploughing of high-nature value grasslands and meadows, and preventing development which is incompatible with the goals of the Natura 2000 sites are all obvious recommendations.

However, for many species there is going to be a need for more specific guidance adapted to the local context (e.g. Papp et al. 2013). This guidance is going to require much more knowledge about the biodiversity that is present and how it responds to different intensities of land use management regimes. Accordingly, there is going to be an urgent need to conduct more biodiversity related studies within the ecosystem to form the basis for habitat specific management plans. The following recommendations cover some of the most urgent issues:

(1) **Create a database of geo-referenced species observations**. Although we could find very little georeferenced information published, it should be possible to retrospectively populate a

database with at least some of the existing published information, especially from the Sinca Noua and Upper Dambrovita river basin studies (Promberger 2006, Danciu et al. 2008, Nicolae 2012, 2013, Kovacs et al. 2014). Such a database should ideally be built up along emerging international standards for biodiversity data (such as Darwin Core standards http://rs.tdwg.org/dwc/) to facilitate making data openly available through sites such as the Global Biodiversity Information Facility (http://www.gbif.org/).

(2) **Conduct a full inventory of all forest plots**, with a priority given to mapping the location and status of all remaining areas of virgin forest suitable for protection using standardised criteria (e.g. Biris & Veen 2001, Veen et al. 2010), as well as the areas that have been subject to clearcutting that may need active restoration.

(3) **Conduct an inventory of meadows and high nature value grasslands.** The biodiversity of meadows and grasslands depends completely on the way in which they are managed. Therefore, a simple mapping of their distribution will not automatically represent their conservation value. In effect each meadow will need to be inspected its status.

(4) **Establish a series of biodiversity survey plots** that cover multiple taxonomic groups in a range of habitat types and along a gradient of human land uses such that it is possible to gain insights into how biodiversity is distributed between habitat types and how it responds to different human activities. Structuring biodiversity survey activities into such a program will lead to much more efficient production and utilization of data. This should include key habitats such as the old growth forests, and the few patches of limestone (with associated caves) that are scattered throughout the otherwise metamorphic geology as well as the full range of more common forest and grasslands habitats.

(5) **Establish monitoring programs for a limited set of key indicator species** using appropriate species specific methods such that trends in their development can be followed. These should include (a) the rare species which are of national or international concern (in keeping with Natura 2000, Birds Directive and Habitats Directive reporting obligations), (b) species known to have specific habitat needs, and (c) a set of the more common, but functionally important species such as plants, insects and large mammals.

(6) **Landuse zoning and associated management plans** are needed for the whole ecosystem and each of the key habitats with their associated species. This is an urgent need such that it will need a broad plan to be drawn up using existing data, which can then be modified over time as more detailed knowledge becomes available.

6 Conclusions

The Fagaras Mountains represent a massive continuous block of forested and alpine habitat, which interfaces into lowlands areas of extensive agricultural land. Although the region is relatively poorly studied, the existing information summarized in this report indicates that it is an area with a very rich biodiversity. This includes a fully functional large mammal community, and very diverse communities of birds, reptiles, amphibians, invertebrates and plants. The region has been subject to extensive human activity for centuries, but recent changes in land uses are representing a diversity of threats to the areas biodiversity. There is an urgent need to implement land use planning on an ecosystem scale. While the existing biodiversity data and experience from other sites is sufficient to help draw the broad outlines of such a plan, far more species / habitat inventory and ecological fieldwork is needed to guide more detailed planning.

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8 Annexes: Lists of species recorded from the Fagaras Mountains, Romania

Table A1 Mammals present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Order	Family	Scientific Name	Common name	Source
Artiodactyla	Bovidae	*Rupicapra rupicapra*	Chamois	1,6,8,9
Artiodactyla	Cervidae	*Capreolus capreolus*	Roe deer	1,6,8,9
Artiodactyla	Cervidae	*Cervus elaphus*	Red deer	1,6,7,8,9
Artiodactyla	Suidae	*Sus scrofa*	Wild boar	6,7,8,9
Carnivora	Canidae	*Canis lupus*	Wolf	1,1a,1c,6,7,8,9
Carnivora	Canidae	*Vulpes vulpes*	Red fox	6,7,8,9
Carnivora	Felidae	*Felis silvestris*	Wild cat	1,6,8
Carnivora	Felidae	*Lynx lynx*	Lynx	1,1a,6,8
Carnivora	Mustelidae	*Lutra lutra*	Otter	1,1c,7,8
Carnivora	Mustelidae	*Martes foina*	Stone marten	6
Carnivora	Mustelidae	*Martes martes*	Pine marten	1,6,8
Carnivora	Mustelidae	*Meles meles*	Badger	6
Carnivora	Mustelidae	*Mustela erminea*	Stoat	6
Carnivora	Mustelidae	*Mustela nivalis*	Weasel	6,8
Carnivora	Mustelidae	*Mustela putorius*	Polecat	6
Carnivora	Ursidae	*Ursus arctos*	Brown bear	1,1a,1c,6,7,8,9
Chiroptera	Rhinolophidae	*Rhinolophus ferrumequinum*	Common bent-wing	1c
Chiroptera	Rhinolophidae	*Rhinolophus hipposideros*	Lesser horseshoe bat	1,1c,6
Chiroptera	Vespertilionidae	*Barbastella barbastellus*	Western barnastelle	1c,6
Chiroptera	Vespertilionidae	*Eptesicus serotinus*	Serotine bat	6
Chiroptera	Vespertilionidae	*Myotis bechsteinii*	Bechstein's bat	1c
Chiroptera	Vespertilionidae	*Myotis blythi*	Lesser mouse-eared bat	1c
Chiroptera	Vespertilionidae	*Myotis daubentoni*	Daubenton's bat	
Chiroptera	Vespertilionidae	*Myotis emarginatus*	Geoffroy's bat	6
Chiroptera	Vespertilionidae	*Myotis myotis*	Greater mouse-eared bat	1,1c,6
Chiroptera	Vespertilionidae	*Myotis mystacinus*	Whiskered bat	6
Chiroptera	Vespertilionidae	*Nyctalus noctula*	Noctule bat	1,6
Chiroptera	Vespertilionidae	*Pipistrellus pipistrellus*	Common pipistrelle	6
Eulipotyphla	Erinaceidae	*Erinaceus roumanicus*	Eastern hedgehog	3,6
Eulipotyphla	Soricidae	*Crocidura leucodon*	Bicoloured white-toothed shrew	3
Eulipotyphla	Soricidae	*Crocidura suaveolens*	Lesser white-toothed shrew	1,2,3
Eulipotyphla	Soricidae	*Neomys anomalus*	Miller's water shrew	1
Eulipotyphla	Soricidae	*Neomys fodiens*	Water shrew	1,3,6,7

Eulipotyphla	Soricidae	*Sorex alpinus*	Alpine shrew	1
Eulipotyphla	Soricidae	*Sorex araneus*	Common shrew	2,3,6,7
Eulipotyphla	Soricidae	*Sorex minutus*	Pygmy shrew	2,3
Eulipotyphla	Talpidae	*Talpa europaea*	European mole	3,6
Lagomorpha	Leporidae	*Lepus europaeus*	Brown hare	6,7,8
Rodentia	Castoridae	*Castor fiber*	Beaver	1c,5,8
Rodentia	Cricetidae	*Arvicola terrestris*	Water vole	1,2,3,6
Rodentia	Cricetidae	*Chionomys nivalis*	Snow vole	1,3
Rodentia	Cricetidae	*Clethrionomys (Myodes) glareolus*	Bank vole	2,3,6
Rodentia	Cricetidae	*Microtus (Terricola) subterraneus*	Common pine vole	2,3,7
Rodentia	Cricetidae	*Microtus arvalis*	Common vole	2,3,6
Rodentia	Cricetidae	*Ondatra zibethicus*	Muskrat	3
Rodentia	Gliridae	*Eliomys quercinus*	Garden dormouse	1,3
Rodentia	Gliridae	*Muscardinus avellanarius*	Common dormouse	1,2,3,6
Rodentia	Gliridae	*Myoxus (Glis) glis*	Edible dormouse	1,3,6
Rodentia	Muridae	*Apodemus agrarius*	Striped field mouse	2,3,6
Rodentia	Muridae	*Apodemus flavicollis*	Yellow-necked mouse	2,3,6
Rodentia	Muridae	*Apodemus sylvaticus*	Wood mouse	2,3
Rodentia	Muridae	*Apodemus uralensis*	Pygmy field mouse	2,3
Rodentia	Muridae	*Micromys minutus*	Harvest mouse	1,2,3
Rodentia	Muridae	*Mus musculus*	House mouse	2,3
Rodentia	Muridae	*Rattus norvegicus*	Brown rat	3
Rodentia	Sciuridae	*Marmota marmota*	Alpine marmot	4,8
Rodentia	Sciuridae	*Sciurus vulgaris*	Red squirrel	3,6,8

Sources: 1 = N2000 ROSCI0122, 1a = N2000 ROSCI0352, 1c = N2000 ROSCI0304, 2 = Lazar et al. 2012 , 3 = cited in Lazar et al. 2012 , 4 = Hodor & Valcu 2003, 5 = Pasca et al. 2013, 6 = Promberger 2006, 7 = Nicolae 2012, 8 = FCC observations, 9 = Hunting statistics

Table A2 Birds present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Family	Scientific Name	Common name	Source
Accipitridae	*Accipiter gentilis*	Goshawk	3,6
Accipitridae	*Accipiter nisus*	Sparrowhawk	2,3,4,6,7
Accipitridae	*Aquila chrysaetos*	Golden Eagle	1,2,9
Accipitridae	*Buteo buteo*	Common buzzard	2,3,4,5,6,7,8
Accipitridae	*Circaetus gallicus*	Short-toed Eagle	1,6
Accipitridae	*Circus aeruginosus*	Marsh Harrier	1
Accipitridae	*Circus cyaneus*	Hen Harrier	1
Accipitridae	*Clanga (Aquila) pomarina*	Lesser Spotted Eagle	1,3,5,6
Accipitridae	*Milvus migrans*	Black kite	3
Accipitridae	*Pernis apivorus*	Honey Buzzard	1,6,7
Acrocephalidae	*Acrocephalus palustris*	Marsh Warbler	6
Aegithalidae	*Aeghitalos caudatus*	Long-tailed Tit	6
Alaudidae	*Alauda arvensis*	Skylark	2,6
Alaudidae	*Lullula arborea*	Woodlark	1,6
Alcedinidae	*Alcedo atthis*	Common kingfisher	8
Anatidae	*Anas platyrhynchos*	Mallard	3,6,7
Anatidae	*Mergus merganser*	Common merganser	7,7
Apodidae	*Apus apus*	Swift	6
Apodidae	*Apus melba*	Alpine swift	6
Ardeidae	*Ardea cinerea*	Grey Heron	6
Ardeidae	*Egretta alba*	Great egret	3
Caprimulgidae	*Caprimulgus europaeus*	Nightjar	6
Certhiidae	*Certhia familiaris*	Eurasian treecreeper	2,3,4,6,7
Ciconidae	*Ciconia ciconia*	White Stork	1,6
Ciconidae	*Ciconia nigra*	Black Stork	1,2,6
Cinclidae	*Cinclus cinclus*	White-throated dipper	2,3,6,7,8
Columbidae	*Columba livia domestica*	Feral pigeon	6
Columbidae	*Columba oenas*	Stock dove	6,7
Columbidae	*Columbia palumbus*	Common wood pigeon	2,6,7
Columbidae	*Streptopelia decaocto*	Eurasian collared dove	3,6
Columbidae	*Streptopelia turtur*	Turtle dove	6
Corvidae	*Corvus corax*	Raven	3,6,7,8
Corvidae	*Corvus cornix*	Hooded crow	7
Corvidae	*Corvus frugilegus*	Rook	6
Corvidae	*Corvus monedula*	Western jackdaw	5,6

Corvidae	*Garrulus glandarius*	Eurasian jay	2,3,4,5,6,7,8
Corvidae	*Nucifraga caryocatactes*	Spotted nutcracker	2,3,4,6,7
Corvidae	*Pica pica*	Magpie	6
Cuculidae	*Cuculus canorus*	Common cuckoo	2,4,6,7
Emberizidae	*Emberiza citrinella*	Yellowhammer	6
Emberizidae	*Emberiza hortulana*	Ortolan Bunting	1
Falconidae	*Falco peregrinus*	Peregrine Falcon	1,6
Falconidae	*Falco subbuteo*	Hobby	6
Falconidae	*Falco tinnunculus*	Common kestrel	3,6
Fringillidae	*Carduelis carduelis*	Goldfinch	6
Fringillidae	*Chloris (Carduelis) chloris*	Greenfinch	6
Fringillidae	*Coccothraustes coccothraustes*	Hawfinch	6,7
Fringillidae	*Fringilla coelebs*	Common chaffinch	2,3,4,7,8
Fringillidae	*Linaria (Carduelis) cannabina*	Common linnet	2,3,6
Fringillidae	*Loxia curvirostra*	Red crossbill	2,3,4,7
Fringillidae	*Pyrrhula pyrrhula*	Eurasian bullfinch	2,3,4,6,7,8
Fringillidae	*Serinus serinus*	Serin	6
Fringillidae	*Spinus (Carduelis) spinus*	Siskin	6,7
Hirundinidae	*Delichon urbica*	Common house martin	3,6,7
Hirundinidae	*Hirundo rustica*	Barn swallow	2,3,6
Laniidae	*Lanius collurio*	Red-backed Shrike	1,3,5,6,7
Laniidae	*Lanius excubitor*	Great-grey Shrike	6
Laniidae	*Lanius minor*	Lesser Grey Shrike	1
Laniidae	*Larus ridibundus*	Black-headed gull	3
Meropidae	*Merops apiaster*	Bee-eater	6,7
Motacillidae	*Anthus spinoletta*	Rock pipit	2,3,5
Motacillidae	*Anthus trivialis*	Tree pipit	2,3,4,6,7
Motacillidae	*Motacilla alba*	White wagtail	2,3,6,7
Motacillidae	*Motacilla cinerea*	Grey wagtail	2,3,4,6,7
Motacillidae	*Motacilla flava*	Western yellow wagtail	8
Muscicapidae	*Erithacus rubecula*	European robin	2,3,4,6,7,8
Muscicapidae	*Ficedula albicollis*	Collared Flycatcher	1,2
Muscicapidae	*Ficedula albicollis*	Collared Flycatcher	6,7
Muscicapidae	*Ficedula hypoleuca*	European pied flycatcher	2
Muscicapidae	*Ficedula parva*	Red-breasted Flycatcher	1,2,6,7
Muscicapidae	*Luscinia luscinia*	Thrush Nightingale	6
Muscicapidae	*Muscicapa striata*	Spotted Flycatcher	6
Muscicapidae	*Oenanthe oenanthe*	Northern wheatear	2,6
Muscicapidae	*Phoenicurus ochruros*	Black redstart	2,3,4,6

Muscicapidae	*Phoenicurus phoenicurus*	Common redstart	3,6,7
Muscicapidae	*Saxicola rubetra*	Whinchat	2,6
Muscicapidae	*Saxicola rubicola*	European stonechat	7
Oriolidae	*Oriolus oriolus*	Eurasian golden oriole	3,6
Paridae	*Cyanistes (Parus) caeruleus*	Eurasian blue tit	2,3,6,8
Paridae	*Lophophanes (Parus) cristatus*	European crested tit	2,4,7
Paridae	*Parus major*	Great tit	2,3,6,7,8
Paridae	*Periparus (Parus) ater*	Coal tit	2,3,4,5,6,7,8
Paridae	*Poecile (Parus) montanus*	Willow tit	2,3,4,7
Paridae	*Poecile (Parus) palustris*	Marsch tit	6
Passeridae	*Passer domesticus*	House sparrow	3,6
Passeridae	*Passer montanus*	Tree sparrpw	6
Phasianidae	*Bonasa bonasia*	Hazel Grouse	1,2,9
Phasianidae	*Coturnix coturnix*	Quail	6
Phasianidae	*Phasianus colchicus*	Pheasant	6
Phasianidae	*Tetrao urogallus*	Capercaillie	1,2,7,8
Phylloscopidae	*Phylloscopus collybita*	Common chiffchaff	2,3,4,5,6,7
Phylloscopidae	*Phylloscopus sibilatrix*	Wood Warbler	6
Phylloscopidae	*Phylloscopus trochilus*	Willow warbler	3,6,7
Picidae	*Dendrocopos leucotos*	White-backed Woodpecker	1,2,3,6,7
Picidae	*Dendrocopos major*	Great spotted woodpecker	2,3,6,7,9
Picidae	*Dendrocopos medius*	Middle Spotted Woodpecker	1,3,6
Picidae	*Dendrocopos minor*	Lesser Spotted Woodpecker	6
Picidae	*Dendrocopos syriacus*	Syrian Woodpecker	1
Picidae	*Dryocopus martius*	Black Woodpecker	1,2,4,6,7,8,9
Picidae	*Jynx torquilla*	Wryneck	6
Picidae	*Picoides tridactylus*	Eurasian three-toed woodpecker	4,7
Picidae	*Picus canus*	Grey-headed Woodpecker	1,6
Picidae	*Picus viridis*	Green woodpecker	2,6
Prunellidae	*Prunella collaris*	Alpine accentor	2
Prunellidae	*Prunella modularis*	Dunnock	3,4,6,7
Rallidae	*Crex crex*	Corncrake	1,6
Regulidae	*Regulus ignicapillus*	Common firecrest	4,7
Regulidae	*Regulus regulus*	Goldcrest	2,3,4,6,7
Scolopacidae	*Scolopax rusticola*	Woodcock	6
Sittidae	*Sitta europaea*	Eurasian nuthatch	3,4,6,7
Strigidae	*Athene noctua*	Little owl	3,6,9
Strigidae	*Bubo bubo*	Eagle owl	6,9
Strigidae	*Otus scops*	Scops owl	6

