Assessing the natural interest of the landscapes of Andorra, a mountain country under contrasted land use changes

by Albert Ferré, Jordi Carreras, Empar Carrillo and Josep-M. Ninot

Grup de Geobotànica i Cartografia de la Vegetació, Centre de Recerca de Biodiversitat vegetal (CERBIV). Dept. Biologia vegetal, Universitat de Barcelona, Av. Diagonal, 645, E-08028 Barcelona; aferrecodina@ub.edu
Centre de Biodiversitat, Institut d'Estudis andorrans, C/ la Valireta 5, Encamp, Andorra

Abstract - In this paper, we present a method for analysing the landscape, using the example of Andorra, through assessing the interest of the CORINE units recognised. The starting point was a map of habitats previously drawn at the 1:25,000 scale, on infrared orthomosaic, it includes some 3,000 polygons, identified by 103 legend units based on the CORINE habitats. Diversity, naturalness, endemism, rarity and other attributes of each habitat were evaluated a priori and then combined with site features (analysed through the GIS ArcInfo) to yield a global evaluation for each legend unit. This enabled us to produce a map showing a few levels of natural interest in the landscape of Andorra and to draw the attention to main tendencies of change, which are, when compared with similar neighbouring Pyrenean valleys, not so affected by human activity.

Key words: habitats - Andorra - Pyrenees - GIS - natural interest.

Résumé - Au cours de ce travail, en prenant comme exemple la principauté d’Andorre, nous exposons une méthode qui permet l’analyse du paysage grâce à l’évaluation patrimoniale des unités identifiées. Nous avons utilisé comme base une carte des habitats CORINE préalablement dressée à l’échelle 1:25 000 sur ortho-images infrarouge. Cette carte contient environ 3 000 polygones, classés selon 130 unités basées sur les habitats CORINE. Nous avons évalué la diversité, le degré d’artificialisation, d’endémisme, de raréité, etc., de chaque habitat a priori, puis nous avons combiné ces aspects avec les paramètres locaux (analysés avec le SIG ArcInfo) dans le but d’obtenir une évaluation globale de chaque unité. Ceci nous a permis d’élaborer une cartographie graduant l’intérêt naturel du paysage andorran, ainsi que de mettre en évidence les principales tendances de changement grâce à la comparaison avec certaines vallées pyrénéennes proches et similaires, mais moins anthropisées.

Mots clés: habitats - Andorre - Pyrénées - SIG - intérêt naturel.
I. INTRODUCTION

In the field of landscape planning and conservation, the habitats CORINE defined for the European Union area (ECC, 1991) have become a milestone reference in the last decade. From the management perspective, these habitat definitions are very important in providing the standardisation of a comprehensive, precise typology, useful as reference in planning documents. In fact, the CORINE biotopes, or habitats, system arose as the basis for the conservation policies in the European Union; the areas included in Natura 2000 net are based on the occurrence, quality and singularity of the most interesting habitats (European Union Habitats) in them. A noticeable aspect of the habitats system is its biological basis, which may become very precisely defined, where the lower rank units are used. For a given habitat, this allows the assumption of the «quality» indexes of the biological communities which define it, referring to items such as diversity, endemicity and resilience. As the habitat definitions are generally based on higher plant communities, a good correlation may be assumed at least with edaphic components and with those communities depending on higher plants (fungi, insects, etc.).

Although Andorra is not part of the European Union, its geographic situation has led its environmental agencies to adopt methods and bases of information similar to those of CORINE and Natura 2000 net. This practice was clearly followed by «Centre de Biodiversitat», a non-government organisation for nature study and protection in Andorra, when commissioning a habitats map of that country. Based on the CORINE biotopes and following thematic mapping procedures, we have produced a detailed map of the habitats of Andorra, which we present and briefly discuss here.

