



CORINE biotopes manual

Habitats of the European Community

A method to identify and describe consistently
sites of major importance for nature conservation

Data specifications — Part 2

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This volume explains the habitats of the European Community.

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INTRODUCTION

Scope

A catalogue of the recognizable communities formed by the flora and fauna in response to the abiotic environment and to each other's influence is a prerequisite to any attempt at characterizing sites in terms of their importance for nature conservation, of inventorying such sites, of constituting coherent networks of protected sites, or of monitoring the evolution of such networks.

The present typological list was developed within the context of the biotope project of the Commission of the European Communities CORINE information and mapping system, as a tool for the description of sites of importance for nature conservation in Europe. It is, however, hopefully susceptible to wider applications in the field of conservation biology.

The primary objective of the list is to identify all major communities whose presence contributes to the conservation significance of a site. It has endeavoured to strike a balance between the need to emphasize the extremely interesting but rare natural or near-natural communities and the widespread semi-natural ones, which result from a long history of extensive use by man and domestic animals and constitute most of the habitat of the larger species of the wild fauna.

Three considerations have mostly guided the construction of the list. Its structure and the arrangement of its units have been chosen so as to keep a permanent and flexible possibility to adapt the classification to needs for finer division of the classes proposed. The units have been defined, as far as possible, to be easily identified by persons in charge of data collecting, conservation decision-making or monitoring. A constant effort has been made to ensure compatibility with other existing schemes and, in particular, those that concern the whole European Community.

Choice of units

Only the natural, near-natural and sub-natural habitats, all of which are today threatened because they either are rare and extremely local or are dependent on extensive agro-pastoral activities that no longer have an obvious place in the economic fabric, have been treated in detail. The more artificial habitats, which together cover probably 80 to 90% of the surface of the Community, have for the most part been summarily considered under Section 8.

The separate units listed and numbered in the typology have been chosen so as to explicitly identify the communities that either:

- (1) are capable of covering large enough surfaces to be important habitats for animal species with high space requirements;
- (2) are physiognomically significant in the landscape;
- (3) are essential to the survival of distinctive populations of rare or sensitive species of plants or animals;
- (4) constitute necessary elements of larger ecosystems; or
- (5) are remarkable because of the ecological processes they demonstrate or because of their aesthetic value.

In addition, communities of lesser conservation significance, but necessary to the description of sites at a moderately fine level have been listed, mostly in Section 8.

The level of definition thus reflects the differential conservation significance and needs of various types of habitats. It is also directly dependent on the scope of the CORINE project. Habitats that did not figure prominently in the mapping programme, such as marine ecosystems, were not detailed. Amplification of those sections is an obvious field for future revisions.

Structure

The basic arrangement and the higher rank units (left of the decimal point) were imposed by the need to conform with the categories defined in *Biotoques of significance for nature conservation* (Wyatt *et al.*, 1982) as amended and adopted by the Adaptation Committee of Directive 79/409/EEC and subsequently used in the site designation procedure essential to the application of that directive.

In the subdivision of these basic units, flexibility is ensured by the adoption of a hierarchical decimal list that can be expanded at any point to accommodate further additions or divisions. Such additions can be done whenever needed either for greater descriptive and predictive precision or to accommodate existing local schemes.

The need to make the contents and the limits of the various units easily communicable between various operators led us to use as a main reference the basic units of the phytosociological classification of vegetation. In spite of its well-known limitations, the phytosociological system has the advantage of being founded on a regulated procedure of field sampling, description, definition and agreed nomenclature. However, in order to take into account the faunal significance and the landscape-shaping role of communities, and to allow due space to the more anthropogenic or zoogenic habitat types, we have departed from the higher phytosociological hierarchy and have incorporated a large proportion of reference to physical features, integrated ecosystems and phytosociologically non-significant facies. This has often led to a certain amount of redundancy which is of no adverse consequence to the object of the scheme.

Compatibility

Throughout the development of the classification great efforts were made to establish or retain compatibility, in the sense of possibilities of one-to-one conversion, between the CORINE classification and two other Europe-wide projects. These are, on the one hand, the Council of Europe *Classification of European ecosystems* designed by J. M. Géhu (1984), on the other hand, the *Carte de la végétation naturelle des États membres des Communautés européennes et du Conseil de l'Europe* that was being prepared by Professor Noirfalise simultaneously with the CORINE project. It must be borne in mind that both these projects are concerned with vegetation, and mostly with natural vegetation, rather than with a broader habitat concept. In addition, whenever the possibility arose, we endeavoured to take into account in the same way local schemes that either existed or were being prepared. The contribution of Ulla Pinborg and of Ruth Briggs and Mark O. Hill in facilitating the establishment of bridges with systems in use in Denmark and in the United Kingdom, respectively, were determinant. Future identifications will, we hope, be facilitated by the possibility of bringing both this classification and the one to be incorporated down to objective field units, at the level of phytosociological associations, sub-associations or their facies.