Strigidae	*Strix aluco*	Tawny owl	2,3,6
Strigidae	*Strix uralensis*	Ural Owl	1,6,7,9
Sturnidae	*Sturnus vulgaris*	Common starling	3,6
Sylviidae	*Sylvia atricapilla*	Eurasian blackcap	2,3,4,6,7,8
Sylviidae	*Sylvia borin*	Garden Warbler	6,7
Sylviidae	*Sylvia communis*	Whitethroat	6
Sylviidae	*Sylvia curruca*	Lesser whitethroat	3,6,7
Sylviidae	*Sylvia nisoria*	Barred Warbler	1
Troglodytidae	*Troglodytes troglodytes*	Eurasian wren	2,3,4,6,7
Turdidae	*Turdus merula*	Common blackbird	2,3,4,6,7,8
Turdidae	*Turdus philomelos*	Song thrush	2,6,7
Turdidae	*Turdus philomelos*	Song thrush	4
Turdidae	*Turdus pilaris*	Fieldfare	6
Turdidae	*Turdus torquatus*	Ring ouzel	2,3,4,6,7
Turdidae	*Turdus viscivorus*	Mistle thrush	4,6,7,8
Tytonidae	*Tyto alba*	Barn owl	3
Upupidae	*Upupa epops*	Hoopoe	3,6

Sources: 1 = Natura 2000 data, 2 = Waltenkowski et al. 2013, 3 = Petrescu 2005, 4 = Mestecaneanu 2012, 5 = GBIF, 6 = Promberger 2006, 7 = Kovacs et al. 2014, Kovacs 2015, 8 = Nicolae 2012, 9 = FCC observations

Table A3 Amphibians and reptiles present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Family name	***Scientific Name***	**Common name**	**Source**
Amphibians			
Bombinatoridae (Discoglossidae)	*Bombina bombina*	Red-bellied toad	1c,2
Bombinatoridae (Discoglossidae)	*Bombina variegata*	Yellow-bellied toad	1,1c,2,3,4,6,9,10,11,12,14
Bufonidae	*Bufo bufo*	Common toad	1,1a,1c,2,3,4,9,12,14
Bufonidae	*Bufo viridis*	Green toad	1,1a,1c,2,3,14
Hylidae	*Hyla arborea*	European tree frog	1,1a,1b,1c,2,3,9,11,12
Pelobatidae	*Pelobates fuscus*	common spadefoot	1a,1c,2
Ranidae	*Pelophylax (Rana) esculentus*	Edible frog	1a,1c,2,3,11,12
Ranidae	*Pelophylax ridibundus*	Marsh frog	1a,3,9,11
Ranidae	*Rana arvalis*	Moor frog	1,2
Ranidae	*Rana dalmatina*	Agile frog	1,1a,1c,2,3,9,11,14
Ranidae	*Rana ridibunda*	Lake frog	1c,2
Ranidae	*Rana temporaria*	Common frog	1,1a,1b,1c,2,3,4,9,10,11,12,14
Salamandridae	*Salamandra salamandra*	Fire salamander	1,1a,1c,2,3,4,9,11,12,14
Salamandridae	*Triturus (Lissotriton) montandoni*	Montandon's (Carpathian) newt	1,3,4,14
Salamandridae	*Triturus (Lissotriton) vulgaris*	Smooth newt	1,1c,2,3,9,11,12
Salamandridae	*Triturus (Mesotriton)(Ichthyosaura) alpestris*	Alpine newt	1,2,3,4,9,11,12,14
Salamandridae	*Triturus cristatus*	Crested (warty) newt	1,1b,1c,2,3,4,9,11,12
Reptiles			
Anguidae	*Anguis fragilis colchica*	Slow worm	1,1a,1c,2,3,9,12
Colubridae	*Coronella austriaca (coronella)*	Smooth snake	1,1a,1c,9
Colubridae	*Elaphe longissima (Zamenis longissimus)*	Aesculapian snake	1,1a,1c,2,9
Colubridae	*Natrix natrix*	Grass snake	1a,1c,2,9,12
Colubridae	*Natrix tessellate*	Dice snake	2
Emydidae	*Emys orbicularis*	Pond turtle	1b,1c,2
Lacertidae	*Lacerta (Zootoca) vivipara*	Viviparous lizard	1c,2,3,11,12
Lacertidae	*Lacerta agilis*	Sand lizard	1,1a,1c,2,3,9,11,12
Lacertidae	*Lacerta viridis*	Green lizard	1,1a,1c,2

Lacertidae	*Podarcis muralis*	Common wall lizard	1,1a,2,3,11,12
Lacertidae	*Podarcis taurica*	Balkan wall lizard	14
Viperidae	*Vipera ammodytes*	Nose horned viper	2
Viperidae	*Vipera berus*	Adder	1,1c,2,3,9,11,12,14

Sources: 1 = N2000 ROSCI0122data, 1a = N2000 ROSCI0352, 1b = N2000 ROSCI0112 MT, 1c = N2000 ROSCI0304, 2 = Ghira et al. 2002, 3 = Iftime et al. 2009, 4 = Iftime & Iftime 2012, 5 = Prăvălie 2011, 6 = Waltenkowski et al. 2013, 7 = Khalaf et al. 2015, 8 = Ureche et al. 2010, 9 = Sos et al. 2008, 10 = Ferenti & Covaciu-Marcov 2011, 11 = Dinca et al. 2013, 12 = Cogalniceanu et al. 2012 cited in Dinca et al. 2013, 13 = Promberger 2006, 14 = Nicolae 2012

Table A4 Fish and freshwater crayfish present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Family name	***Scientific Name***	**Common name**	**Source**
Fish			
Cobitidae	*Sabanejewia romanica*	Romanian Loach	1
Cottidae	*Cottus gobio*	Freshwater sculpin (bullhead)	1,13,14
Cyprinidae	*Alburnoides bipunctatus*	Riffle minnow	13
Cyprinidae	*Barbus meridionalis*	Mediterranean barbel	1,14
Cyprinidae	*Barbus petenyi*	Romanian barbel	13
Cyprinidae	*Phoxinus phoxinus*	Minnow	8,14
Cyprinidae	*Romanogobio (Gobio) uranoscopus*	Danube Gudgeon	1
Lotidae	*Lota lota*	Thin-tailed burbot	1
Percidae	*Romanichthys valsanicola*	Sculpin-perch	5
Petromyzontidae	*Eudontomyzon mariae*	Ukrainian lamprey	1
Salmonidae	*Salmo (fario) trutta*	Brown trout	7,13,14
Salmonidae	*Thymallus thymallus*	European grayling	1
Crayfish			
Astacidae	*Astacus astacus*	Noble crayfish	15,16
Astacidae	*Austropotamobius torrentium*	Stone crayfish	16

Sources: 1 = N2000 ROSCI0122data, 5 = Prăvălie 2011, 7 = Khalaf et al. 2015, 8 = Ureche et al. 2010, 13 = Promberger et al. 2006, 14 = Nicolae 2012, 15 = www.crayfish.ro, 16 = Petrescu & Petrescu 2010

Table A5. Dragonflies and damselflies (Odonata) present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Family name	Scientific Name	English Name	Source
Aeshnidae	*Aeschna m. mixta*	Migrant Hawker dragonfly	3
Aeshnidae	*Anax parthenope*	Lesser emperor dragonfly	3
Calopterygidae	*Calopteryx splendens*	Banded demoiselle damselfly	3
Calopterygidae	*Calopteryx virgo*	Beautiful demoiselle damselfly	3,4
Coenagrionidae	*Coanagrion ornatum*	Norfolk Damselfly / Dark blue	3
Coenagrionidae	*Ischnura pumilio*	Scarce blue-tailed damselfly	3
Corduliidae	*Somatochlora alpestris*	Alpine emerald dragonfly	2
Gomphidae	*Onychogomphus forcipatus*	Small pincertail / green-eyed hook-tailed dragonfly	3,4
Gomphidae	*Ophiogomphus cecilia*	Green gomphid dragonfly	1
Lestidae	*Lestes barbarus*	Migrant spreadwing damselfly	3,4
Libellulidae	*Libellula depressa*	Broad-bodied chaser dragonfly	3
Libellulidae	*Libellula quadrimaculata*	Four-spotted chaser dragonfly	3,4
Libellulidae	*Orthetrum brunneum*	Southern skimmer dragonfly	3
Libellulidae	*Orthetrum coerulescens*	Keeled skimmer dragonfly	3
Platycnemididae	*Platycnemis pennipes*	White-legged damselfly	3

Sources: 1 = N2000 ROSCI0122, 2 = De Knijf et al. 2011, 3= Kipping 1998, 4 = Promberger 2006

Table A6 Butterflies (Lepidoptera: sub-order Rhopalocera) present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Family	***Scientific Name***	**Common name**	**Source**
Nymphalidae	*Aglais urticae*	Small tortoiseshell	3,5,10,11
Pieridae	*Anthocharis cardamines*	Orange-tip	1b,10
Nymphalidae	*Apatura ilia*	Lesser Purple Emperor	10
Nymphalidae	*Apatura iris*	Purple Emperor	5,10
Nymphalidae	*Aphantopus hyperantus*	Ringlet	5,10
Pieridae	*Aporia crataegi crataegi*	Black-veined White	10
Nymphalidae	*Araschnia levana*	Map	5,10
Nymphalidae	*Argynnis adippe*	High brown fritillary	3,10
Nymphalidae	*Argynnis aglaja*	Dark green fritillary	3,10
Nymphalidae	*Argynnis laodice*	Pallas' fritillary	5,10
Nymphalidae	*Argynnis niobe niobe*	Niobe fritillary	10
Nymphalidae	*Argynnis paphia*	Silver-washed fritillary	3,5,10
Lycaenidae	*Aricia agestis agestis*	Brown argus	10
Nymphalidae	*Boloria (Clossiana) euphrosyne*	Pearl-bordered fritillary	10
Nymphalidae	*Boloria dia*	Weaver's Fritillary	10
Nymphalidae	*Boloria euphrosyne*	Pearl-bordered fritillary	3
Nymphalidae	*Boloria pales*	Shepherd's Fritillary	5
Nymphalidae	*Boloria selene*	Small pearl-bordered fritillary	5,10
Nymphalidae	*Brenthis daphne*	Marbled fritillary	5,10
Nymphalidae	*Brenthis ino*	Lesser Marbled Fritillary	10
Lycaenidae	*Callophrys rubi*	Green hairstreak	10
Hesperiidae	*Carcharodus floccifera*	Tufted Skipper	5
Hesperiidae	*Carterocephalus palaemon*	Chequered skipper	5,10
Lycaenidae	*Celastrina argiolus*	Holly blue	10
Nymphalidae	*Bolaria (Clossiana) dia*	Weaver's Fritillary	5
Nymphalidae	*Coenonympha arcania*	Pearly Heath	10
Nymphalidae	*Coenonympha glycerion*	Chestnut Heath	10
Nymphalidae	*Coenonympha iphis*	Chestnut Heath	5
Nymphalidae	*Coenonympha pamphilus*	Small heath	5,10
Pieridae	*Colias croceus*	Dark Clouded Yellow	5,10,11
Pieridae	*Colias hyale*	Pale Clouded Yellow	5,10
Lycaenidae	*Cupido minimus minimus*	Small blue	10
Lycaenidae	*Cyaniris (Polyommatus) semiargus*	Mazarine blue	5
Nymphalidae	*Erebia aethiops*	Scotch argus	10
Nymphalidae	*Erebia epiphron*	Small mountain ringlet	3,5
Nymphalidae	*Erebia euryale*	Large ringlet	3,5,10

Nymphalidae	*Erebia gorge*	Silky ringlet	5,6,9
Nymphalidae	*Erebia ligea*	Arran brown	3,5,10
Nymphalidae	*Erebia manto*	Yellow-spotted ringlet	3,5
Nymphalidae	*Erebia medusa*	Woodland ringlet	5,6,10
Nymphalidae	*Erebia pandrosus*	Dewy ringlet	5
Nymphalidae	*Erebia sudetica*	Sudeten Ringlet	1,5,6
Hesperiidae	*Erynnis tages*	Dingy skipper	1b,10
Nymphalidae	*Euphydryas aurinia*	Marsh Fritillary	1,5,10
Nymphalidae	*Argynnis (Fabriciana) niobe*	Niobe fritillary	5
Lycaenidae	*Glaucopsyche alexis*	Green-underside blue	10
Pieridae	*Gonepteryx rhamni*	Common brimstone	3,5,10
Riodinidae	*Hamearis lucina*	Duke of Burgundy	10
Hesperiidae	*Hesperia comma*	Silver-spotted skipper	10
Nymphalidae	*Hipparchia fagi*	Woodland Grayling	5,10
Nymphalidae	*Hipparchia semele*	Grayling	10
Nymphalidae	*Hyponephele lycaon*	Dusky Meadow Brown	6
Nymphalidae	*Nymphalis (Inachis, Aglais) io*	European Peacock	3,5,10,11
Papilionidae	*Iphiclides podalirius podalirius*	Scarce Swallowtail	10,11
Nymphalidae	*Issoria (Argynnis) lathonia*	Queen of Spain fritillary	5,10
Nymphalidae	*Lasiommata maera*	Large Wall Brown	3,10
Pieridae	*Leptidea morsei major*	Fenton's Wood White	10
Pieridae	*Leptidea sinapis*	Wood white	5,10
Nymphalidae	*Limenitis camilla*	White Admiral	10
Nymphalidae	*Limenitis populi*	Poplar admiral	10
Lycaenidae	*Plebejus (Lycaeides) idas*	Northern Blue	5
Lycaenidae	*Lycaena alciphron alciphon*	Purple-shot copper	10
Lycaenidae	*Lycaena dispar*	Large Copper	1,6,10
Lycaenidae	*Lycaena phlaeas*	Small copper	5,10
Lycaenidae	*Lycaena tityrus*	Sooty Copper	3,5,10
Lycaenidae	*Lycaena virgaureae virgaureae*	Scarce copper	10
Lycaenidae	*Lysandra (Polyommatus) coridon*	Chalkhill blue	5,10
Lycaenidae	*Maculinea alcon*	Alcon Large Blue	10
Lycaenidae	*Maculinea arion*	Large blue	10
Lycaenidae	*Maculinea teleius*	Scarce large blue	10
Nymphalidae	*Maniola jurtina*	Meadow brown	1b,5,10
Nymphalidae	*Melanargia galathea*	Marbled white	1b,10
Lycaenidae	*Polyommatus (Meleageria) bellargus*	Adonis Blue Butterfly	10
Lycaenidae	*Polyommatus (Meleageria) daphnis*	Meleager's blue	10
Nymphalidae	*Melitaea athalia*	Heath fritillary	10

Nymphalidae	*Melitaea aurelia*	Nickerl's fritillary	10
Nymphalidae	*Melitaea cinxia*	Glanville fritillary	10
Nymphalidae	*Melitaea didyma*	Spotted Fritillary	5,10
Nymphalidae	*Melitaea phoebe*	Knapweed Fritillary	5,10
Nymphalidae	*Minois dryas*	Dryad	10
Nymphalidae	*Neptis hylas*	Common Sailer	10
Nymphalidae	*Neptis rivularis*	Hungarian Glider	5,10,11
Nymphalidae	*Nymphalis antiopa*	Camberwell Beauty	5,10,11
Nymphalidae	*Nymphalis polychloros*	Large tortoiseshell	10
Nymphalidae	*Nymphalis xanthomelas*	Scarce Tortoiseshell	6
Hesperiidae	*Ochlodes sylvanus*	Large skipper	10
Papilionidae	*Papilio machaon*	Old World swallowtail	3,5,10
Nymphalidae	*Pararge aegeria*	Speckled wood	5,10
Papilionidae	*Parnassius mnemosyne*	Clouded Apollo	1,6,10
Pieridae	*Pieris brassicae*	Large white	5,10
Pieridae	*Pieris bryoniae*	Dark-veined white	3,5
Pieridae	*Pieris napi*	Green-veined white	5,10
Pieridae	*Pieris rapae*	Small white	3,5,10,11
Lycaenidae	*Plebejus argus*	Silver-studded blue	10
Lycaenidae	*Plebejus argyrognomon*	Reverdin's Blue	10
Lycaenidae	*Plebejus idas*	Idas Blue or Northern Blue	10
Nymphalidae	*Polygonia (Nymphalis) c-album*	Comma	3,5,10,11
Lycaenidae	*Polyommatus dorylas magnus*	Turquoise Blue	10
Lycaenidae	*Polyommatus (Cyaniris) semiargus*	Mazarine blue	10
Lycaenidae	*Polyommatus icarus*	Common blue	3,10,11
Lycaenidae	*Polyommatus thersites*	Chapman's Blue	10
Pieridae	*Pontia edusa*	Eastern Bath white	10
Lycaenidae	*Pseudophilotes (vicrama) schiffermülleri*	Eastern baton blue	6,10
Hesperiidae	*Pyrgus cacaliae*	Dusky Grizzled Skipper	5
Hesperiidae	*Pyrgus malvae malvae*	Grizzled skipper	10
Nymphalidae	*Pyronia (Maniola) tithonus*	Gatekeeper	5
Lycaenidae	*Satyrium pruni*	Black hairstreak	10
Lycaenidae	*Satyrium spini*	Blue Spot Hairstreak	10
Lycaenidae	*Thecla betulae*	Brown hairstreak	10
Hesperiidae	*Thymelicus lineola*	Essex skipper	10
Hesperiidae	*Thymelicus sylvestris*	Small skipper	10
Nymphalidae	*Vanessa atalanta*	Red Admiral	3,5,10
Nymphalidae	*Vanessa cardui*	Painted lady	5,10

Sources: 1 = N2000 ROSCI0122, 1b = N2000 ROSCI0112 MT, 3 = Cuvelier & Dinca 2007, 5 = GBIF, 6 = Levente 2010, 7 = Kovacs & Kovacs 2001, 8 = Kovacs & Kovacs 2003-2004, 9 = Stanca-Moise 2015, 10 = Promberger 006, 11 = Nicolae 2012

Table A7 Moths (Lepidoptera: sub-order Heterocera) present within Muntii Fagaras Site of Community Interest and Piemontul Fagaras Special Protected Area, southern Carpathians, Romania.