A basic use of a habitats map is a general assessment of the landscape, which represents a first information step in any land planning. The handling of the map through a geographical information system (GIS) has enabled us to evaluate the mapped units from several points of view. Then, we assessed the whole landscape, taking into account general procedures in this field (Mallarach, 1999) and following a method applied in another Pyrenean area (Carrillo et al., 2003). The particular situation of Andorra has led us to compare its landscape with that of similar Pyrenean valleys, albeit not subject to such striking changes. Therefore, we have evaluated the landscape of Vallferrera and Vall de Cardós in the same way, from an existing habitat map (DMA, 1998-2003), and have discussed the most interesting differences.

II. THE STUDY AREA

Andorra is a small country, ca. 468 km², located in the main range of the Pyrenees (Fig. 1). It corresponds roughly to the basin of the Valira river which, together with its tributaries, runs from north to south. The relief is generally abrupt, made by fluvial valleys bearing more or less steep slopes at medium altitudes and by typical glacial geomorphs at the high mountain altitudes. Substrata correspond to diverse outcrops; acidic rocks (slate and granite) are the majority, whereas calcareous materials (calcschists) are relatively rare. Altitudes range from 840 to 2,942 m a.s.l., which produce strong bioclimatic and ecologic gradients.

The landscape of Andorra shows the typical zonation of the axial Pyrenees, including four vegetation belts. The lower altitudes correspond to the Submontane belt, where the relatively warm, dry climate favours Submediterranean oak forests, box scrubs, dry pastures and even noticeable Mediterranean units, such as sclerophyllous forests. The Montane belt is more diverse, due to its greater surface and also to topographic factors, climatic variations (from Submediterranean to Mountain Atlantic) and human impact; almost all the villages and towns, as well as fields, are included in it. Scotch pine woodlands, oak and mixed deciduous forests, pastures and mountain scrubs make most of the montane landscape. In the subalpine belt, mountain pine makes forest units on diverse substrata and aspects, accompanied by pastures and scrubs. In the alpine belt the typical short pastures occupy favourable soils, whereas communities of special sites make the most of the landscape, settling on scree, rocky areas, snow beds, lacustrine areas, etc.

The particular rules in Andorra, together with the good snow covering conditions in the high mountain of the country, have favoured a spectacular increase in trade activities and winter sports during the last decades. This has created a rapid increase of urban surfaces and infrastructures, sometimes in a rather uneven manner, which has caused drastic changes in land use.
III. MATERIAL AND METHOD

A. Mapping of the area

The starting point of this landscape study is a map of habitats based on the CORINE biotopes or habitats (ECC, 1991). This map was made from photointerpretation on infrared digital orthoimages at 1:20,000 scale (taken in 1997) and through intensive field work during the summers of 2000 and 2001. After validation of the map produced, including comparison with other cartographic sources (Folch et al., 1979; Roquet et al., 1997; Zwart, 1979), it was integrated as a coverage into a GIS (geographic information system) implemented on ArcInfo.

The legend units were taken from the list established in the cartographic project for Catalonia (Carreras & Diego, 1998; DMA, 1998-2003; Vigo & Carreras, 2003). Each unit is a main habitat in most cases (forests, fields, extensive scrubs or pastures) or a group of related habitats in the case of small surface-habitats which generally occur together. In the appendix, there is the final legend list, with the main habitats included in each unit. As mapping procedure, in each polygon up to three legend units were identified where appropriate.

B. Landscape evaluation

To assess the natural interest of the area considered, we previously evaluated each legend unit in terms of diversity, naturalness, vulnerability, etc. We have taken into account some proposals made from vegetation maps (Diaz & Fernandez, 1997; Dumont, 1988; Loidi, 1994; Rameau & Bricault, 1988; Richard et al., 1988; etc.), following a procedure already used in another Pyrenean area (Carrillo et al., 2003). The particular interest of this method is in the use of some attributes of the legend units, which were obtained from the habitats map, through landscape analysis made by means of the GIS ArcInfo.