Arctiidae	*Arctia caja*	Garden tiger moth	10
Arctiidae	*Atolmis rubricollis*	Red-necked footman	10
Arctiidae	*Cybosia mesomella*	Four-dotted footman	10
Arctiidae	*Diacrisia sannio*	Clouded Buff	10
Arctiidae	*Dysauxes ancilla*	Handmaid	10
Arctiidae	*Eilema complana*	Scarce footman	10
Arctiidae	*Eilema depressa*	Buff Footman	10
Arctiidae	*Eilema lurideola*	Common footman	10
Arctiidae	*Lithosia quadra*	Four-spotted Footman	10
Arctiidae	*Miltochrista miniata*	Rosy footman	10
Arctiidae	*Parasemia plantaginis*	Wood Tiger	10
Arctiidae	*Phragmatobia fuliginosa*	Ruby Tiger	10
Arctiidae	*Setina irrorella*	Dew moth	10
Arctiidae	*Spilosoma lubricipeda*	White Ermine	10
Arctiidae	*Spilosoma lutea (Spilarctia luteum)*	Buff ermine	10
Cossidae	*Acossus (Lamelocossus) terebra*		10
Cossidae	*Cossus cossus*	Goat moth	10
Drepanidae	*Cilix glaucata*	Chinese Character	10
Drepanidae	*Drepana falcataria*	Pebble Hook-tip	10
Drepanidae	*Habrosyne pyritoides*	Buff arches	10
Drepanidae	*Ochropacha duplaris*	Common Lutestring	10
Drepanidae	*Sabra harpagula*	Scarce Hook-tip	10
Drepanidae	*Tethae ocularis*	Figure of Eighty	10
Drepanidae	*Tethea or*	Poplar Lutestring	10
Drepanidae	*Thyatira batis*	Peach blossom	10
Drepanidae	*Watsonalla binaria*	Oak hook-tip	10
Drepanidae	*Watsonalla cultraria*	Barred Hook-tip	10
Endromidae	*Endromis versicolora*	Kentish glory	10
Erebidae	*Euclidia glyphica*	Burnet companion moth	10
Erebidae	*Herminia grisealis*	Small Fan-foot	10
Erebidae	*Herminia tarsicrinalis*	Shaded Fan-foot	10
Erebidae	*Minucia lunaris*	Lunar Double-stripe	10
Erebidae	*Rivula sericealis*	Straw Dot	10
Erebidae	*Trisateles emortualis*	Olive Crescent	10
Eribidae	*Amatha phegea*	Nine-spotted moth	10
Eribidae	*Bomolocha crassalis*	Beautiful Snout	5

Eribidae	*Callimorpha dominula*	Scarlet tiger moth	10
Eribidae	*Catocala elocata*	French red underwing	10
Eribidae	*Catocala fraxini*	Blue underwing	10
Eribidae	*Catocala nupta*	Red underwing	10
Eribidae	*Catocala sponsa*	Dark crimson underwing	10
Eribidae	*Euplagia (Callimorpha) quadripunctaria*	Jersey Tiger	1, 10
Geometridae	*Abraxas (Calospilos) sylvata*	Clouded magpie	10
Geometridae	*Agriopis aurantiaria*	Scarce Umber	10
Geometridae	*Agriopis leucophaearia*	Spring Usher	10
Geometridae	*Alcis bastelbergeri*		10
Geometridae	*Alcis repandata*	Mottled beauty	10
Geometridae	*Alsophila aescularia*		10
Geometridae	*Angerona prunaria*	Orange moth	10
Geometridae	*Anticollix sparsata*	Dentated pug	10
Geometridae	*Apeira syringaria*	Lilac Beauty	10
Geometridae	*Aplocera plagiata*	Treble-bar / St. John's Wort Inchworm	10
Geometridae	*Aplocera praeformata*	Purple Treble-bar	10
Geometridae	*Aplocera simpliciata*		9
Geometridae	*Ascotis selenaria*	Giant looper	10
Geometridae	*Asthena albulata*	Small White Wave	10
Geometridae	*Biston betularia*	Peppered moth	10
Geometridae	*Bupalus piniaria*	Bordered white	10
Geometridae	*Cabera exanthemata*	Common wave	10
Geometridae	*Cabera pusaria*	Common white wave	10
Geometridae	*Campaea margaritata*	Light Emerald	10
Geometridae	*Camptogramma bilineata*	Yellow Shell	10
Geometridae	*Catarhoe cuculata*	Royal Mantle	10
Geometridae	*Chiasmia clathrata*	Latticed heath	10
Geometridae	*Chlorissa cloraria*	Southern Grass Emerald	10
Geometridae	*Chloroclysta citrata*	Dark Marbled Carpet	10
Geometridae	*Chloroclysta siterata*	Red-green Carpet	10
Geometridae	*Chloroclysta truncata*	Common marbled carpet	10
Geometridae	*Chloroclystis viata*		10
Geometridae	*Cidaria fulvata*		10
Geometridae	*Coenotephria (Nebula) salicata*	Striped twin-spot carpet	10
Geometridae	*Colostygia aptata*		10
Geometridae	*Colostygia pectinataria*	Green Carpet	10
Geometridae	*Colotois pennaria*	Feathered thorn	10
Geometridae	*Cosmorhoe ocellata*	Purple Bar	10

Geometridae	*Costaconvexa polygrammata*	Many-Lined Moth	10
Geometridae	*Crocallis elinguaria*	Scalloped oak	10
Geometridae	*Cyclophora annularia*	Mocha	10
Geometridae	*Cyclophora linearia*	Clay triple-lines	10
Geometridae	*Cyclophora punctaria*	Maiden's blush	10
Geometridae	*Deileptenia ribeata*	Satin Beauty	10
Geometridae	*Ecliptopera silaceata*	Small Phoenix	10
Geometridae	*Ectropis crepuscularia*	Engrailed	10
Geometridae	*Electrophaes corylata*	Broken-barred Carpet	10
Geometridae	*Ematurga atomaria*	Common Heath	10
Geometridae	*Ennomos erosaria*	September Thorn	10
Geometridae	*Ennomos fuscantaria*	Dusky Thorn	10
Geometridae	*Entephria caesiata*	Grey Mountain Carpet	10
Geometridae	*Epione repandaria*	Bordered Beauty	10
Geometridae	*Epirrhoe alternata*	Common carpet	10
Geometridae	*Epirrhoe galiata*	Galium Carpet	10
Geometridae	*Epirrhoe hastulata*		10
Geometridae	*Epirrhoe molluginata*		10
Geometridae	*Epirrhoe tristata*	Small Argent	10
Geometridae	*Erannis defoliaria*	Mottled umber	10
Geometridae	*Eulithis populata*	Northern spinach	10
Geometridae	*Eulithis prunata*	Phoenix	10
Geometridae	*Eulithis pyraliata*	Barred straw	10
Geometridae	*Euphyia scripturata*		10
Geometridae	*Eupithecia abietaria*	Cloaked pug	10
Geometridae	*Eupithecia absinthiata*	Wormwood pug	10
Geometridae	*Eupithecia distinctaria*		10
Geometridae	*Eupithecia icterata*	Tawny speckled pug	10
Geometridae	*Eupithecia impurata*		10
Geometridae	*Eupithecia plumbeolata*	Lead-coloured pug	10
Geometridae	*Eupithecia pusillata*	Juniper pug	10
Geometridae	*Eupithecia sinuosaria*	Goosefoot pug	10
Geometridae	*Eupithecia subumbrata*	Shaded pug	10
Geometridae	*Eupithecia tantillaria*	Dwarf Pug	10
Geometridae	*Eupithecia trisignaria*	Triple-spotted pug	10
Geometridae	*Eustroma reticulata*	Netted Carpet	10
Geometridae	*Heliomata glarearia*		10
Geometridae	*Hemistola chrysoprasaria*	Small Emerald	10
Geometridae	*Horisme aemulata*		10

Geometridae	*Horisme tersata*	Fern	10
Geometridae	*Hydrelia flammeolaria*	Small Yellow Wave	10
Geometridae	*Hydriomena furcata*	July highflyer	10
Geometridae	*Hydriomena impluviata*	May highflyer	10
Geometridae	*Hylaea fasciaria*	Barred red	10
Geometridae	*Hypomecis roboraria*	Great oak beauty	10
Geometridae	*Hypoxystis pluviaria*		10
Geometridae	*Idaea aversata*	Riband wave	10
Geometridae	*Idaea biselata*	Small fan-footed wave	10
Geometridae	*Idaea degeneraria*	Portland ribbon wave	10
Geometridae	*Idaea dilutaria*	Silky wave	10
Geometridae	*Idaea dimidiata*	Single-dotted wave	10
Geometridae	*Idaea fuscovenosa*	Dwarf Cream Wave	10
Geometridae	*Idaea ochrata*	Bright Wave	10
Geometridae	*Idaea pallidata*	Pale Wave	10
Geometridae	*Idaea politaria*	Dusky-bordered Wave	10
Geometridae	*Idaea seriata*	Small Dusty Wave	10
Geometridae	*Idaea serpentata*	Ochraceous Wave	10
Geometridae	*Lampropteryx suffumata*	Water Carpet	10
Geometridae	*Ligdia adustata*	Scorched Carpet	10
Geometridae	*Lomaspilis marginata*	Clouded Border	10
Geometridae	*Lomographa bimaculata*	White-pinion Spotted	10
Geometridae	*Macaria alternata*	Sharp-angled Peacock	10
Geometridae	*Macaria liturata*	Tawny-barred Angle	10
Geometridae	*Macaria signaria*		10
Geometridae	*Macaria wauaria*	V-moth	10
Geometridae	*Martania (Perizoma) taeniata*	Barred Carpet	10
Geometridae	*Melanthia procellata*	Pretty Chalk Carpet	10
Geometridae	*Mesoleuca albicillata*	Beautiful Carpet	10
Geometridae	*Mesotype (Perizoma) parallelolineata*		10
Geometridae	*Minoa murinata*	Drab Looper	10
Geometridae	*Odontopera bidentata*	Scalloped Hazel	10
Geometridae	*Opisthograptis luteolata*	Brimstone	10
Geometridae	*Ourapteryx sambucaria*	Swallow-tailed Moth	10
Geometridae	*Paradarisa consonaria*	Square Spot	10
Geometridae	*Parectropis similaria*		10
Geometridae	*Pareulype berberata*	Barberry Carpet	10
Geometridae	*Pelurga comitata*	Dark Spinach	10
Geometridae	*Peribatodes rhomboidaria*	Willow Beauty	10

Geometridae	*Peribatodes secundaria*		10
Geometridae	*Perizoma albulata*	Grass Rivulet	10
Geometridae	*Perizoma alchemillata*	Small Rivulet	10
Geometridae	*Perizoma blandiata*	Pretty Pinion	10
Geometridae	*Perizoma flavofasciata*	Sandy Carpet	10
Geometridae	*Perizoma minorata*	Heath rivulet	10
Geometridae	*Plagodis dolobraria*	Scorched Wing	10
Geometridae	*Plagodis pulveraria*	Barred Umber	10
Geometridae	*Plemyria rubiginata*	Blue-bordered Carpet	10
Geometridae	*Pseudopanthera macularia*	Speckled yellow	10
Geometridae	*Pseudoterpna pruinata*	Grass emerald	10
Geometridae	*Pungeleria capreolaria*		10
Geometridae	*Rheumaptera hastata*	Argent and sable	10
Geometridae	*Rheumaptera undulata*	Scallop Shell	10
Geometridae	*Scopula immutata*	Lesser cream wave	10
Geometridae	*Scopula incanata*		10
Geometridae	*Scopula ornata*	Lace Border	10
Geometridae	*Scopula rubiginata*	Tawny wave	10
Geometridae	*Scopula subpunctaria*		10
Geometridae	*Scopula ternata*	Smoky wave	10
Geometridae	*Scopula umbelaria*		10
Geometridae	*Scotopteryx chenopodiata*	Shaded Broad-bar	10
Geometridae	*Selenia dentaria*	Early thorn	10
Geometridae	*Selenia lunularia*	Lunar thorn	10
Geometridae	*Selenia tetralunaria*	Purple thorn	10
Geometridae	*Siona lineata*	Black-veined moth	10
Geometridae	*Spargania luctuata*	White-banded carpet	10
Geometridae	*Synopsia sociaria*		10
Geometridae	*Thalera fimbrialis*	Sussex emerald	10
Geometridae	*Thera variata*	Spruce Carpet	10
Geometridae	*Timandra comae*	Blood-vein	10
Geometridae	*Triphosa dubitata*	Tissue	10
Geometridae	*Venusia (Discoloxia) blomeri*	Blomer's rivulet	10
Geometridae	*Venusia cambrica*	Welsh Wave	10
Geometridae	*Xanthorhoe biriviata*	Balsam Carpet	10
Geometridae	*Xanthorhoe designata*	Flame Carpet	10
Geometridae	*Xanthorhoe ferrugata*	Dark-barred Twin-spot Carpet	10
Geometridae	*Xanthorhoe fluctuata*	Garden carpet	10
Geometridae	*Xanthorhoe montanata*	Silver-ground carpet	10

Geometridae	*Xanthorhoe quadrifasciata*	Large Twin-spot Carpet	10
Geometridae	*Xanthorhoe spadicearia*	Red Twin-spot Carpet	10
Hepialidae	*Hepialus humuli*	Ghost moth	10
Hepialidae	*Phymatopus hecta*	Gold swift	10
Hepialidae	*Triodia sylvina*	Orange swift	10
Lasiocampidae	*Cosmotriche lobulina*		10
Lasiocampidae	*Dendrolimus pini montana*	Pine-tree Lappet	10
Lasiocampidae	*Euthrix potatoria*	Drinker	10
Lasiocampidae	*Gastropacha populifolia*	Poplar lappet	10
Lasiocampidae	*Gastropacha quercifolia*	Lappet	10
Lasiocampidae	*Geometra papilionaria*	Large emerald	10
Lasiocampidae	*Lasiocampa quercus*	Oak eggar	10
Lasiocampidae	*Lasiocampa trifolii*	Grass eggar	10
Lasiocampidae	*Macrothylacia rubi*	Fox moth	
Lasiocampidae	*Malacosoma neustria*	Lackey moth	10
Lasiocampidae	*Odonestis pruni*	Plum Lappet	10
Lasiocampidae	*Phyllodesma tremulifolia*	Aspen Lappet	10
Lasiocampidae	*Poecilocampa populi*	December moth	10
Lasiocampidae	*Trichiura crataegi*	Pale Oak Eggar	10
Lymantriidae	*Arctornis l-nigrum*	Black V Moth	10
Lymantriidae	*Calliteara pudibunda*	Pale Tussock	10
Lymantriidae	*Leucoma salicis*	White Satin Moth	10
Lymantriidae	*Lymantria dispar*	European gypsy moth	10
Lymantriidae	*Lymantria monacha*	Black arches	10,11
Lymantriidae	*Orgyia antiqua*	Rusty Tussock Moth	10
Lymantriidae	*Penthophera morio*		10
Noctuidae	*Abrostola tripartita*	Spectacle	10
Noctuidae	*Abrostola triplasia*	Dark Spectacle	10
Noctuidae	*Acronicta (Viminia) auricoma*	Scarce Dagger	10
Noctuidae	*Acronicta alni*	Alder Moth	10
Noctuidae	*Acronicta leporine*	Miller	10
Noctuidae	*Acronicta rumicis*	Knot Grass	10
Noctuidae	*Acronicta tridens*	Dark Dagger	10
Noctuidae	*Actinotia polyodon*	Purple cloud	10
Noctuidae	*Agrochola lota*	Red-line Quaker	10
Noctuidae	*Agrochola macilenta*	Yellow-line Quaker	10
Noctuidae	*Agrotis clavis*	Heart and club	10
Noctuidae	*Agrotis exclamationis*	Heart and dart	10
Noctuidae	*Agrotis ipsilon*	Dark sword-grass	10

Noctuidae	*Agrotis segetum*	Turnip moth	10
Noctuidae	*Ammoconia caecimacula*		10
Noctuidae	*Amphipoea fucosa*	Saltern Ear	10
Noctuidae	*Amphipoea oculea*	Ear Moth	5,10
Noctuidae	*Amphipyra berbera*	Svensson's Copper Underwing	5
Noctuidae	*Amphipyra perflua*		10
Noctuidae	*Amphipyra pyramidea*	Copper Underwing	5,10
Noctuidae	*Amphipyra tragopoginis*	Mouse Moth	5,10
Noctuidae	*Anaplectoides prasina*	Green Arches	5,100
Noctuidae	*Antitype chi*	Grey chi	10
Noctuidae	*Apamea anceps*		10
Noctuidae	*Apamea crenata*	Clouded-bordered Brindle	10
Noctuidae	*Apamea epomidion*	Clouded Brindle	10
Noctuidae	*Apamea lateritia*	Scarce Brindle	5
Noctuidae	*Apamea lithoxylea*	Light Arches	10
Noctuidae	*Apamea maillardi*		5
Noctuidae	*Apamea monoglypha*	Dark Arches	5,10
Noctuidae	*Apamea oblonga*	Crescent Striped	5
Noctuidae	*Apamea ophiogramma*	Double Lobed	10
Noctuidae	*Apamea remissa*	Dusky brocade	5,10
Noctuidae	*Apamea scolopacina*	Slender Brindle	10
Noctuidae	*Apamea sordens*	Rustic shoulder-knot	10
Noctuidae	*Apamea zeta*		5
Noctuidae	*Apterogenum (Parastichtis) ypsilon*	Dingy Shears	10
Noctuidae	*Archanara dissoluta*	Brown-veined Wainscot	10
Noctuidae	*Atypha pulmonaris*		5,10
Noctuidae	*Autographa bractea*	Gold Spangle	5,10
Noctuidae	*Autographa gamma*	Silver Y	5,10
Noctuidae	*Autographa jota*	Plain Golden Y	5,10
Noctuidae	*Autographa pulchrina*	Beautiful Golden Y	5,10
Noctuidae	*Axylia putris*	Flame	10
Noctuidae	*Brachylomia viminalis*	Minor shoulder-knot	10
Noctuidae	*Callierges ramosa*		10
Noctuidae	*Callistege mi*	Mother Shipton Moth	10
Noctuidae	*Ceramica pisi*	Broom Moth	10
Noctuidae	*Cerapteryx graminis*	Antler moth	5,10
Noctuidae	*Cerastis rubricosa*	Red Chestnut	10
Noctuidae	*Charanyca trigrammica*	Treble Lines	10
Noctuidae	*Chersotis margaritacea*		10