As shown in Table 1, we selected 11 attributes which reflect the most outstanding aspects of each legend unit: 4 inherent attributes — naturalness, plant diversity, resilience, and form of landscape covering —, 3 attributes expressing their biogeographical significance — endemicity, rarity within the Pyrenees and rarity within Andorra — and 4 other attributes produced from the GIS analysis — altitude range, exposure diversity, mean surface of the polygons and landscape density of polygons. These 4 attributes, which depend on the local landscape, give higher scores to a given unit, the more defined topography it inhabits in the area. All the attributes were ruled as corresponding indexes ranging from 1 to 4, as shown in Table 1. A particular value was given for each attribute and for each legend unit, taking into account various information sources dealing with Pyrenean vegetation (Braun-Blanquet, 1948; Gruber, 1978; Folch et al., 1979; Rivas-Martinez et al., 1991; Carrillo & Ninot, 1992; Carreras, 1993; etc.). Where a legend unit includes more than one habitat, we gave one global value per attribute, according to the sharing of the habitats included.

All these attributes were then synthesised into a global interest value (GIV). Since we considered some of them to be a bit redundant, namely the couples f & g, h & i, and j & k, we used the formula:

\[
GIV = (a + b + c + d + e + \frac{(f+g)}{2} + \frac{(h+i)}{2} + \frac{(j+k)}{2})/8
\]

This enabled us to produce a basic map of natural interest of the landscape of Andorra, in which the polygons showed the given GIV, as well as its specific vegetation contents.

Then, we introduced a threat factor, which would express the probability of disturbance of each legend unit, taking into account the singularity of the area studied. Therefore, we assumed that the most threatened landscape units in Andorra were fens, mires, alluvial forests and other systems related to superficial waters, because they always occupy reduced surfaces, which become altered by all the frequent hydrologic change. We evaluated this situation, giving to these units a coefficient of 1.5. Other units under medium threat got a coefficient of 1.2: snowbeds and chionophilous pastures (threatened by uprisings ski facilities), Montane pastures (depending on traditional management), and forests typical of low, gentle slopes (vanishing due to growing urban areas). The rest of the legend units remained unchanged. The combination of GIV together with the potential threat factor gives a new value (global interest value with threat factor, GIVT), for each legend unit, ranging from 1 to 6, which may be used as the basis for a comprehensive map of interest of the landscape of Andorra.

IV. RESULTS AND DISCUSSION

A. The landscape of Andorra

The map produced includes 3,340 polygons, each identified by 1, 2 or 3 legend units, with an evaluation of their sharing ratio (Ninot et al., 2002). The legend is formed by 103
units, corresponding to 175 habitats (see the Appendix). Thus, the most simple polygons contain a sole legend unit which in most cases is formed by a sole habitat unit; whereas, others may contain a combination of 3 legend units, each one including a group of related habitats, which occurs in the most abrupt surfaces, or in lacustrine complexes.

The most represented habitat types in Andorra are forests, which account for 39% of the area. Since 43.4% of the country is situated above 2,200 m a.s.l. (the general altitude at which big forests stop), montane and subalpine belts are vastly forested. Among the forests, coniferous woodland (Pinus sylvestris, P. uncinata and Abies alba forests) represents more than 91% of them. The calciphugue, mesophileus Pinus uncinata forest (habitat 42.413) is the most extensive habitat in the country (5,567 ha, 11.9% of the total surface). Grasslands and fens occupy 31.4% of Andorra and rocks and screes account for 17.3%. At low altitudes, the landscape is more diverse and fragmented, in part due to human activities. Here are concentrated the majority of urban areas and crops (which represent together 3% of the area). The remaining 9.2% correspond to scrub and standing and running waters.

This habitats map, as well as its legend and numerical appendices, may be consulted under digital format (Centre de Biodiversitat-IEA 2003, http://www.sigma.ad).