Noctuidae	*Chloantha hyperici*	Pale-shouldered cloud	10
Noctuidae	*Colobochyla salicalis*	European Lesser Belle	10
Noctuidae	*Colocasia coryli*	Nut-tree Tussock	10
Noctuidae	*Cosmia pyralina*	Lunar-spotted Pinion	10
Noctuidae	*Cosmia trapezina*	Dun-bar	5,10
Noctuidae	*Craniophora ligustri*	Coronet	10
Noctuidae	*Cryphia algae*	Tree-lichen Beauty	10
Noctuidae	*Cryphia ereptricula*		10
Noctuidae	*Cucullia chamomillae*	Chamomile Shark	10
Noctuidae	*Cucullia lactucae*	Lettuce Shark	10
Noctuidae	*Cucullia umbratica*	Shark	5,10
Noctuidae	*Deltote deceptoria*	Pretty Marbled	10
Noctuidae	*Diachrysia chrysitis*	Burnished Brass	10
Noctuidae	*Diachrysia tutti*		10
Noctuidae	*Diarsia brunnea*	Purple Clay	5,10
Noctuidae	*Diarsia dahlii*	Barred Chestnut	5
Noctuidae	*Diarsia mendica*	Ingrailed clay	5,10
Noctuidae	*Discestra trifolii*	Nutmeg	5
Noctuidae	*Dypterigia scabriuscula*	Bird’s Wing	10
Noctuidae	*Egira conspicillaris*	Silver Cloud	10
Noctuidae	*Emmelia trabealis*	Spotted Sulphur	10
Noctuidae	*Enargia paleacea*	Angle-striped Sallow	10
Noctuidae	*Epipsilia grisescens*		5
Noctuidae	*Euchalcia variabilis*	Purple-shaded Gem	10
Noctuidae	*Eugraphe sigma*		5,10
Noctuidae	*Euplexia lucipara*	Small angle shades	5,10
Noctuidae	*Eupsilia transversa*	Satellite	10
Noctuidae	*Eurois occulta*	Great Brocade	5,10
Noctuidae	*Euxoa conspicua (agricola)*		5
Noctuidae	*Graphiphora augur*	Double dart / Soothsayer	10
Noctuidae	*Hada plebeja*	Shears	10
Noctuidae	*Hadena (Anepia) perplexa*	Tawny Shears	10
Noctuidae	*Hadena albimacula*	White Spot	10
Noctuidae	*Hadena compta compta*	Varied Coronet	10
Noctuidae	*Hadena confusa*	Marbled Coronet	5
Noctuidae	*Hecatera bicolorata*	Broad-barred white	10
Noctuidae	*Heliophobus reticulata*	Bordered Gothic	5,10
Noctuidae	*Heliothis viriplaca*	Marbled Clover	10
Noctuidae	*Hoplodrina ambigua*	Vine’s Rustic	10

Noctuidae	*Hoplodrina blanda*	Rustic	10
Noctuidae	*Hoplodrina octogenaria (alsines)*	The Uncertain	5,10
Noctuidae	*Hydraecia micacea*	Rosy Rustic	10
Noctuidae	*Hypena crassalis*	Beautiful Snout	10
Noctuidae	*Hypena obesalis*	Paignton Snout	5,10
Noctuidae	*Hypena proboscidalis*	Snout	5,10
Noctuidae	*Hyppa rectilinea*	Saxon	10
Noctuidae	*Idia calvaria*		10
Noctuidae	*Ipimorpha retusa*	Double Kidney	10
Noctuidae	*Ipimorpha subtusa*	Olive	10
Noctuidae	*Lacanobia oleracea*	Bright-line brown-eye	10
Noctuidae	*Lacanobia suasa*	Dog's tooth	10
Noctuidae	*Lacanobia w-latinum*	Light brocade	10
Noctuidae	*Lamprosticta culta*		10
Noctuidae	*Lasionycta imbecilla*		10
Noctuidae	*Laspeyria flexula*	Beautiful Hook-tip	10
Noctuidae	*Leucania comma*	Shoulder-striped wainscot	5,10
Noctuidae	*Lithophane ornithopus*	Grey Shoulder-knot	10
Noctuidae	*Luperina testacea*	Flounced Rustic	10
Noctuidae	*Lygephila pastinum*	Blackneck	10
Noctuidae	*Lygephila viciae*		10
Noctuidae	*Macdunnoughia confusa*	Dewick's Plusia	10
Noctuidae	*Mamestra brassicae*	Cabbage moth	5,10
Noctuidae	*Melanchra persicariae*	Dot moth	10
Noctuidae	*Mesapamea secalis*	Common Rustic	5,10
Noctuidae	*Mesogona acetosellae*	Pale Stigma	10
Noctuidae	*Mesogona oxalina*		10
Noctuidae	*Mniotype (Blepharita) adusta*	Dark Brocade	5,10
Noctuidae	*Mniotype satura*	Beautiful Arches	10
Noctuidae	*Moma alpium*	Scarce Merveille du Jour	10
Noctuidae	*Mythimna (Hyphilare) albipuncta*	White-point	5,10
Noctuidae	*Mythimna (Hyphilare) ferrago*	Clay	5,10
Noctuidae	*Mythimna conigera*		5,10
Noctuidae	*Mythimna impura*	Smoky Wainscot	10
Noctuidae	*Mythimna l-album*	L-album Wainscot	10
Noctuidae	*Mythimna pallens*	Common Wainscot	10
Noctuidae	*Mythimna pudorina*	Striped Wainscot	10
Noctuidae	*Mythimna turca*	Double Line	10
Noctuidae	*Naenia typica*	Gothic	10

Noctuidae	*Noctua fimbriata*	Broad-bordered Yellow Underwing	5,10
Noctuidae	*Noctua interposita*		5
Noctuidae	*Noctua janthina*	Langmaid's Yellow Underwing	10
Noctuidae	*Noctua pronuba*	Large Yellow Underwing	5,10
Noctuidae	*Nycteola revayana*	Oak Nycteoline	10
Noctuidae	*Ochropleura (Dichagyris) flammatra*	Black Collar	5
Noctuidae	*Ochropleura plecta*	Flame shoulder	5,10
Noctuidae	*Oligia latruncula*	Tawny Marbled Minor	10
Noctuidae	*Oligia strigilis*	Marbled minor	10
Noctuidae	*Orthosia cerasi*	Common Quaker	10
Noctuidae	*Orthosia cruda*	Small Quaker	10
Noctuidae	*Orthosia gothica*	Hebrew character	10
Noctuidae	*Orthosia gracilis*	Powdered Quaker	10
Noctuidae	*Orthosia incerta*	Clouded Drab	10
Noctuidae	*Orthosia populeti*	Lead-coloured Drab	10
Noctuidae	*Pachetra sagittigera*	Feathered Ear	5,10
Noctuidae	*Panemeria tenebrata*	Small Yellow Underwing	10
Noctuidae	*Panthea coenobita*		10
Noctuidae	*Paracolax tristalis*	Clay Fan-foot	10
Noctuidae	*Paradrina (Caradrina) clavipalpis*	Pale mottled willow	10
Noctuidae	*Parascotia fuliginaria*	Waved Black	10
Noctuidae	*Parastichtis suspecta*	Suspected	10
Noctuidae	*Pechipogo strigilata*	Common Fan-foot	10
Noctuidae	*Phlogophora meticulosa*	Angle shades	5,10
Noctuidae	*Phlogophora scita*		5,10
Noctuidae	*Photedes captiuncula*	Least Minor	5
Noctuidae	*Photedes minima*	Small Dotted Buff	5,10
Noctuidae	*Phytometra viridaria*	Small Purple-barred	10
Noctuidae	*Plusia festucae*	Gold Spot	10
Noctuidae	*Polia bombycina*	Pale Shining Brown	10
Noctuidae	*Polia hepatica*	Silvery Arches	5,10
Noctuidae	*Polia nebulosa*	Grey Arches	5,10
Noctuidae	*Polychrysia moneta*	Golden Plusia	10
Noctuidae	*Polypogon tentacularia*		5,10
Noctuidae	*Protodeltote pygarga*	Marbled white spot	10
Noctuidae	*Pseudeustrotia candidula*	Shining Marbled	10
Noctuidae	*Pyrrhia umbra*	Bordered Sallow	5,10
Noctuidae	*Rhyacia lucipeta*	Southern Rustic	5
Noctuidae	*Rhyacia simulans*	Dotted Rustic	5

Noctuidae	*Rusina ferruginea*	Brown Rustic	5,10
Noctuidae	*Scoliopteryx libatrix*	Herald	5,10
Noctuidae	*Subcronicta (Acronicta) megacephala*	Poplar Grey	10
Noctuidae	*Syngrapha interrogationis*	Scarce silver Y	5
Noctuidae	*Tholera cespitis*	Hedge Rustic	10
Noctuidae	*Tholera decimalis*	Feathered Gothic	10
Noctuidae	*Trachea atriplicis*	Orache Moth	10
Noctuidae	*Tyta luctuosa*	Tyta	10
Noctuidae	*Xestia baja*	Dotted Clay	10
Noctuidae	*Xestia c-nigrum*	Setaceous Hebrew character	5,10
Noctuidae	*Xestia ditrapezium*	Triple-spotted clay	10
Noctuidae	*Xestia speciosa*		5
Noctuidae	*Xestia triangulum*	Double square-spot	10
Noctuidae	*Xestia xanthographa*	Square-spot rustic	10
Noctuidae	*Xylena vetusta*	Red Sword-grass	10
Noctuidae	*Zanclognata lunalis*	Jubilee Fan-foot	10
Noctuidae	*Zanclognatha tarsipennalis*		10
Nolidae	*Bena bicolorana*	Scarce Silver-lines	10
Nolidae	*Meganola albula*	Kent Black Arches	10
Nolidae	*Meganola strigula*	Small Black Arches	10
Nolidae	*Pseudoips prasinana*	Green Silver-lines	10
Notodontidae	*Cerura erminea*	Lesser puss	10
Notodontidae	*Clostera anastomosis*	Fan-foot	10
Notodontidae	*Clostera pigra*	Small Chocolate-tip	10
Notodontidae	*Drymonia dodonaea*	Marbled Brown	10
Notodontidae	*Drymonia obliterata*	Indistinct Marbled Brown	10
Notodontidae	*Furcula bifida*	Poplar kitten	10
Notodontidae	*Gluphasia crenata*	Dusky Marbled Brown	10
Notodontidae	*Notodonta dromedarius*	Iron Prominent	10
Notodontidae	*Notodonta tritophus*	Three-humped Prominent	10
Notodontidae	*Notodonta ziczac*	Pebble Prominent	10
Notodontidae	*Phalera bucephala*	Buff-tip	10
Notodontidae	*Pheosia gnoma*	Lesser Swallow Prominent	10
Notodontidae	*Pheosia tremula*	Swallow Prominent	10
Notodontidae	*Pterostoma palpina*	Pale Prominent	10
Notodontidae	*Ptilodon capucina*	Coxcomb prominent	10
Notodontidae	*Ptilodon cucullina*	Maple Prominent	10
Notodontidae	*Spatalia argentina*	Argentine	10
Notodontidae	*Stauropus fagi*	Lobster moth	10

Psychidae	*Megalophanes viciella*		10
Psychidae	*Sterrhopterix fusca*		10
Saturniidae	*Aglia tau*	Tau emperor	10
Sesiidae	*Sesia apiformis*	Hornet moth	10
Sesiidae	*Synanthedon tipuliformis*	Currant clearwing	10
Sphingidae	*Acherontia atropos*	Death's-head Hawk moth	10
Sphingidae	*Agrius convolvuli*	Convolvulus Hawk-moth	10
Sphingidae	*Deilephila elpenor*	Elephant Hawk-moth	10
Sphingidae	*Deilephila porcellus*	Small Elephant Hawk-moth	10
Sphingidae	*Hemaris fuciformis*	Broad-bordered bee hawk-moth	10
Sphingidae	*Hemaris tityus*	Narrow-bordered bee hawk-moth	10
Sphingidae	*Hyles euphorbiae*	Spurge Hawk-moth	10
Sphingidae	*Laothoe populi*	Poplar hawk-moth	10
Sphingidae	*Macroglossum stellatarum*	Hummingbird hawk-moth	10
Sphingidae	*Mimas tiliae*	Lime hawk moth	10
Sphingidae	*Smerinthus ocellata*	Eyed hawk-moth	10
Sphingidae	*Sphinx (Hyloicus) pinastri pinastri*	Pine hawk-moth	10
Sphingidae	*Sphinx ligustri*	Privet Hawk Moth	10
Tortricidae	*Argyroploce noricanus*		6
Tortricidae	*Phtheochroa drenowskyi*		8
Zygaenidae	*Adscita (Jordanita) statices*	Green Forester	10
Zygaenidae	*Zygaena filipendulae*	Six-spot burnet	10
Zygaenidae	*Zygaena purpuralis*	Transparent bunet	10
Zygaenidae	*Zygaena viciae*	New Forest burne	10

Sources: 1 = N2000 ROSCI0122, 1b = N2000 ROSCI0112 MT, 3 = Cuvelier & Dinca 2007, 5 = GBIF, 6 = Levente 2010, 7 = Kovacs & Kovacs 2001, 8 = Kovacs & Kovacs 2003-2004, 9 = Stanca-Moise 2015, 10 = Promberger 2006, 11 = Nicolae 2012

Table A8 Spiders present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Family	*Scientific name*	Common name	Source
Agelenidae	*Agelena gracilens*		1
Agelenidae	*Coelotes terrestris*	funnel-web spider	1
Agelenidae	*Histopona torpida*	funnel-web spider	1
Amaurobiidae	*Callobius claustrarius*		1
Amaurobiidae	*Callobius claustrarius*		1
Amaurobiidae	*Eurocoelotes inermis*		1
Araneidae	*Aculepeira ceropegia*	Oak Spider	1
Araneidae	*Agalenatea redii*	orbweavers	1
Araneidae	*Araneus quadratus*	Four-spot orb-weaver	1
Araneidae	*Araniella cucurbitina*	Cucumber green spider	1
Araneidae	*Argiope bruennichi*	Wasp spider	1
Araneidae	*Mangora acalypha*	Cricket-bat orb weaver	1
Araneidae	*Singa hamata*		1
Linyphiidae	*Dicymbium nigrum*		1
Linyphiidae	*Linyphia triangularis*		1
Linyphiidae	*Microneta viaria*		1
Linyphiidae	*Neriene emphana*		1
Linyphiidae	*Neriene montana*		1
Linyphiidae	*Tenuiphantes tenebricola*		1
Linyphiidae	*Walckenaeria atrotibialis*		1
Lycosidae	*Alopecos acccentuata*	wolf spider	1
Lycosidae	*Alopecosa pulverulenta*	wolf spider	1
Lycosidae	*Trochosa terricola*	Ground wolf-spider	1
Lycosidae	*Xerolycosa nemoralis*	Burnt wolf-spider	1
Lycosidae	*Pardosa alacris*		1
Lycosidae	*Pardosa amentata*	Spotted wolf spider	1
Lycosidae	*Pardosa hortenisis*		1
Lycosidae	*Pardosa lugubris*		1
Lycosidae	*Pardosa palustris*		1
Pisauridae	*Pisaura mirabilis*	Nursery web spider	1
Salticidae	*Evarcha arcuata*	jumping spider	1
Salticidae	*Heliophanus cupreus*	jumping spider	1
Segestriidae	*Sagestria senoculata*	Snake-back spider	1
Tetragnathidae	*Metellina segmentata*		1
Tetragnathidae	*Pachygnatha degeeri*	long-jawed orb weavers	1
Theridiidae	*Enoplognatha ovata*		1
Theridiidae	*Euryopis flavomaculata*	tangle-web spider	1

Theridiidae	*Theridion impressum*		1
Thomisidae	*Misumena vatia*	crab spider	1
Zoridae	*Zora silvestris*		1

Source: 1 = Promberger 2006

Table A9 Beetles present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Family name	***Scientific Name***	**Common name**	**Source**
Aleocharinae	*Tectusa transsylvanica (Oxpoda montana)*		3
Athoinae	*Harminius undulatus*		4
Bostrichidae	*Stephanopachys substriatus*	Powder post	1
Buprestidae	*Acmaeoderella flavofasciata*		4
Buprestidae	*Anthaxia podolica*		4
Buprestidae	*Capnodis tenebrionis*		4
Buprestidae	*Chrysobothris affinis*		4
Buprestidae	*Coraebus elatus*		4
Buprestidae	*Dicerca alni*		4
Buprestidae	*Dicerca berolinensis*		4
Buprestidae	*Eurythyrea austriaca*		4
Buprestidae	*Melanophila acuminata*		4
Buprestidae	*Perotis lugubris*		4
Buprestidae	*Phaenops knoteki*		4
Buprestinae	*Buprestis haemorrhoidalis*		4
Cantharidae	*Rhagonycha fulva*	Common red soldier beetle	4
Carabidae	*Calathus metallicus*		2
Carabidae	*Calosoma inquisitor*	Lesser searcher beetle	4
Carabidae	*Carabus (Carabus) granulatus*		4
Carabidae	*Carabus (Megodontus) planicollis*		2
Carabidae	*Carabus (Megodontus) violaceus mehelyi*		2
Carabidae	*Carabus (Oreocarabus) glabratus*		4
Carabidae	*Carabus (Tomocarabus) convexus*		4
Carabidae	*Carabus cancellatus*		4
Carabidae	*Carabus coriaceus*		4
Carabidae	*Carabus hampei*		1
Carabidae	*Carabus variolosus*		4
Carabidae	*Chrysocarabus auronitens escheri*		2
Carabidae	*Cicindela silvicola*		4
Carabidae	*Cychrus caraboides*		4
Carabidae	*Cychrus rostratus pygmaeus*		2
Carabidae	*Cychrus semigranosus*		4
Carabidae	*Cychrus semigranosus*		4
Carabidae	*Orinocarabus linnaei macaierei*		2
Carabidae	*Orinocarabus sylvetris transylvanicus*		2
Carabidae	*Platycarabus irregularis montandoni*		2

Carabidae	*Platynus glaciale*		2
Carabidae	*Pterostichus findeli*		2
Carabidae	*Pterostichus foveolatus interruptestriatus*		2
Carabidae	*Pterostichus kokeili*		2
Carabidae	*Pterostichus pilosus*		2
Carabidae	*Pterostichus rufitarsis*		2
Carabidae	*Pterostichus unctulatus*		2
Carabidae	*Zabrus tenebrioides*		5
Cerambycidae	*Anoplodera sexguttata*		4
Cerambycidae	*Callidium violaceum*		4
Cerambycidae	*Chlorophorus herbsti*		4
Cerambycidae	*Dinoptera colaris*		4
Cerambycidae	*Exocentrus adspersus*		4
Cerambycidae	*Gaurotes (Carilia) virginea*		4
Cerambycidae	*Grammoptera ruficornis*		4
Cerambycidae	*Hylotrupes bajulus*	European house borer	4
Cerambycidae	*Judolia sexmaculata*		4
Cerambycidae	*Leptura quadrifasciata*	Longhorn beetle	4
Cerambycidae	*Morimus funereus*		1
Cerambycidae	*Necydalis major*		4
Cerambycidae	*Oxymirus cursor*		4
Cerambycidae	*Pidonia lurida*		5
Cerambycidae	*Plagionotus detritus*		4
Cerambycidae	*Prionus coriarius*	Tanner longhorn	4
Cerambycidae	*Rhagium inquisitor*		4
Cerambycidae	*Rhagium mordax*		4
Cerambycidae	*Rhagium sycophanta*		4
Cerambycidae	*Rhamnusium bicolor*		4
Cerambycidae	*Rosalia alpina*	Rosalia longicorn	1
Cerambycidae	*Rutpela maculata*	Spotted Longhorn	4
Cerambycidae	*Stenopterus rufus*		4
Cerambycidae	*Stenurella bifasciata*		4
Cerambycidae	*Stenurella melanura*		4
Cerambycidae	*Stenurella melanura*		4
Cerambycidae	*Stictoleptura erythroptera*		4
Cerambycidae	*Compsidia populnea*		4
Cerambycidae	*Saperda scalaris*		4
Cerambycidae	*Stictoleptura scutellata*		4
Cerambycinae	*Obrium brunneum*		4

Chrysomelidae	*Agelastica alni*	Alder leaf beetle	5
Chrysomelidae	*Chrysolina olivieri*		4
Chrysomelidae	*Chrysolina polita*		4
Chrysomelidae	*Chrysomela populi*		4
Chrysomelidae	*Cryptocephalus moraei*		4
Chrysomelidae	*Cryptocephalus sericeus*		4
Chrysomelidae	*Cryptocephalus violaceus*		4
Chrysomelidae	*Oreina gloriosa*		5
Cleridae	*Trichodes apiarius*		4
Curculionidae	*Curculio glandium*	Acorn weevil	4
Curculionidae	*Donus oxalis*		4
Curculionidae	*Larinus jaceae*		4
Curculionidae	*Larinus planus*		4
Curculionidae	*Larinus turbinatus*		4
Curculionidae	*Lepyrus palustris*		4
Curculionidae	*Liparus glabrirostris*		4
Curculionidae	*Miarus monticola*		4
Curculionidae	*Rhynchaenus fagi*		4
Curculionidae	*Sitona lineatus*		4
Elateridae	*Agripnus murinus*		4
Geotrupidae	*Anaplotrupes stercorosus*		4,5
Geotrupidae	*Geotrupes stercorarius*		4
Lamiinae	*Dorcadion pedestre*		4
Lamiinae	*Dorcadion scopolii*		4
Lepturinae	*Anoplodera rufipes*		4
Lepturinae	*Cortodera femorata*		4
Lepturinae	*Strangalia attenuata*		4
Lucanidae	*Dorcus parallelipipedus*	Lesser stag beetle	4
Lucanidae	*Lucanus cervus*	Stag Beetle	1,1a,1c,4
Lucanidae	*Platycerus caraboides*		4
Meloidae	*Meloe violaceus*	Violet oil beetle	4
Rutelidae	*Anisoplia segetum*		4
Scarabaeidae	*Aphodius depressus*		4
Scarabaeidae	*Aphodius distinctus*		4
Scarabaeidae	*Aphodius fimetarius*		4
Scarabaeidae	*Aphodius rufipes*		4
Scarabaeidae	*Cetonia aurata*	Rose chafer	4,5
Scarabaeidae	*Gnorimus nobilis*	Noble chafer	4
Scarabaeidae	*Melolontha melolontha*		5

Scarabaeidae	*Melolontha melolontha*		4
Scarabaeidae	*Osmoderma eremita*	Russian leather beetle	1
Scarabaeidae	*Protaetia (Liocola) lugubris*		4
Scarabaeidae	*Trichius fasciatus*		4
Scarabaeoidea	*Copris minutus*		5
Scarabaeoidea	*Mimela aurata*		4
Scarabaeoidea	*Odontaeus armiger*		4
Scarabaeoidea	*Pleurophorus caesus*		4
Silphidae	*Nicrophorus investigator*		4
Silphidae	*Nicrophorus vespilloides*		4
Tenebrionidae	*Lagria hirta*		4

Source: 1 = N2000 ROSCI0122, 1a = N2000 ROSCI0352, 1c = N2000 ROSCI0304, 2 = Barloy & Prunar 2010, 3 = Zerche 2007, 4 = Promberger 2006, 5 = Nicolae 2012

Table A10 Mosses and liverworts present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Family	Scientific Name	Common name	Source
Amblystegiaceae	*Hamatocaulis (Drepanocladus) vernicosus*	Slender green feather moss	1
Amblystegiaceae	*Hamatocaulis vernicosus.*	Slender green feather-moss	12
Aneuraceae	*Aneura maxima*		2
Aneuraceae	*Pseudoneura (Riccardia) multifida*	Liverwort	2
Aulacomniaceae	*Aulacomnium palustre*	Ribbed bog moss	2
Bryaceae	*Bryum pseudotriquetrum*		17
Calypogeiaceae	*Calypogeia fissa*	Liverwort	2
Cephaloziaceae	*Cephalozia connivens*	Liverwort	2
Dicranaceae	*Dicranum scoparium*	Broom moss	17
Dicranaceae	*Diobelonella (Dichodontium) palustris*		17
Fontinalaceae	*Fontinalis antipyretica*	Common water moss	17,18
Huperziaceae	*Huperzia (Lycopodium) selago*		1,17,18
Hylocomiaceae	*Pleurozium schreberi*	Schreber's big red stem moss	2
Hylocomiaceae	*Hylocomium brachitecium*		17
Jungermanniaceae	*Jungermannia polaris (borealis)*		13
Lophocoleaceae	*Lophocolea bidentata*	Bifid crestwort	2
Lycopodiaceae	*Lycopodium annotinum*	Bristly club-moss	1
Lycopodiaceae	*Lycopodium clavatum*	Wolf's-foot clubmoss	1,16,17
Lycopodiaceae	*Lycopodium complanatum*	Groundcedar	1,16
Meesiaceae	*Meesia longiseta*	Long seta hump moss	1
Mniaceae	*Mnium sp.*	Calcareous moss	17
Pallaviciniaceae	*Pallavicinia lyellii*	Liverwort	2
Plagiotheciaceae	*Plagiothecium denticulatum*		2
Plagiotheciaceae	*Atrichum undulatum*	Common smoothcap	18
Polytrichaceae	*Polytrichum commune*	Common haircap moss	16,18
Polytrichaceae	*Polytrichum formosum*	Hair Cap Moss	16,18
Polytrichaceae	*Polytrichum strictum*	Bog haircap moss	2
Rhabdoweisiaceae	*Rhabdoweisia crenulata*	Himalayan ribbed-weissia	10
Sphagnaceae	*Sphagnum compactum*		2
Sphagnaceae	*Sphagnum corymbosum*		17
Sphagnaceae	*Sphagnum magellanicum*	Magellan's peatmoss	2

Source: 1 = N2000 ROSCI0112, 2 = Stefanut 2012, 10 = Novotny 2002, 12 = Papp et al. 2015, 13 = Stefanut 2014, 16 = Promberger 2006, 17 = Nicolae 2012, 18 = Nicolae 2013

Table A11 Fungi present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Family	Scientific Name	Common name	Source
Agaricaceae (Lycoperdaceae)	*Calvatia (Bovista) gigantea*	Giant puffball	17
Amanitaceae	*Amanita muscaria*	Fly agaric	17
Amanitaceae	*Amanita phalloides*	Deathcap	17
Boletaceae	*Boletus edulis*	Porcino	17
Boletaceae	*Leccinum* sp	Leccinum	
Boletaceae	*Rubroboletus (Boletus) satanas*	Satan's bolete	17
Bondarzewiaceae	*Heterobasidion annosum (Fomes annosus)*	Annosum root rot	17
Cantharellaceae	*Cantharellus cibarius*	Chanterelle	17
Cystopteridaceae	*Gymnocarpium dryopteris*	Western Oakfern	16
Hymenochaetaceae	*Phellinus igniarus*	Willow bracket	17
Morchellaceae	*Morchella esculenta*	Common morel	17
Physalacriaceae	*Armillaria mellea*	Honey fungus	17
Polyporaceae	*Fomes fomentarius*	Tinder fungus	16
Polyporaceae	*Trametes (Polyporus) versicolor*	Turkey tail	16
Russulaceae	*Lactarius piperatus*	Peppery milk-cap	17
Russulaceae	*Russula virescens*	Green brittlegill	17
Russulaceae	*Lactarius deliciosus*	Saffron milk cap	17
Russulaceae	*Russula emetica*	Vomiting russula	17
Strophariaceae	*Kuehneromyces sp*		

Sources: 16 = Promberger 2006, 17 = Nicolae 2012

Table A12 Ferns present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Blechnaceae (Polypodiaceae)	*Blechnum spicant*	Deer fern	16
Cystopteridaceae	*Cystopteris fragilis*	Brittle bladder-fern	5
Dennstaedtiaceae	*Pteridium aquilinium*	Bracken	16,17
Dryopteridaceae	*Dryopteris affinis*	Scaly male fern	16
Dryopteridaceae	*Dryopteris expansa*	Alpine buckler fern	16
Dryopteridaceae	*Dryopteris filix-mas*	Male fern	16,17,18
Dryopteridaceae	*Dryopteris viridis*		17,18
Dryopteridaceae	*Polystichum braunii*	Braun's holly fern	16, 17,18
Dryopteridaceae	*Polystichum lonchitis*	Northern holly fern	17,18
Ophioglossaceae	*Botrychium (Sceptridium) multifidum*	Leathery grape-fern	1,16
Ophioglossaceae	*Botrychium matricariifolium*	Chamomile grape-fern	1
Woodsiaceae (Polypodiaceae) (Aspleniaceae)	*Athyrium filix-femina*	Lady fern	16,18
Aspleniaceae (Polypodiaceae)	*Asplenium scolopendrium*	Hart's tongue fern	16
Dryopteridaceae	*Polystichum aculeatum*	Hard Shield Fern	16
Onocleaceae	*Matteuccia struthiopteris*	Fiddlehead ferns	17
Thelypteridaceae	*Phegopteris connectilis (Dryopteris fegopteris)*	Long beechfern	16,18
Thelypteridaceae	*Thelypteris confluens (palustris)*	Eastern marsh fern	2

Sources: 1 = N2000 ROSCI0112, 2 = Stefanut 2012, 5 = Ronikier 2010, 16 = Promberger 2006, 17 = Nicolae 2012, 18 = Nicolae 2013

Table A13 Flowering plants present within Muntii Fagaras Site of Community Interest, southern Carpathians, Romania

Family	Scientific Name	Common name	Source
Aceraceae (Sapindaceae)	*Acer campestre*	Field maple	16
Aceraceae (Sapindaceae)	*Acer platanoides*	Norway maple	16
Aceraceae (Sapindaceae)	*Acer pseudoplatanus*	Sycamore	16,17,18
Adoxaceae	*Adoxa moschatellina*	Moschatel/ five-faced bishop	16
Adoxaceae	*Sambucus ebulus*	Dwarf elder	16
Adoxaceae	*Sambucus nigra*	Elder	16
Adoxaceae	*Sambucus racemosa*	Red elderberry	16,17,18
Adoxaceae	*Viburnum lantana*	Wayfaring tree	16
Adoxaceae	*Viburnum opulus*	Guelder-rose	16
Alismataceae	*Alisma plantago-aquatica*	European water-plantain / Mad-dog weed	16
Amaranthaceae	*Amaranthus powellii*	Powell's amaranth	16
Amaranthaceae (Chenopodiaceae)	*Atriplex patula*	Common Orache	16
Amaryllidaceae	*Galanthus nivalis*	Snowdrop	1,16
Amaryllidaceae	*Allium schoenoprasum ssp. sibiricum*	Siberian chives	1,6
Amaryllidaceae	*Allium victorialis*	Alpine leek	1
Amaryllidaceae (Alliaceae)	*Allium ursinum*	Bear garlic	16
Apiaceae	*Aegopodium podagraria*	ground elder /herb gerard	16
Apiaceae	*Angelica archangelica*	Garden angelica	1,18
Apiaceae	*Angelica sylvestris*	Wild angelica	16,18
Apiaceae	*Anthriscus nitida*	Chervil	16
Apiaceae	*Athamanta turbith ssp. hungarica*		1
Apiaceae	*Carum carvi*	Caraway	16,17,18
Apiaceae	*Chaerophyllum aromaticum*		16
Apiaceae	*Chaerophyllum bulbosum*	Turnip-rooted chervil	16
Apiaceae	*Chaerophyllum hirsutum*	Hairy chevril	16
Apiaceae	*Conioselinum tataricum*	Hemlock parsley	1
Apiaceae	*Daucus carota*	Wild carrot	16
Apiaceae	*Heracleum carpaticum*		15
Apiaceae	*Heracleum palmatum*		1,16,17,18
Apiaceae	*Heracleum spondylium*	Common hogweed	1,16,17,18
Apiaceae	*Laserpitium prutenicum*		16
Apiaceae	*Mutellina adonidifolia*		6
Apiaceae	*Oenanthe aquatica*	Water dropworts	16

Apiaceae	*Oenanthe banatica*		16
Apiaceae	*Peucedanum oreoselinum*		16
Apiaceae	*Peucedanum palustre*	Marsh hog's fennel	1b
Apiaceae	*Pimpinella saxifraga*	Burnet-saxifrage	16
Apiaceae	*Pleurospermum austriacum*		1
Apiaceae	*Sanicula elata (europaea)*	Wood sanicle	16
Apiaceae	*Selinum carvifolia*	Cambridge Milk Parsley	16
Apiaceae	*Seseli anuum*		16
Apiaceae	*Torilis japonica*	Japanese hedge parsley	16
Apiaceae	*Cicuta virosa*	Northern water hemlock / cowbane	17,18
Araceae	*Arum maculatum*	Snakeshead	18
Asparagaceae	*Maianthemum bifolium*	False lily of the valle	16
Asparagaceae	*Polygonatum multiflorum*	Solomon's seal	16
Asparagaceae	*Polygonatum verticillatum*	Whorled Solomon's-seal	16
Aspleniaceae (Polypodiaceae)	*Asplenium trichomanes*	Maidenhair spleenwort	17
Aspleniaceae (Polypodiaceae)	*Asplenium viride*	Green spleenwort	17
Balsaminaceae	*Impatiens glandulifera*	Himalayan Balsam	16
Balsaminaceae	*Impatiens noli-tangere*	Touch-me-not balsam	16,17,18
Balsaminaceae	*Impatiens parviflora*	Small Balsam	16
Betulaceae	*Alnus glutinosa*	Alder	16
Betulaceae	*Alnus incana*	Grey alder	16,17
Betulaceae	*Betula pendula*	Silver birch	16,17,18
Betulaceae	*Betula pubescens*	Downy birch	1b
Betulaceae	*Carpinus betulus*	European hornbeam	16
Betulaceae	*Corynus avellana,*	Common hazel	18
Betulaceae	*Alnus viridis*	Green alder	17,18
Betulaceae	*Corylus avellana*	Common hazel	16,17
Boraginaceae	*Anchusa officinalis*	Common bugloss	16
Boraginaceae	*Cerinthe glabra*	Honeywort	1
Boraginaceae	*Echium vulgare*	Viper's Bugloss / Blueweed	16
Boraginaceae	*Eritrichium nanum jankae*	Arctic alpine forget-me-not	1
Boraginaceae	*Myosotis arvensis*	Field Forget-me-not	16
Boraginaceae	*Myosotis scorpioides (palustris)*	True forget-me-not	16.17,18
Boraginaceae	*Myosotis sylvatica*	Wood forget-me-not	16
Boraginaceae	*Pulmonaria officinalis*	Lungwort	16,17,18
Boraginaceae	*Pulmonaria rubra*		16,17,18
Boraginaceae	*Symphytum cordatum*		1,16,17,18
Boraginaceae	*Symphytum officinale*	Common comfrey	16
Boraginaceae	*Symphytum tuberosum nodosum*	Tuberous comfrey	16
Brasicaceae	*Bunias orientalis*	Turkish warty-cabbage	16
Brasicaceae	*Capsella bursa-pastoris*	Shepherd's Purse	16