B. Territorial assessment

The values given to each legend unit and the corresponding global values are shown in the Appendix. The implementation of them on the map of habitats is expressed in the map of Figure 2, upper, where the polygons are grouped into grey intensities, according to a few levels of natural interest. This points out that higher values of interest coincide, for the larger part, with three landscape units: i) calcareous outcrops (occurring in the middle-west and in the south-west parts of the country), with a high concentration of rare, diverse and endemic habitats; ii) low altitude bottoms of the main valleys, where mixed forests, mesophyllous forests, and alluvial forests occur; iii) some small, sparse areas in the high mountain zone, where coincide lakes, dwarf heaths and scrub, tall herb communities, snow-patch communities, fens, etc.

The polygons under potential threat in Andorra draw a particular pattern (not shown), in which the areas standing out correspond to the high mountain snow lasting areas, the gentle slopes at low or moderate altitudes and a system of riparian stripes. The index of potential threat produces noticeable modifications on the combined index (GIVT), shown in the lower part of Figure 2. The most evident are the rising values exhibited by some high mountain areas, where interesting habitats coincide with good snow coverage, and are thus liable to suffer from snow sports infrastructures. A similar combination occurs along the riparian areas, in which high values of GIV coincide with other types of urban pressure.

The landscape evaluation obtained may serve the public bodies of Andorra as a useful tool in basic planning. It shows the main tendencies, both of interest and of threat, which should be taken into account for management purposes, such as delimitation of preserved areas, design of infrastructures, and general land planning.

However, it should be taken into account that such evaluation is based only on the mapped habitats, i.e. those occupying medium sized to large surfaces. Although small sized habitats add interesting biodiversity to most landscapes, they have not been truly included here, since not mapped due to the scale used. This fact, and also several aspects not evenly related to habitats (communication infrastructures, ski resorts, even faunistic particularities at large scale) should be further incorporated into a comprehensive evaluation for any particular purpose.
Table II.- Comparison of the percentages in Andorra and in Vallferrera and Vall de Cardós of some units. Whereas the most extended show very similar percentages in both areas, the differences in land use are expressed by a few small units.

<table>
<thead>
<tr>
<th>Units mapped</th>
<th>Andorra</th>
<th>Vallf. &amp; Cardós</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most extensive and coincident units</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcicuge, mesophils <em>Pinus sylvestris</em> forests</td>
<td>3,192</td>
<td>3,092</td>
<td>1,032</td>
</tr>
<tr>
<td>Calcicuge, mesophils <em>P. uncinata</em> forests</td>
<td>11,984</td>
<td>11,275</td>
<td>1,056</td>
</tr>
<tr>
<td><em>Rhododendron ferrugineum</em> heaths</td>
<td>4,061</td>
<td>3,072</td>
<td>1,106</td>
</tr>
<tr>
<td>Siliceous mountain cliffs</td>
<td>5,81</td>
<td>5,201</td>
<td>1,117</td>
</tr>
<tr>
<td><strong>Artificial units produced by human activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urbanised areas with semi-natural vegetation</td>
<td>0,259</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Quarries and similar exploitations</td>
<td>0,052</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reclaimed areas</td>
<td>0,764</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Urban and industrial areas</td>
<td>1,598</td>
<td>0,099</td>
<td>16,141</td>
</tr>
<tr>
<td><strong>Deciduous montane forests</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesophylous mixed forests with <em>Quercus pyrenaica</em></td>
<td>0,023</td>
<td>1,423</td>
<td>0,016</td>
</tr>
<tr>
<td>Mesophylous <em>Quercus pyrenaica</em> forests</td>
<td>0,123</td>
<td>3,57</td>
<td>0,034</td>
</tr>
<tr>
<td><em>Callicage Quercus pubescens</em> forests</td>
<td>0,416</td>
<td>1,772</td>
<td>0,225</td>
</tr>
<tr>
<td><em>Alnus glutinosa</em> forests</td>
<td>0,01</td>
<td>0,089</td>
<td>0,112</td>
</tr>
<tr>
<td>Mesophylous <em>Corylus avellana</em> thicket</td>
<td>0,133</td>
<td>0,392</td>
<td>0,339</td>
</tr>
<tr>
<td><strong>Fields and other exploited areas</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low altitude hay meadows</td>
<td>0,676</td>
<td>2,408</td>
<td>0,281</td>
</tr>
<tr>
<td>Extensive herbaceous fields</td>
<td>1,799</td>
<td>0,062</td>
<td>29,016</td>
</tr>
<tr>
<td>Abandoned fields</td>
<td>0,022</td>
<td>0,012</td>
<td>1,833</td>
</tr>
<tr>
<td>Woodlands severely cleared</td>
<td>0,111</td>
<td>0,538</td>
<td>0,206</td>
</tr>
<tr>
<td><strong>Xerophilous mountain forests</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcicuge, xerophylous <em>Pinus uncinata</em> forests</td>
<td>6,859</td>
<td>5,099</td>
<td>1,329</td>
</tr>
<tr>
<td>Calcicuge, xerophylous <em>P. sylvestris</em> forests</td>
<td>4,488</td>
<td>2,071</td>
<td>2,167</td>
</tr>
<tr>
<td><strong>Secondary dry heaths and pastures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montane <em>Genista balansae</em> heaths</td>
<td>0,117</td>
<td>7,428</td>
<td>0,056</td>
</tr>
<tr>
<td>High mountain <em>Genista balansae</em> heaths</td>
<td>0,03</td>
<td>5,941</td>
<td>0,008</td>
</tr>
<tr>
<td>Calcicuge, semi-dry grasslands with <em>Agrimetis capillaris</em></td>
<td>0,514</td>
<td>1,953</td>
<td>0,263</td>
</tr>
</tbody>
</table>