Brasicaceae	*Cardamine amara*	Bittercress	16,17
Brasicaceae	*Cardamine flexuosa*	Wavy Bittercress	16
Brasicaceae	*Cardamine pratensis*	Cuckooflowerог / Lady's smock	6,16
Brasicaceae	*Cardamine resedifolia*		1,6
Brasicaceae	*Dentaria bulbifera*	European bittercress	16
Brasicaceae	*Dentaria glandulosa*	Toothwort	16,18
Brasicaceae	*Raphanus raphanistrum*	Wild radish	16
Brasicaceae	*Rorippa pyrenaica*		16
Brasicaceae	*Rorippa sylvestris*	Creeping yellowcress	16
Brassicaceae	*Aethionema saxatile*	burnt candytuft	1
Brassicaceae	*Arabidopsis (Cardaminopsis) neglecta*	Rockcress	1,6
Brassicaceae	*Arabidopsis halleri*	Rockcress	6
Brassicaceae	*Arabis alpina*	Alpine rockcress	5
Brassicaceae	*Arabis soyeri subcoriacaea*		1
Brassicaceae	*Armoracia rusticana*	Horseradish	16
Brassicaceae	*Barbarea vulgaris*	Bittercress	16
Brassicaceae	*Draba fladnizensis*	Arctic draba	1
Brassicaceae	*Draba kotschyi*		1
Brassicaceae	*Draba lasiocarpa*		1
Brassicaceae	*Hesperis matronalis cladotricha*		1
Brassicaceae	*Hesperis matronalis nivea (candida)*		1
Brassicaceae	*Hornungia (Hutchinsia) alpina brevicaulis*		1
Brassicaceae	*Hornungia (Pritzelago) alpina*		5
Brassicaceae	*Lunaria rediviva*	Perennial honesty	16
Brassicaceae	*Thlaspi dacicum*		1
Brassicaceae	*Cardamine (Dentaria) glandulifera*		17,18
Brassicaceae	*Cardamine glauca*		11
Brassicaceae	*Cardamine opizii*		17
Campanulaceae	*Campanula (Symphyandra) wanneri*	Wanner's harebell	1
Campanulaceae	*Campanula cervicaria*	Bristly bellflower	16
Campanulaceae	*Campanula glomerata*	Clustered bellflower	6,16
Campanulaceae	*Campanula latifolia*	Giant bellflower	16
Campanulaceae	*Campanula patula*	Spreading bellflower	6,16,17,18
Campanulaceae	*Campanula rapunculoides*	Creeping bellflower	16
Campanulaceae	*Campanula rotundifolia ssp. polymorpha*	Harebell	1
Campanulaceae	*Campanula serrata*		1,6
Campanulaceae	*Campanula transsilvanica*	Transsylvanian bellflower	1
Campanulaceae	*Phyteuma confusum*		1,6
Campanulaceae	*Phyteuma spicatum*	Spiked Rampion	1
Campanulaceae	*Phyteuma vagneri*		1,6
Campanulaceae	*Campanula abietina*		17,18
Campanulaceae	*Campanula alpina*		3,6
Campanulaceae	*Campanula carpatica*	Carpathian harebell	1
Campanulaceae	*Campanula persicifolia*	Peach-leaved bellflower	17

Cannabaceae	*Humulus lupulus*	Common hop	16
Caprifoliaceae	*Knautia arvensis*	Field Scabious	16
Caprifoliaceae	*Knautia drymeia*	Hungarian Widow Flower	1
Caprifoliaceae	*Lonicera caerulea*	Blue-berried honeysuckle	1
Caprifoliaceae	*Scabiosa lucida barbata*	Glossy scabious	1
Caprifoliaceae	*Scabiosa ochroleuca*	Cream scabious	16
Caprifoliaceae	*Succisa pratensis*	Devil's-bit scabious	16
Caprifoliaceae	*Lonicera nigra*	Black Berried Honeysuckle	17
Caprifoliaceae	*Lonicera xylosteum*	Fly honeysuckle	18
Caprifoliaceae	*Valeriana officinalis*	Valerian	16,17,18
Caprifoliaceae	*Valeriana tripteris*		17
Caryophyllaceae	*Scleranthus anuus*		16
Caryophyllaceae	*Arenaria biflora*		1,6
Caryophyllaceae	*Arenaria serpylifolia*	Thyme-leaved sandwort	16
Caryophyllaceae	*Cerastium (holosteoides) fontanum vulgare*	Mouse-ear chickweed	16
Caryophyllaceae	*Cerastium alpinum lanatum*	Alpine mouse-ear	5
Caryophyllaceae	*Cerastium arvense lerchenfeldianum*	Field mouse-ear	1
Caryophyllaceae	*Cerastium fontanum macrocarpum*	Mouse-ear chickweed	1
Caryophyllaceae	*Cerastium sylvaticum*		16
Caryophyllaceae	*Cerastium transsilvanicum*		1
Caryophyllaceae	*Dianthus armeria armeria*	Grass Pink	16
Caryophyllaceae	*Dianthus barbatus compactus*	Sweet William	1
Caryophyllaceae	*Dianthus carthusianorum tenuifolius*	Carthusian Pink	1,16,17
Caryophyllaceae	*Dianthus giganteus banaticus*		1
Caryophyllaceae	*Dianthus glacialis gelidus*	Glacier pink	1,6
Caryophyllaceae	*Dianthus henteri*		1
Caryophyllaceae	*Dianthus spiculifolius*		1
Caryophyllaceae	*Dianthus superbus*	Large Pink	1,16
Caryophyllaceae	*Gypsophila muralis* L.		16
Caryophyllaceae	*Gypsophila petraea*		1
Caryophyllaceae	*Heliosperma pusillum*		5
Caryophyllaceae	*Lychnis flos-cuculi*	Ragged-Robin	16,17
Caryophyllaceae	*Minuartia austriaca*	Sandworts	1
Caryophyllaceae	*Minuartia hirsuta frutescens*	Sandworts	1
Caryophyllaceae	*Minuartia laricifolia*	Sandworts	1
Caryophyllaceae	*Minuartia verna*	Spring sandworts	6
Caryophyllaceae	*Moehringia trinervia*	Apetalous sandwort	16
Caryophyllaceae	*Myosoton aquaticum*	Water Chickweed	16
Caryophyllaceae	*Sagina procumbens*	Procumbent pearlwort	16
Caryophyllaceae	*Sagina saginoides*	Arctic pearlwort	1
Caryophyllaceae	*Saponaria officinalis*	Common soapwort	16
Caryophyllaceae	*Saponaria pumilio*	Pygmy Pink	1,8
Caryophyllaceae	*Silene (Cucubalus) baccifer*	Berry-bearing catchfly	16

Caryophyllaceae	*Silene (Lychnis) viscaria / Silene (Viscaria) vulgaris*	Sticky Catchfly	16, 17, 18
Caryophyllaceae	*Stellaria graminea*	Common starwort	16,17
Caryophyllaceae	*Stellaria holostea*	Greater stitchwort	16,18
Caryophyllaceae	*Stellaria media*	Common chickweed	16,17,18
Caryophyllaceae	*Stellaria nemorum*	Wood stitchwort	16,17,18
Caryophyllaceae	*Silene dinarica*		1,6,7
Caryophyllaceae	*Silene dioica*	Red campion	17
Caryophyllaceae	*Silene italica*	Italian Catchfly	16
Caryophyllaceae	*Silene lerchenfeldiana*		1
Caryophyllaceae	*Silene nutans dubia*		16
Caryophyllaceae	*Silene nutans nutans*	Nottingham catchfly	16
Caryophyllaceae	*Silene zawadzkii*	Zawadzky's catchfly	1,3
Chenopodiaceae	*Chenopodium album*	Lamb's quarters	16
Cistaceae	*Helianthemum numularium nummularium*	Common rock-rose	16
Compositae	*Achillea collina*		16
Compositae	*Achillea distans*	Alps yarrow	16
Compositae	*Achillea millefolium*	Milfoil / Yarrow	16,18
Compositae	*Achillea oxyloba schurii*		1
Compositae	*Achillea ptarmica*	Sneezewort	16
Compositae	*Adenostyles alliariae ssp. hybrida*		1
Compositae	*Antennaria dioica*	Catsfoot / Cudweed	16
Compositae	*Anthemis carpatica*	Snow carpet	1,5
Compositae	*Anthemis macrantha*		1
Compositae	*Arctium lappa*	Greater burdock	16,17
Compositae	*Arctium tomentosum*	Woolly burdock	17
Compositae	*Arnica montana*	Leopards's bane / Mountain tobacco	1
Compositae	*Artemisia eriantha*		1,5
Compositae	*Artemisia umbelliformis*	White Genepì	6
Compositae	*Artemisia vulgaris*	Mugwort	16
Compositae	*Bellis perennis*	Common daisy	16,17
Compositae	*Bidens cernua*	Nodding bur-marigold	16
Compositae	*Bidens tripartita*	Trifid Bur-marigold	16
Compositae	*Carduus acanthoides*	Spiny plumeless thistle	16,18
Compositae	*Carduus nutans*	Musk thistle	18
Compositae	*Carduus personata*	Plumeless thistle	16
Compositae	*Carlina acaulis*	Stemless carline thistle	16
Compositae	*Carlina vulgaris*	Carline thistle	16
Compositae	*Centaurea jacea*	Brown knapweed	16
Compositae	*Centaurea maculosa (bibersteinii)*	Spotted knapweed	16
Compositae	*Centaurea melanocalathia*		16
Compositae	*Centaurea nigrescens*	Tyrol knapweed	16
Compositae	*Centaurea phrygia*	Wig knapweed	16

Compositae	*Centaurea stoebe*		16
Compositae	*Cichoryum inthybus*	Common chicory	16
Compositae	*Cirsium arvense*	Creeping thistle	6,16,18
Compositae	*Cirsium oleraceum*	Cabbage thistle	16,17
Compositae	*Cirsium rivulare*		16
Compositae	*Cirsium vulgare*	Bull thistle	16
Compositae	*Conium maculatum*		16
Compositae	*Crepis biennis*	Rough hawksbeard	16,18
Compositae	*Crepis conyzifolia*		1
Compositae	*Crepis foetida*	Stinking hawksbeard	18
Compositae	*Crepis paludosa*	Marsh hawk's-beard	16
Compositae	*Doronicum austriacum*	Leopard's bane	16
Compositae	*Doronicum carpaticum*		1,5,6
Compositae	*Erigeron acris*	Bitter fleasbane	16
Compositae	*Erigeron alpinus*	Alpine fleabane	1
Compositae	*Erigeron anuus*	Annual fleabane	16
Compositae	*Erigeron atticus*	Greek Fleabane	1
Compositae	*Erigeron uniflorus*	One-flower fleabane.	1
Compositae	*Eupatorium canabinum*	Hemp-agrimony / Holy rope	16
Compositae	*Galinsoga quadriradiata*	Shaggy soldier	16
Compositae	*Gnaphalium sylvaticum*	Heath cudweed	16
Compositae	*Gnaphalium uliginosum*	Marsh cudweed	16
Compositae	*Hieracium negoiense*		1
Compositae	*Hieracium rotundatum (Hieracium transsylvanicum)*		16
Compositae	*Hieracium sparsum (silesiacum)*		1
Compositae	*Hieracium umbellatum*	Narrowleaf hawkweed	16
Compositae	*Homogyne alpina*	Alpine coltsfoot	6
Compositae	*Hypochaeris radicata*	Cat's-ear	16
Compositae	*Inula britanica*	Meadow fleabane	16,17
Compositae	*Inula helenium*	Elecampane	16,17
Compositae	*Inula salicina*	Willowleaf yellowhead	16
Compositae	*Jacobaea (Senecio) paludosus*	Fen ragwort	16
Compositae	*Jacobaea abrotanifolia*		6
Compositae	*Lapsana communis*	Common nipplewort	16
Compositae	*Leontodon (Scorzoneroides) autumnalis*	Autumn hawkbit	16
Compositae	*Leontodon hispidus*	Rough Hawkbi	16
Compositae	*Leontopodium alpinum*	Edelweiss	1
Compositae	*Leucanthemopsis alpina alpina*	Alpine daisy	1
Compositae	*Leucanthemum vulgare*	Ox-eye daisy	16
Compositae	*Leucanthemum vulgare (Chrysanthemum leucanthemum)*	Oxeye daisy	17,18
Compositae	*Ligularia glauca*		1
Compositae	*Mycelis (Lactuca) muralis*	Wall lettuce	16

Compositae	*Omalotheca supina*	Arctic cudweed	
Compositae	*Petasites albus*	White Butterbur	16,18
Compositae	*Petasites hybridus*	Common butterbur	16
Compositae	*Petasites hybridus (officinalis)*		17
Compositae	*Picris hieracioides*	Hawkweed oxtongue	16
Compositae	*Pilosella aurantiaca (Hieracium aurantiacum)*	Orange hawkweed	17,18
Compositae	*Pilosella officinarum (Hieracium pilosella)*	Mouse-ear hawkweed	16,17,18
Compositae	*Prenanthes purpurea*	Purple lettuce	16
Compositae	*Saussurea discolor*		1
Compositae	*Senecio doronicum*		6
Compositae	*Senecio jacobaea*	Ragwort	16
Compositae	*Senecio nemoralis*		17
Compositae	*Senecio ovatus (fuchsii)*	Wood ragwort	16,18
Compositae	*Senecio vulgaris*	Groundsel	17
Compositae	*Serratula tinctoria*	Dyer's plumeless saw-wort	16
Compositae	*Solidago virgaurea*	European goldenrod	16
Compositae	*Sonchus arvensis*	Field sowthistle	16
Compositae	*Tanacetum corymbosum*	Scentless feverfew	16
Compositae	*Tanacetum macrophyllum*	Rayed tansy	1
Compositae	*Tanacetum vulgare*	Common tansy	16
Compositae	*Taraxacum hoppeanum*		17
Compositae	*Taraxacum officinale*	Common dandelion	16,17
Compositae	*Telekia speciosa*	Ox-eye daisy	16,17,18
Compositae	*Tephroseris crispa (Senecio rivularis)*		1
Compositae	*Tragopogon pratensis*	Meadow goat's-beard	16
Compositae	*Tussilago farfara*	Coltsfoot	16,17,18
Compositae	*Centaurea kotschyana*		1
Convolvulaceae	*Calystegia sepium*	Larger bindweed	16
Convolvulaceae	*Convolvulus arvensis*	Field bindweed	16
Convolvulaceae	*Cuscuta epithymum*	Lesser dodder / Hellweed	16
Cornaceae	*Cornus sanguinea*	Common dogwood	16
Crassulaceae	*Sedum acre*	Goldmoss stonecrop	16,17
Crassulaceae	*Sedum alpestre*		6
Crassulaceae	*Sedum maximum*		16,17,18
Crassulaceae	*Sedum roseum (Rhodiola rosea)*	Golden root	1
Crassulaceae	*Sedum sexangulare*	Tasteless stonecrop	16
Crassulaceae	*Sedum telephium fabaria*	Livelong	1
Crassulaceae	*Sempervivum montanum*	Houseleeks	1
Cucurbitaceae	*Echinocystis lobata*	Wild cucumber / prickly cucumber	16
Cupresaceae	*Juniperus communis*	Common juniper	16
Cyperaceae	*Carex (leporina) ovalis*	Oval sedge	16
Cyperaceae	*Carex acuta*	Acute Sedge	16

Cyperaceae	*Carex digitata*		16
Cyperaceae	*Carex distans*	Distant sedge	16
Cyperaceae	*Carex echinata*	Star sedge	1b,16
Cyperaceae	*Carex firma*		1
Cyperaceae	*Carex fuliginosa*		1,6
Cyperaceae	*Carex hartmanii* (*buxbaumii*)	Hartmann's sedge	16
Cyperaceae	*Carex hirta*	Hairy sedge	16
Cyperaceae	*Carex lasiocarpa*	Slender sedge	2
Cyperaceae	*Carex lepidocarpa*		1b,16
Cyperaceae	*Carex limosa*	Bog sedge	1
Cyperaceae	*Carex nigra*	Common sedge	1b
Cyperaceae	*Carex pallescens*	Pale sedge	16
Cyperaceae	*Carex panicea*	Grass-like sedge	16
Cyperaceae	*Carex parviflora*		1
Cyperaceae	*Carex pendula*	Pendulous sedge	16
Cyperaceae	*Carex pilosa*		16
Cyperaceae	*Carex polyphylla*		16
Cyperaceae	*Carex praecox*		16
Cyperaceae	*Carex pyrenaica*		6
Cyperaceae	*Carex sempervirens*		6
Cyperaceae	*Carex spicata*		16
Cyperaceae	*Carex strigosa*		1
Cyperaceae	*Carex sylvatica*		16,17,18
Cyperaceae	*Carex tomentosa*		16
Cyperaceae	*Carex umbrosa*		16
Cyperaceae	*Carex vesicaria*	Bladder-sedge	16
Cyperaceae	*Cyperus fuscus*	Brown galingale	16
Cyperaceae	*Eleocharis (palustris) vulagris*	Common spike-rush	16,17
Cyperaceae	*Eleocharis carniolica*		1,16
Cyperaceae	*Eleocharis ovata*	Ovate Spikerush	16
Cyperaceae	*Eriophorum angustifolium*	Cottongrass	1b
Cyperaceae	*Eriophorum gracile*	Cottongrass	1b
Cyperaceae	*Eriophorum latifolium*	Cottongrass	16
Cyperaceae	*Eriophorum vaginatum*	Cottongrass	1b,2
Cyperaceae	*Kobresia myosuroides*	Bog sedge	1
Cyperaceae	*Rhynchospora alba*	White beak-sedge	1b
Cyperaceae	*Scirpus sylvaticus*	Wood club-rush	16
Cyperaceae	*Carex alpina*		17
Cyperaceae	*Carex arenaria*	Sand sedge	17
Cyperaceae	*Carex atrata aterrima*	Black Alpine-sedge	1
Cyperaceae	*Carex brachystachys*		1
Cyperaceae	*Carex brizoides*		16
Cyperaceae	*Carex brunnescens*	Brownish sedge	1
Cyperaceae	*Carex buekii*		16