C. Some tendencies in the landscape evolution

The landscape of Andorra reflects the particular management of this country, in which urban activity and snow sports, together with allied facilities, have been on the increase for some decades. In a parallel way, traditional land use has been strongly decreasing, mainly through pasture abandonment and low forest exploitation. These tendencies and their results, although general in the Pyrenees, clearly differentiate Andorra from the neighbouring valleys, at least those on the south facing side of the range. Thus, a comparison between the landscape of these valleys and that of Andorra may be used to outline the particular tendencies of Andorra, assuming the neighbouring areas may be taken as representative of its "previous situation".

We take as a comparison subject the area of neighbouring Vallferrera and Vall de Cardós. It accounts for 409 sq. km and is very similar to Andorra in altitude range, geomorphic structure, and vegetation units. The data were obtained from the cartography of habitats done in Catalonia (DMA 1998-2003: sheets 150 and 182). The first aspect to be commented on is the strong surface similarity between Andorra and Vallferrera and Vall de Cardós area in the most extensive units: mesophile *Pinus uncinata* forests, mesophile *P. sylvestris* forests, *Rhododendron* scrubs, and acidic high mountain rocks, occupy almost the same surface in both the areas, accounting for about 23-25% of the landscape. As for the differences evidenced by other units, their causes may be grouped into four main aspects:

1. Differences in substrata composition; since no calcareous rocks occur in Vallferrera & Vall de Cardós, calciculous units indicate a noticeable difference - about 20 calciculous units present in Andorra and not in Vallferrera and Vall de Cardós;
2. A different situation in the Pyrenean range of the compared areas; there is a greater presence in Andorra of eastern Pyrenean units and of Atlantic units (occurring mainly in the north-eastern part of the area open to the Ariège); there are some units related to Central Pyrenees in Vallferrera & Vall de Cardós;
3. Methodological differences between the maps compared; due to the more detailed cartography done in Andorra, about 15 units were mapped there, such as alpine dwarf shrubs, clearings, or tall herb communities, which were not mapped in Vallferrera and Vall de Cardós;
4. Different land use.

Table II shows the most interesting differences in the landscape percentages related to land use. In the particular regime of Andorra, the most direct effect on the landscape is the greater urban surfaces, which reflect from relatively small figures a great difference: the scarce 900 inhabitants of Vallferrera and Vall de Cardós are dramatically surpassed by the 70,000 of Andorra. As counterpart consequently, the deciduous forests (oak forests, mixed forests, etc.), which in these Pyrenean valleys occupy gentle, low slopes, are less extensive in Andorra, where they have, at least in part, been replaced by urban facilities. As for the cultivated areas, most of the fields in Vallferrera and Vall de Cardós are used as hay meadows, whereas the remaining fields in Andorra are mainly used for growing tobacco, not allowed by Spanish rules.

As for to mountain forests, although most of the communities show similar extension in both the areas considered, the xerophilous pine forests (both of *P. sylvestris* and *P. uncinata*), occupying south facing slopes, are more extensive in Andorra. Among the units able to occupy these dry aspects, some serial scrubs (*Genista balansae* heaths, etc.) are clearly more abundant in Vallferrera and Vall de Cardós. Since south facing areas have been traditionally used as pasture range in the montane and subalpine belts of the Pyrenees, this may be taken as an indication of spontaneous afforestation, which would maintain Vallferrera and Vall de Cardós in a more immature situation, since extensive pasture and occasional burning still play an important role. Forest exploitation is apparently only residual in Andorra, whereas it is still occurring in the neighbouring valleys, where there are a number of severely cut woodland areas.

Another aspect revealed is the greater surface used by snow sports in Andorra. Although not very big in terms of hectares, it should be recognised that this land use implies severe damage in alpine systems, which includes substrate moving (with subsequent low plant colonisation and irreversible loss of soil) and the introduction of allochthonous plants for reclamation.
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Appendix. Values given to each legend unit (with the most outstanding CORINE codes specified where appropriate): a, naturalness; b, diversity; c, resilience; d, form of landscape covering; e, endemicity; f, rarity within the Pyrenees; g, rarity within Andorra; h, altitude range; i, exposure diversiry; j, density of polygons; k, Mean size of polygons; GIV, global interest value; t, threat coefficient; GIVT, modified GIVT through. The complete definitions of the habitats are available in http://www.gencat.net/mediamap/pn/2habitats-lista.pdf.

Anexa. Valors donades a cada unitat (qui est identificat per les codes CORINE). a, naturalitat; b, diversitat; c, resiliència; d, formar de coberta del paisatge; e, endèmicitat; f, raritat en els Pirineus; g, raritat en Andorra; h, interval d'altitude; i, diversitat d'exposició; j, densitat de polígons; k, mediana de polígons; GIV, valor global d'interès; t, coeficient de mena; GIVT, valor modificat per part.
Calliclise mixed Quercus pubescens and Pinus sylvestris forests (43.7131)

Calliclise mixed Quercus pubescens and Pinus sylvestris forests (43.7132)

Other mixed forests of deciduous and coniferous trees (43.31)

Willow thickets and allied communities (44.124, 24.226)

Alnus glutinosa forests (44.3431)

Mixed Quercus rotundifolia and Q. xerocarpa or Q. pubescens forests (45.3416)

Quercus robur forests (45.2442)

Mixed Quercus rotundifolia and Pinus sylvestris forests (45.3417)

Alkaline lens with Carex douglasiana (54.24)

Acidophilous lens with Carex flexuosa (54.424, 54.425)

Pinus uncinata bog forests (44.33)

Silicicline montane stands (61.12)

Silicicline high mountain stands (61.33, 61.37)

Calearcous high mountain stands (61.341)

Calearcous badlands with sparse vegetation (61.51)

Calearcous mountain cliffs (62.12)

Silicicline mountain cliffs (62.211)

Flat outcrops with sparse communities (62.3, 36.2)

Extensive herbaceous fields (62.3)

Populus tremuloides forests (41.63, 41.64)