Cyperaceae	*Carex capillaris*		1
Cyperaceae	*Carex caryophyllea*		16
Cyperaceae	*Carex cespitosa*		16
Cyperaceae	*Carex curvula*		3
Cyperaceae	*Carex depressa transsilvanica*		16
Cyperaceae	*Carex diandra*	Lesser tussock-sedg	1b
Dipsacaceae	*Dipsacus pilosus*		16
Droseraceae	*Drosera rotundifolia*	Common sundew	1,1b,2
Equisetaceae	*Equisetum arvense*	Common horsetail	16,17
Equisetaceae	*Equisetum hyemale*	Rough horsetail	16,17
Equisetaceae	*Equisetum maximum*		18
Equisetaceae	*Equisetum palustre*	Marsh horsetail	16,17
Equisetaceae	*Equisetum telmateia*	Great horsetail	16
Equisetaceae	*Equisetum sylvaticum*	Wood horsetail	17
Ericaceae	*Bruckenthalia spiculifolia*	Spike heath	2,6,16
Ericaceae	*Kalmia (Loiseleuria) procumbens*	Alpine azalea	1
Ericaceae	*Orthilia secunda*	Sidebells wintergreen	16
Ericaceae	*Pyrola rotundifolia*	Round-leaved wintergreen	16
Ericaceae	*Rhododendron myrtifolium*		1,6
Ericaceae	*Vaccinium myrtillus*	Billberry	2,16,17,18
Ericaceae	*Vaccinium vitis-idaea*	Lingonberry	16,17,18
Ericaceae	*Erica ciliaris (cilliata)*	Dorset heath	17
Euphorbiaceae	*Euphorbia amygdaloides*	Wood spurge	16
Euphorbiaceae	*Euphorbia carniolica*		16
Euphorbiaceae	*Euphorbia cyparissias*	Cypress spurge	16
Euphorbiaceae	*Euphorbia stricta*		16
Euphorbiaceae	*Mercurialis perennis*	Dog's mercury	16,18
Fabaceae	*Anthyllis vulneraria*	Common kidneyvetch	16
Fabaceae	*Astragalus alpinus*	Alpine milkvetch	1,6
Fabaceae	*Astragalus glycyphyllos*	Liquorice milkvetch	16
Fabaceae	*Dorycnium pentaphyllum herbaceum*	Prostrate Canary clover	16
Fabaceae	*Genista (Genistella) sagittalis*	Broom	16
Fabaceae	*Genista tinctoria campestris*	Dyer's broom / Waxen woad	16
Fabaceae	*Hedysarum hedysaroides*	Alpine Sainfoin	1
Fabaceae	*Lathyrus niger*	Black pea	16
Fabaceae	*Lathyrus pratensis*	Meadow pea	16
Fabaceae	*Lathyrus sylvestris*	Narrow-leaved everlasting-pea	16
Fabaceae	*Lathyrus vernus*	Spring pea	16
Fabaceae	*Lotus corniculatus*	Bird's-foot trefoil	16,18
Fabaceae	*Onobrychis montana*	Mountain Sainfoin	1
Fabaceae	*Onobrychis montana ssp. transsilvanica*		1
Fabaceae	*Onobrychis viciifolia*	Common sainfoin	16
Fabaceae	*Ononis arvensis arvensis*	Field Restharrow	16

Fabaceae	*Securigera (Coronilla) varia*	Purple crown vetch	16
Fabaceae	*Trifolium alpestre*	Purple-globe Clover	16
Fabaceae	*Trifolium aureum*	Golden clover	16
Fabaceae	*Trifolium badium*		6
Fabaceae	*Trifolium campestre*	Hop trefoil	16
Fabaceae	*Trifolium dubium*	Lesser hop trefoil	16
Fabaceae	*Trifolium fragiferum*	Strawberry clover	16
Fabaceae	*Trifolium hybridum*	Alsike clover	16
Fabaceae	*Trifolium medium*	Zigzag clover	16
Fabaceae	*Trifolium montanum*	Mountain clover	16
Fabaceae	*Trifolium ochroleucum*		16
Fabaceae	*Trifolium pannonicum*	Hungarian clover	16
Fabaceae	*Trifolium pratense*	Red clover	16,18
Fabaceae	*Trifolium repens*	Shamrock	16
Fabaceae	*Trifolium spadiceum*		1
Fabaceae	*Vicia cracca*	Tufted vetch	16,18
Fabaceae	*Vicia sativa*	Common vetch	16
Fabaceae	*Vicia sepium*	Bush vetch	16
Fabaceae	*Vicia sylvatica*	Wood vetch	16
Fagaceae	*Fagus sylvatica*	European beech	16,17,18
Fagaceae	*Quercus petraea*	Sessile oak	16
Fagaceae	*Quercus robur*	Pedunculate oak	16
Gentianaceae	*Centaurium erythraea*	Common centaury	16
Gentianaceae	*Comastoma tenellum*		6
Gentianaceae	*Gentiana acaulis*	Gentian	9
Gentianaceae	*Gentiana asclepiadea*	Willow gentian	16
Gentianaceae	*Gentiana clusii*	Clusius' gentian	1
Gentianaceae	*Gentiana cruciata*	Star gentian	1,16
Gentianaceae	*Gentiana frigida*		1,6
Gentianaceae	*Gentiana lutea*	Great yellow gentian	1
Gentianaceae	*Gentiana pneumonanthe*	Marsh gentian	16
Gentianaceae	*Gentiana punctata*	Spotted gentian	1
Gentianaceae	*Gentianopsis ciliata* (*Gentianella ciliata*)	Fringed gentians	16
Gentianaceae	*Lomatogonium carinthiacum*		1
Geraniaceae	*Geranium columbinum*	Long-stalked crane's-bill	16
Geraniaceae	*Geranium palustre*	Marsh Cranesbill	16
Geraniaceae	*Geranium phaeum*	Dusky crane's-bill	16,17,18
Geraniaceae	*Geranium pratense*	Meadow crane's-bill	16
Geraniaceae	*Geranium robertianum*	Herb-Robert	16,17,18
Grimmiaceae	*Grimmia teretinervis*		1
Haloragaceae	*Myriophyllum spicatum*	Eurasian watermilfoil	16
Hypericaceae	*Hypericum humifusum*	Trailing St John's-wort	16
Hypericaceae	*Hypericum maculatum*	Spotted St. Johnswort	16

Hypericaceae	*Hypericum perforatum*	Common Saint John's wort	16,17
Hypericaceae	*Hypericum richeri*		4
Hypericaceae	*Hypericum tetrapterum*	St. Peter's Wort	16
Iridaceae	*Crocus banaticus*	Byzantine crocus	16
Iridaceae	*Crocus vernus*	Spring Crocus / Giant Crocus	16
Iridaceae	*Gladiolus imbricatus*	Gladiolus / sword lily	16
Iridaceae	*Iris siberica*	Siberian iris	16
Juncaceae	*Juncus alpinus*	Richardson's rush	1b
Juncaceae	*Juncus articulatus*	Jointleaf Rush	16
Juncaceae	*Juncus bufonius*	Toad rush	16
Juncaceae	*Juncus conglomeratus*	Compact Rush	16
Juncaceae	*Juncus effusus*	Soft rush	16,17,18
Juncaceae	*Juncus filiformis*		1
Juncaceae	*Juncus gerardii*	Blackgrass	16,17
Juncaceae	*Juncus inflexus*	European meadow rush	16,17,18
Juncaceae	*Juncus tenuis*	Slender rush	16
Juncaceae	*Juncus thomassii*		16
Juncaceae	*Juncus trifidus*	Highland rush	1,6
Juncaceae	*Juncus triglumis*	Three-flowered Rush	1
Juncaceae	*Luzula alpinopilosa*	Wood rush	5,6
Juncaceae	*Luzula campestris*	Field wood-rush	16
Juncaceae	*Luzula luzuloides*	White wood-rush	16,17,18
Juncaceae	*Luzula multiflora*	Heath Wood-rush	16
Juncaceae	*Juncus scirpoides*	Needlepod rush	17
Juncaceae	*Luzula sylvatica*	Greater wood-rush	17,18
Lamiaceae	*Ajuga genevensis*	Upright bugle	16,17
Lamiaceae	*Ajuga reptans* L.	Common bugle	16,18
Lamiaceae	*Clinopodium vulgare*	Wild basil	16
Lamiaceae	*Galeopsia tetrahit*	Common hemp-nettle	16
Lamiaceae	*Galeopsis speciosa*	Large-flowered Hemp-nettle	16
Lamiaceae	*Glechoma hederacea*	Ground-ivy	16
Lamiaceae	*Lamium album*	White nettle	16,17,18
Lamiaceae	*Lamium galeobdolon*	Yellow archangel	16,17
Lamiaceae	*Lamium maculatum*	Spotted deadnettle	16
Lamiaceae	*Lycopus europaeus*	Gypsywort	16,17
Lamiaceae	*Melittis melissophyllum*	Bastard balm	16
Lamiaceae	*Mentha aquatica*	Water mint	16,17,18
Lamiaceae	*Mentha longifolia*	Horse Mint	16
Lamiaceae	*Mentha piperita*	Peppermint	18
Lamiaceae	*Origanum vulgare*	Oregano	18
Lamiaceae	*Prunella vulgaris*	Common self-heal	16
Lamiaceae	*Salvia glutinosa*	Glutinous sage	16
Lamiaceae	*Salvia pratensis*	Meadow sage	16

Lamiaceae	*Scutellaria galericulata*	Common skullcap	16
Lamiaceae	*Stachys alpina*	Limestone Woundwort	16
Lamiaceae	*Stachys officinalis*	Common hedgenettle	16
Lamiaceae	*Stachys palustris*	Marsh woundwort	16
Lamiaceae	*Stachys recta*	Stiff hedgenettle	16
Lamiaceae	*Stachys sylvatica*	Hedge woundwort	16,17
Lamiaceae	*Teucrium chamaedrys*	Wall germander	16
Lamiaceae	*Thymus bihoriensis*		1
Lamiaceae	*Thymus comosus*		1
Lamiaceae	*Thymus dacicus*		18
Lamiaceae	*Thymus glabrescens*		16
Lamiaceae	*Thymus pannonicus*	Eurasian thyme	16
Lamiaceae	*Thymus praecox*	mother of thyme	6
Lamiaceae	*Thymus pulcherrimus*		1,4
Lamiaceae	*Thymus pulegioides*	Lemon thyme	16
Lamiaceae	*Thymus serpyllum*	Wild thyme	18
Lamiaceae	*Ballota nigra*	Black horehound	17,18
Lamiaceae	*Lamium purpureum*	Red deadnettle	17
Lamiaceae	*Thymus dacicus*		17
Leguminosae	*Astragalus australis*	Indian milkvetch	1
Leguminosae	*Oxytropis campestris*	Field locoweed	1
Leguminosae	*Oxytropis carpatica*	Carpathian locoweed	1
Leguminosae	*Oxytropis halleri*		1
Lentibulariaceae	*Pinguicula alpina*	Alpine butterwort	1
Lentibulariaceae	*Pinguicula vulgaris*	Common butterwort	1
Liliaceae	*Colchicum autumnale*	Autumn crocus	16
Liliaceae	*Gagea (Lloydia) serotina*	Mountain spiderwort	1
Liliaceae	*Lilium martagon*	Turk's cap lily	16,17
Linaceae	*Linum catharticum*	Fairy flax	16
Linaceae	*Linum perenne extraaxillare*	Perennial flax	1
Lythraceae	*Lythrum (Peplis) portula*	Water-purslane	16
Lythraceae	*Lythrum salicaria*	Purple loosestrife	1b,16,17
Malvaceae	*Malva sylvestris*	Common mallow	16
Melanthiaceae	*Veratrum album*	White hellebore	17,18
Menyanthaceae	*Menyanthes trifoliate*	Bogbean	1a,2
Oleraceae	*Fraxinus excelsior*	European ash	16
Oleraceae	*Ligustrum vulgare*	Wild privet	16
Onagraceae	*Circaea lutetiana*	Enchanter's-nightshade	16
Onagraceae	*Epilobium alsinifolium*	Chickweed willowherb	1
Onagraceae	*Epilobium anagallidifolium*	Pimpernel willowherb / alpine willowherb	1,5,6
Onagraceae	*Epilobium angustifolium*	Rosebay willowherb	2,16
Onagraceae	*Epilobium hirsutum*	Great willowherb	16
Onagraceae	*Epilobium parviflorum*	Hoary willowherb	16

Onagraceae	*Epilobium roseum*	Pale willowherb	16
Onagraceae	*Epilobium tetragonum*	Square-stemmed willowherb	16
Onagraceae	*Epilobium montanum*	Broad-leaved willowherb	17,18
Onagraceae	*Epilobium nutans*		1
Onagraceae	*Epilobium palustre*	Marsh willowherb	2,17,18
Orchidaceae	*Anacamptis (Orchis) coriophora*	Bug Orchid	1,16
Orchidaceae	*Anacamptis (Orchis) morio*	Green-winged orchid	1,16
Orchidaceae	*Anacamptis palustris (Orchis laxiflora) elegans*		1,16
Orchidaceae	*Cephalanthera damasonium*	White Helleborine	16
Orchidaceae	*Cephalanthera longifolia*	Narrow-leaved Helleborine	1,16
Orchidaceae	*Cephalanthera rubra*	Red Helleborine	1
Orchidaceae	*Coeloglossum viride*	Frog orchid	1
Orchidaceae	*Corallorrhiza trifida*	Early coralroot	16
Orchidaceae	*Dactylorhiza (Orchis) sambucina*	Elder-flowered orchid	1,16
Orchidaceae	*Dactylorhiza cordigera*	Marsh orchid / Spotted orchid	1
Orchidaceae	*Dactylorhiza fuchsii*	Common spotted orchid	16
Orchidaceae	*Dactylorhiza incarnata incarnata*	Early marsh-orchid	1,16
Orchidaceae	*Dactylorhiza maculata maculata*	Heath spotted orchid	16
Orchidaceae	*Dactylorhiza maculata schurii*	Heath spotted orchid	16
Orchidaceae	*Dactylorhiza maculata transsilvanica*	Heath spotted orchid	1,16
Orchidaceae	*Dactylorhiza majalis*	Western marsh orchid	1
Orchidaceae	*Epipactis atrorubens*	Dark-red Helleborine	1,16
Orchidaceae	*Epipactis helleborine*	Broad-leaved Helleborine	1,16
Orchidaceae	*Epipactis microphylla*	Small-leaved Helleborine	1
Orchidaceae	*Epipactis palustris*	Marsh Helleborine	1b,16
Orchidaceae	*Epipogium aphyllum*	Ghost orchid	1
Orchidaceae	*Gymnadenia (Nigritella) nigra*		1
Orchidaceae	*Gymnadenia conopsea*	Fragrant Orchid	1,16
Orchidaceae	*Gymnadenia rubra (Nigritella nigra rubra)*		1
Orchidaceae	*Liparis loeselii*	fen orchid	1
Orchidaceae	*Neotinea (Orchis) ustulata*	Burnt orchid	1,16
Orchidaceae	*Neottia (Listera) ovata*	Eggleaf twayblade	16
Orchidaceae	*Neottia nidus-avis*	Bird's-nest Orchid	16
Orchidaceae	*Platanthera bifolia*	Lesser butterfly-orchid	16
Orchidaceae	*Platanthera chlorantha*	Greater Butterfly-orchid	1
Orchidaceae	*Pseudorchis albida*	Small white orchid	1
Orchidaceae	*Spiranthes spiralis*	Autumn lady's-tresses	1,16
Orchidaceae	*Traunsteinera globosa*	Round Headed Orchid	1
Orobanchaceae	*Pedicularis baumgartenii*		1
Orobanchaceae	*Pedicularis oederi*	Crimson-tipped Lousewort	1
Orobanchaceae	*Pedicularis verticillata*	Verticillate Lousewort	6
Orobanchaceae	*Rhinanthus aestivalis (angustifolius)*	Greater Yellow-rattle	16

Orobanchaceae	*Rhinanthus minor*	Yellow rattle	16
Orobanchaceae (Scrophulariaceae)	*Tozzia carpathica*		1
Orobanchaceae	*Euphrasia minima*		17,18
Orobanchaceae	*Euphrasia nemorosa (officinalia)*	Common eyebright	16
Orobanchaceae	*Euphrasia stricta*	Drug eyebright	16
Orobanchaceae	*Lathraea squamaria*	Common toothwort	17
Oxalidaceae	*Oxalis acetosella*	Wood sorrel	16,17,18
Oxalidaceae	*Oxalis stricta*	Yellow woodsorrel	16
Oxalidaceae	*Oxyria digyna*	Mountain sorrel	5,6
Papaveraceae	*Papaver alpinum*	Alpine poppy	1
Papaveraceae	*Corydalis cava*		16
Papaveraceae	*Corydalis solida*	Fumewort	16
Papaveraceae	*Papaver aurantiacum (pyrenaicum)*		1
Pinaceae	*Larix decidua carpatica*	European larch	1
Pinaceae	*Larix decidua polonica*	European larch	1
Pinaceae	*Picea abies*	Norway spruce	16,17
Pinaceae	*Pinus cembra*	Stone pine	1
Pinaceae	*Pinus mugo*	Mountain pine	1,17
Pinaceae	*Pinus sylvestris*	Scots pine	18
Pinaceae	*Abies alba*	Silver fir	17,18
Plantaginaceae	*Plantago gentianoides*		1,6
Plantaginaceae	*Plantago lanceolata*	Narrowleaf plantain	16,17,18
Plantaginaceae	*Plantago major*	Greater plantain	16,17,18
Plantaginaceae	*Plantago media*	Hoary plantain	16
Plantaginaceae	*Veronica alpina*	Alpine speedwell	1,5,6
Plantaginaceae	*Veronica anagallis-aquatica*	Water speedwell	17,18
Plantaginaceae	*Veronica aphylla*	Leafless stemmed speedwell	1
Plantaginaceae	*Veronica arvensis*	Wall speedwell	16
Plantaginaceae	*Veronica bachofenii*		1
Plantaginaceae	*Veronica baumgartenii*		1,5
Plantaginaceae	*Veronica beccabunga*	Brooklime	16
Plantaginaceae	*Veronica chamaedrys*	Germander speedwell	17
Plantaginaceae	*Veronica fruticans*	Rock speedwell	1
Plantaginaceae	*Veronica montana*	Wood speedwell	16
Plantaginaceae	*Veronica officinalis*	Heath speedwell	16
Plantaginaceae	*Veronica orchidea*		16
Plantaginaceae	*Veronica prostrata*	Sprawling speedwell	16
Plantaginaceae	*Veronica serpyllifolia*	Thyme-leaved speedwell	16
Plantaginaceae	*Digitalis grandiflora*	Yellow foxglove	16,17
Plumbaginaceae	*Armeria alpina (maritima) (barcensis)*		1
Poaceae	*Agrostis alpina*		1
Poaceae	*Agrostis canina*	Brown bent	1b,16
Poaceae	*Agrostis capillaris (tenuis)*	Common bent	16,17,18