Abies alba forests with Pyrola chlorantha (42.113, 42.132)

Abies alba forests with Rhododendron ferrugineum (42.1331)

Calliclise, mesophyllous Pinus uncinata forests (42.411)

Calliclise, xerophilous Pinus uncinata forests (42.4241)

Calliclise, xerophilous Pinus uncinata forests (42.4242)

Calliclise, mesophyllous Pinus sylvestris forests (42.425)

Pinus uncinata stands devoid of forest understorey (42.43)

Calliclise, mesophyllous Pinus sylvestris forests (42.561)

Calliclise, xerophilous Pinus sylvestris forests (42.562)

Calliclise, xerophilous Pinus sylvestris forests (42.9291)

Neotrophophilous, mesophyllous Pinus sylvestris forests (42.9912)

Calliclise, xerophilous Pinus sylvestris forests (42.5B11)

Calliclise, xerophilous Pinus sylvestris forests (42.5E)

Mixed Abies alba and Pinus uncinata forests (42.81)

Mixed Abies alba and Pinus sylvestris forests (42.82)

Mixed Pinus sylvestris and Pinus nigra subsp. salzmannii forests (42.83)

Other mixed coniferous forests (42.85)

Other mesophyllous forests (36.111)

Calcicolous snow-plant communities (36.112)

Mesophilous Nardus stricta grasslands (36.311, 36.315)

Hygrophilous Nardus stricta grasslands (36.316)

Dense Festuca eskia grasslands (36.314)

Festuca pseudocymbalaria grasslands (36.331)

Open, striped Festuca eskia grasslands (36.332)

Carex curvula short grasslands (36.341)

Festuca airoles short grasslands (36.342)

Dense, calcicolous grasslands with Triphlaena thalii (36.4142)

Kobresia myosuroides short grasslands (36.422)

Open, striped Festuca gautieri grasslands (36.434)

Montane humid, tall grasslands (37.1, 37.2, 37.3)

Subalpine, hygrophilous tall herb communities (37.83)

Subalpine, nitrophilous tall herb communities (37.88)

Low altitude hay meadows (38.23)

Montane and Subalpine hay meadows (38.3, 36.51)

Fringtum excelsorum forests (41.33)

Mixed forests of vaynoloids and slopes (41.44)

Mesophilous Quercus petraea forests (41.5611)

Mesophyllous mixed forests with Quercus petraea (41.5612)

Calcicolous Quercus pubescens forests (41.7131)

Calcigraf Quercus pubescens forests (41.7132)

Secondary Betula pendula forests (41.332)

Mesophyllous Betula spp. forests with tall herb communities (41.333)

Populus tremula forests (41.63, 41.64)

Alnus alba forests with Pyrola chlorantha (42.113, 42.132)

Abies alba forests with Rhododendron ferrugineum (42.1331)

Calliclise, mesophyllous Pinus uncinata forests (42.411)

Calliclise, xerophilous Pinus uncinata forests (42.4241)

Calliclise, xerophilous Pinus uncinata forests (42.4242)

Calliclise, mesophyllous Pinus uncinata forests (42.425)

Pinus uncinata stands devoid of forest understorey (42.43)

Calliclise, mesophyllous Pinus sylvestris forests (42.561)

Calliclise, xerophilous Pinus sylvestris forests (42.562)

Calliclise, xerophilous Pinus sylvestris forests (42.9291)

Neotrophophilous, mesophyllous Pinus sylvestris forests (42.9912)

Calliclise, xerophilous Pinus sylvestris forests (42.5B11)

Calliclise, xerophilous Pinus sylvestris forests (42.5E)

Mixed Abies alba and Pinus uncinata forests (42.81)

Mixed Abies alba and Pinus sylvestris forests (42.82)

Mixed Pinus sylvestris and Pinus nigra subsp. salzmannii forests (42.83)

Other mixed coniferous forests (42.85)
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