Poaceae	*Agrostis rupestris*		6
Poaceae	*Agrostis stolonifera*	Creeping bentgrass	16,17,18
Poaceae	*Agrostis vinealis*	Brown bentgrass	1
Poaceae	*Alopecurus geniculatus*	Water foxtail	16
Poaceae	*Alopecurus pratensis*	Meadow foxtail	1,6,16,17
Poaceae	*Alpoecurus aequalis*	Orange foxtail	16
Poaceae	*Anthoxanthum odoratum*	Sweet vernal grass	16
Poaceae	*Arrhenaterum elatius*	False oat-grass	16,17,18
Poaceae	*Bothricochloa (Dichanthium) ischaemum*		16
Poaceae	*Brachypodium pinnatum*	Tor-grass	16
Poaceae	*Brachypodium sylvaticum*	False brome	16
Poaceae	*Briza media*	Quaking grass	16
Poaceae	*Bromus commutatus*	Meadowbrome	16
Poaceae	*Bromus hordeaceus*	Soft brome	16
Poaceae	*Bromus inermis*	Arctic brome	18
Poaceae	*Bromus ramosus*	Hairy brome	16
Poaceae	*Bromus tectorum*	Drooping brome	18
Poaceae	*Calamagrostis arundinacea*		16
Poaceae	*Calamagrostis epigeios*	Bushgrass	16
Poaceae	*Catabrosa aquatica*	Water whorlgrass	16
Poaceae	*Cynosurus cristatus*	Crested dog's-tail	16
Poaceae	*Dactylia polygama*	Slender Cock`s-foot	16
Poaceae	*Dactylis glomerata*	Cock`s-foot	16,17,18
Poaceae	*Danthonia decumbens*	Heath grass	16
Poaceae	*Deschampsia caespitosa*	Tufted hairgrass	16
Poaceae	*Elymus caninus*	Bearded wheatgrass	16
Poaceae	*Elymus repens*	Couch grass	16
Poaceae	*Festuca airoides*		6
Poaceae	*Festuca amethystina*	Tufted fescue	1
Poaceae	*Festuca bucegiensis*		1
Poaceae	*Festuca carpatica*		1
Poaceae	*Festuca drymeja*		16
Poaceae	*Festuca gigantea*	Giant fescue	16
Poaceae	*Festuca nitida flaccida*		1
Poaceae	*Festuca picturata*		6
Poaceae	*Festuca pratensis*	Meadow fescue	16
Poaceae	*Festuca rubra*	Red fescue	16,17,18
Poaceae	*Festuca rupicola*		6,16
Poaceae	*Festuca subverticillata (Poa laxa)*	Nodding fescue	1,5,6
Poaceae	*Festuca valesiaca*	Volga fescue	18
Poaceae	*Festuca varia*		6
Poaceae	*Glyceria maxima*	Great Manna Grass	18
Poaceae	*Glyceria notata*	Plicate sweet-grass	16
Poaceae	*Helictotrichon decorum*	Alpine oatgras	1

Poaceae	*Holcus lanatus*	Tufted grass	16
Poaceae	*Koeleria macrantha*	Crested hair-grass	16
Poaceae	*Leersia oryzoides*	Rice cutgrass	16
Poaceae	*Lolium perenne*	Perennial rye-grass	16
Poaceae	*Melica uniflora*	Wood melick	16
Poaceae	*Milium effusum*	Wood millet	16
Poaceae	*Molinia caerulea*	Purple moor-grass	1b,16
Poaceae	*Nardus stricta*	Matgrass	16
Poaceae	*Oreochloa disticha*		6
Poaceae	*Phalaris arundinacea*	Reed canary grass	16
Poaceae	*Phleum alpinum*	Alpine cat's-tail	6
Poaceae	*Phleum pratense*	Timothy-grass	16
Poaceae	*Phragmites australis*	Common reed	16
Poaceae	*Poa angustifolia*	Smooth Meadow-grass	16
Poaceae	*Poa annua*	Annual meadow-grass	16,18
Poaceae	*Poa badensis*		1
Poaceae	*Poa cenisia*		1
Poaceae	*Poa compresa*	Flattened meadow-grass	16
Poaceae	*Poa granitica*		1,6
Poaceae	*Poa nemoralis*	Wood meadow-grass	6,16
Poaceae	*Poa palustris*	Swamp meadow-grass	16
Poaceae	*Poa pratensis*	Smooth meadow-grass,	16
Poaceae	*Poa psychrophila*	?	14
Poaceae	*Poa remota*	?	1
Poaceae	*Poa trivialis*	Rough meadow-grass	16
Poaceae	*Sesleria bielzii*		6
Poaceae	*Sesleria rigida haynaldiana*		1
Poaceae	*Setaria pumila* (*lutescens)*	Yellow foxtail	16
Poaceae	*Trisetum alpestre*		1
Poaceae	*Trisetum ciliare (fuscum)*		1
Poaceae	*Trisetum flavescens*	Golden oat grass	16
Poaceae	*Trisetum macrotrichum*		1
Poaceae	*Bromus inermis*		17,18
Poaceae	*Bromus tenuis*		17
Poaceae	*Glyceria maxima*	Great Manna Grass	17
Polygalaceae	*Polygala comosa*	Tufted milkwort	16
Polygalaceae	*Polygala vulgaris*	Common milkwort	16
Polygonaceae	*Fallopia dumetorum (Polygonum dumetorum)*	Copse bindweed	16
Polygonaceae	*Persicaria alpina (Polygonum alpinum)*	Alpine knotweed	1
Polygonaceae	*Persicaria maculosa (Polygonum persicaria)*	Lady's thumb	16
Polygonaceae	*Persicaria mitis (Polygonum mite)*	Tasteless Water-pepper	16
Polygonaceae	*Polygonum aviculare*	Common knotgrass	16
Polygonaceae	*Rumex acetosa*	Common sorrel	16,17,18

Polygonaceae	*Rumex acetosella*	Sheep's sorrel	16
Polygonaceae	*Rumex alpinus*	Monk's-rhubarb	16,17
Polygonaceae	*Rumex arifolius*	Maiden sorrel	1
Polygonaceae	*Rumex conglomeratus*	Clustered dock	16
Polygonaceae	*Rumex crispus*	Curly dock	16
Polygonaceae	*Rumex obtusifolius*	Bitter dock	16
Polygonaceae	*Rumex sanguineus*	Bloody dock	16
Polygonaceae	*Rumex scutatus*	French sorrel	1
Polygonaceae	*Persicaria hydropiper (Polygonum hydropiper)*	Water-pepper	17,18
Potamogetonaceae	*Potamogeton natans*	Broad-leaved pondweed	16
Primulaceae	*Anagallis arvensis*	Scarlet pimpernel	16
Primulaceae	*Androsace chamaejasme*		1
Primulaceae	*Androsace obtusifolia*		1
Primulaceae	*Androsace villosa (arachnoidea)*		1
Primulaceae	*Lysimachia nemorum*	Yellow Pimpernell	1,16
Primulaceae	*Lysimachia nummularia*	Creeping jenny	16,17,18
Primulaceae	*Lysimachia vulgaris*	Yellow loosestrife	16
Primulaceae	*Primula farinosa*	Bird's-eye primrose	1
Primulaceae	*Primula halleri*		1
Primulaceae	*Primula matthioli*		6
Primulaceae	*Primula minima*	European Alpine Primrose	1,6
Primulaceae	*Primula veris (officinalis)*	Cowslip primrose	16, 17
Primulaceae	*Soldanella alpina*	Alpine snowbell	17
Primulaceae	*Soldanella hungarica*		17,18
Primulaceae	*Soldanella pusilla*		1,3,5,6,17
Ranunculaceae	*Actaea spicata*	Baneberry / herb Christopher	16
Ranunculaceae	*Anemone narcissiflora*	Narcissus-flowered anemone)	1
Ranunculaceae	*Anemone nemorosa*	Wood anemone	16,18
Ranunculaceae	*Anemone ranunculoides*	Yellow anemone	16
Ranunculaceae	*Aquilegia nigricans*	Bulgarian columbine	1
Ranunculaceae	*Aquilegia transsilvanica*	Granny's Bonnet / Columbine	1,6
Ranunculaceae	*Callianthemum coriandrifolium*		1
Ranunculaceae	*Caltha palustris (laeta)*	Marsh marigold	16,17,18
Ranunculaceae	*Clematis vitalba*	Old man's beard	16
Ranunculaceae	*Helleborus purpurascens*	Hellebores	16
Ranunculaceae	*Hepatica transsilvanica*	Liverleaf	1
Ranunculaceae	*Pulsatilla montana*	Meadow anemone	1
Ranunculaceae	*Ranunculus acris acris*	Meadow buttercup	16
Ranunculaceae	*Ranunculus alpestris*	Alpine buttercup	1
Ranunculaceae	*Ranunculus auricomus*	Goldilocks buttercup,	16
Ranunculaceae	*Ranunculus bulbosus*	Bulbous buttercup	16
Ranunculaceae	*Ranunculus carpaticus*		1,16

Ranunculaceae	*Ranunculus crenatus*		1,5,6
Ranunculaceae	*Ranunculus ficaria*	Lesser celandine	16
Ranunculaceae	*Ranunculus flammula*	Lesser spearwort	1b,16
Ranunculaceae	*Ranunculus glacialis*	Glacier buttercup	1,5
Ranunculaceae	*Ranunculus pseudomontanus*		5
Ranunculaceae	*Ranunculus repens*	Creeping buttercup	16,17,18
Ranunculaceae	*Ranunculus sardous*	Hairy buttercup	16,17,18
Ranunculaceae	*Ranunculus sceleratus*	Cursed buttercup	16,17
Ranunculaceae	*Ranunculus serpens (breyninus) nemorosus*		6,16
Ranunculaceae	*Ranunculus serpens (polyanthemos) polyanthemoides*		16
Ranunculaceae	*Ranunculus thora*	Tora buttercup	1,15
Ranunculaceae	*Thalictrum lucidum*		16
Ranunculaceae	*Trollius europaeus europaeus*	Globeflower	1
Ranunculaceae	*Aconitum moldavicum*		1
Ranunculaceae	*Aconitum nanum*		6
Ranunculaceae	*Aconitum napellus ssp. firmum*	Monkshood	1
Ranunculaceae	*Aconitum toxicum*		1,17
Ranunculaceae	*Caltha laeta*		17,18
Ranunculaceae	*Clematis alpina*	Alpine Clematis	17
Ranunculaceae	*Thalictrum aquilegiifolium*	Columbine meadow-rue	17,18
Rhamnaceae	*Frangula alnus*	Alder buckthorn	1b,16
Rosaceae	*Agrimonia eupatoria*	common agrimony /sticklewort	16
Rosaceae	*Alchemilla micans*		16
Rosaceae	*Filipendula ulmaria*	Meadowsweet	16
Rosaceae	*Filipendula vulgaris*	Dropwort	16
Rosaceae	*Fragaria vesca*	Wild strawberry	16,18
Rosaceae	*Fragaria viridis*	Wild strawberry	16,17,18
Rosaceae	*Geum montanum*	Alpine avens	6
Rosaceae	*Geum reptans*		1,5
Rosaceae	*Geum urbanum*	Wood avens / St Benedict's herb	16,17
Rosaceae	*Malus sylvestris*	European crab apple	16
Rosaceae	*Potentilla anserina*	Silverweed Cinquefoil	16
Rosaceae	*Potentilla arenaria*		16
Rosaceae	*Potentilla argentea*	Silver cinquefoil	16
Rosaceae	*Potentilla erecta*	Erect cinquefoil	1b,16
Rosaceae	*Potentilla reptans*	Creeping cinquefoil	16
Rosaceae	*Prunus (Cerasus) avium*	Bird cherry	16
Rosaceae	*Prunus padus,*	Hackberry	18
Rosaceae	*Prunus spinosa*	Blackthorn	16
Rosaceae	*Pyrus pyraster*	European wild pear	16
Rosaceae	*Rosa nitidula*		16
Rosaceae	*Rosa tomentosa*	Harsh Downy-rose	16

Rosaceae	*Rubus (vitas) idaeus*	European raspberry	16,17,18
Rosaceae	*Rubus caesius*	European dewberry	16
Rosaceae	*Rubus candicans*		16
Rosaceae	*Rubus hirtus*	Blackberry	16,18
Rosaceae	*Rubus nessensis*		16
Rosaceae	*Rubus schleicheri*		16
Rosaceae	*Rubus sulcatus*		16
Rosaceae	*Rubus tereticaulis*		16
Rosaceae	*Rubus thyrsanthus*		16
Rosaceae	*Sanguisorba officinalis*	Great burnet	16
Rosaceae	*Alchemilla vulgaris*	Common lady's mantle	17,18
Rosaceae	*Potentilla ternata*		6,17
Rosaceae	*Prunus padus*	Bird cherry	17
Rosaceae	*Rosa canina*	Dog-rose	17
Rosaceae	*Rosa pendulina*		17
Rosaceae	*Sorbus aucuparia*	Mountain-ash	17,18
Rosaceae	*Spiraea ulmifolia*	Germander meadowsweet	17,18
Rubiaceae	*Asperula cynanchica*	Squincywort	16
Rubiaceae	*Cruciata glabra*		16
Rubiaceae	*Cruciata laevipes*	Crosswort	16
Rubiaceae	*Galium anisophyllon*	Bedstraw	6
Rubiaceae	*Galium aparine*	Cleavers	16
Rubiaceae	*Galium intermedium (schultesii)*		16
Rubiaceae	*Galium mollgo*	Hedge bedstraw	16
Rubiaceae	*Galium (Asperula) odoratum*	Sweetscented bedstraw	16,18
Rubiaceae	*Galium palustre*	Marsh-bedstraw	16
Rubiaceae	*Galium pseudoaristatum*		16
Rubiaceae	*Galium pumilum*	Slender bedstraw	1
Rubiaceae	*Galium rivale*		16
Rubiaceae	*Galium uliginosum*	Fen bedstraw	1b,16
Rubiaceae	*Galium verum*	Yellow bedstraw	16
Salicaceae	*Populus alba*	Silver poplar	16
Salicaceae	*Populus tremula*	Aspen	16,18
Salicaceae	*Salix alba*	White willow	16,17
Salicaceae	*Salix alpina*	Alpine willow	1
Salicaceae	*Salix aurita*	Eared willow	1
Salicaceae	*Salix caprea*	Goat willow	16,17,18
Salicaceae	*Salix cinerea*	Grey sallow	16
Salicaceae	*Salix fragilis*	Crack willow	16,17,18
Salicaceae	*Salix hastata*	Halberd willow	1
Salicaceae	*Salix purpurea*	Purple willow	16
Salicaceae	*Salix retusa*		1
Salicaceae	*Salix rosmarinifolia*	Rosemary-leaved willow	1,16
Salicaceae	*Salix starkeana*		1

Salicaceae	*Salix triandra*	Almond willow	16
Salicaceae	*Salix viminalis*	Common osier	17,18
Saxifragaceae	*Chrysosplenium alpinum*	Alpine golden saxifrage	1,5
Saxifragaceae	*Chrysosplenium alternifolium*	Alternate-leaved golden saxifrage	16
Saxifragaceae	*Saxifraga aizoides*	Yellow mountain saxifrage	5
Saxifragaceae	*Saxifraga androsacea*	Scree saxifrage	1,5
Saxifragaceae	*Saxifraga bryoides*	Mossy saxifrage	1
Saxifragaceae	*Saxifraga carpatica*	Alpine brook saxifrage	1,5
Saxifragaceae	*Saxifraga exarata moschata*		1
Saxifragaceae	*Saxifraga oppositifolia*	Purple saxifrage	1,5
Saxifragaceae	*Saxifraga pedemontana cymosa*		1,5
Saxifragaceae	*Saxifraga retusa*		1
Saxifragaceae	*Saxifraga rotundifolia*	Round-leaved saxifrage	5
Saxifragaceae	*Saxifraga stellaris*	Starry saxifrage	17
Scrophulariaceae	*Melampyrum bihariense*		16
Scrophulariaceae	*Melampyrum pratense purpureum*	Common cow-wheat	16
Scrophulariaceae	*Melampyrum saxosum*		1
Scrophulariaceae	*Melampyrum sylvaticum*	Small Cow-wheat	16
Scrophulariaceae	*Scrophularia heterophylla laciniata*		1
Scrophulariaceae	*Scrophularia nodosa*	Figwort	16
Scrophulariaceae	*Scrophularia scopolii*	Italian Figwort	6
Scrophulariaceae	*Verbascum nigrum*	black mullein	16,17
Scrophulariaceae	*Verbascum phlomoides*	Orange mullein	17
Tamaricaceae	*Myricaria germanica*	False tamarisk	17,18
Taxaceae	*Taxus baccata*	European yew	1
Thymelaeaceae	*Daphne mezereum*	February daphne	17
Thyphaceae	*Typha latifolia*	Common bulrush	16,17,18
Tofieldiaceae	*Tofieldia calyculata*	Alpine Asphodel	1
Typhaceae	*Sparganium erectum*	Simplestem bur-reed	16
Typhaceae	*Typha angustifolia*	Lesser bulrush	17,18
Ulmaceae	*Ulmus glabra (montana)*	Scots elm	16,17
Ulmaceae	*Ulmus minor*	Field elm	18
Urticaceae	*Urtica dioica*	Stinging nettle	16,17,18
Urticaceae	*Urtica urens*	Dwarf nettle	16
Violaceae	*Viola alpina*		1,6
Violaceae	*Viola arvensis*	Field pansy	16
Violaceae	*Viola biflora*	Yellow wood violet	5
Violaceae	*Viola canina canina*	Dog violet	16
Violaceae	*Viola canina rupii*	Dog violet	16
Violaceae	*Viola dacica*		6
Violaceae	*Viola declinata*		16
Violaceae	*Viola hirta*	Hairy violet	16
Violaceae	*Viola palustris*	Marsh violet	1

Violaceae	*Viola reichenbachiana*	Early dog violet	16,17,18
Violaceae	*Viola tricolor*	Wild pansy	16,17

Sources: 1 = N2000 ROSCI0112, 1b = N2000 ROSCI0112 MT, 2 = Stefanut 2012, 3 = Ronikier 2011, 5 = Ronikier 2010, 6 = GBIF, 7 = Hurdu et al. 2012, 8 = Andronescu 2010, 9 = Bartok et al. 2015, 14 = Bacile et al. 2010, 15 = Bartok et al. 2014, 16 = Promberger 2006, 17 = Nicolae 2012, 18 = Nicolae 2013

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