Description of units

The brief descriptions of units within the classification and the lists of plants that they incorporate are intended first and foremost to facilitate identification by data collectors, and secondarily, to draw attention to sensitive taxa harboured by the concerned units. The phytosociological terms included are always indicative only, meant to facilitate the identification of the unit, and allowance must, when appropriate, be made for implicit restrictions, such as 'in particular' and 'among others', to any formal identification between the habitat unit and a phytosociological syntaxon. We have tried, whenever possible, to list the best-known phytosociological names and synonyms, and, in particular, those used in the readily available, recent syntheses of Ellenberg (1988) and Oberdorfer (1990), regardless of syntaxonomic or nomenclatural implications; in addition, plant community names adopted by Rodwell (1991) have, in general, been explicitly mentioned. Plant names are, for the most part, those of *Flora Europaea* (Tutin *et al.*, 1964-83), again with no implication as to the appropriateness of the taxonomic treatment adopted in that work.

A great proportion of the units have been seen in the field by the authors or their collaborators, and a photographic file of habitats, animals and plants has been constituted at the Institut Royal des Sciences Naturelles de Belgique. Nevertheless, the descriptions of the units were largely drawn from the abundant literature provided by numerous European phytosociologists whose work has been fundamental to this compilation. The primary descriptions and syntheses specifically used are listed within the hierarchy together with a few readily available works that provide illustration or discussion of the units concerned.

Some of the references and contributions have to be singled out for their importance to all aspects of the list. The fundamental and elucidating descriptive work of Ellenberg (1963, 1988) has provided many definitions, unit names and key species. The construction of the list closely follows the regional syntheses of Oberdorfer (1990), Horvat *et al.* (1974), Ozenda (1985), Peinado Lorca and Rivas-Martinez (1987) and the European overviews of Ozenda *et al.* (1979) and of Noirfalise (1987). The lucid correspondence established between the British National Vegetation Classification and the CORINE typology by Hill (*in litt.*, 1990) has enormously contributed to the presentation of the habitats of an important part of the Community. For particular habitats, the Nature and Environment Series of the Council of Europe and the analysis of forest habitats by Noirfalise (1984) have provided a framework. The hierarchical vegetation list of Géhu (1984), supported by the wealth of information assembled by the Colloques phytosociologiques that he has guided, has been the main leading line of the list.

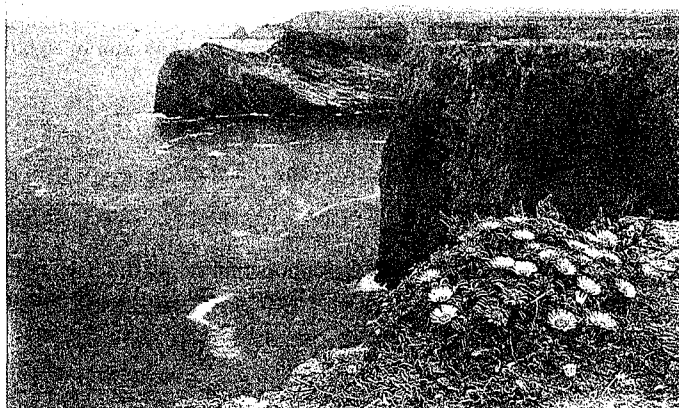
Revisions

This list must be regarded as a provisional working document. It certainly contains errors and many omissions as well as obvious areas for further clarification and precision. The authors will be very grateful for suggestions, corrections or subdivision proposals that would be sent to them with a view to a second, more complete edition.

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1 Coastal and halophytic communities



11 Ocean and seas

Oceanic and continental shelf waters, their associated open-water and bottom communities, and marine vascular vegetation beds.

- 11.1 OPEN MARINE WATERS**
Pelagic biocenoses. They can be characterized by their planktonic communities and by the composition of their nektonic or surface-feeding faunas of cephalopods, fish, sea mammals and seabirds.
(Nicholson, 1977; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988)
- 11.11 OCEANIC WATERS**
Waters beyond the continental shelf.
- 11.12 SHELF AND SLOPE WATERS**
Waters of the continental shelf, underwater plateau extending from the coast to a depth of about 100 fathoms, beyond which the continental slope falls steeply toward the ocean bottom.
- 11.121 Inshore waters**
Waters within the strong influence of land masses, both in terms of physical parameters and of fauna, often arbitrarily defined as waters less than 5 km from low-water mark, waters between the continent and islands or islets well in sight of shore, and any seas of depth less than 6 metres.
- 11.122 Offshore waters**
The zone extending from the limits of inshore waters to the continental slope.
- 11.123 Continental slope**
Waters situated over the continental slope, the steep descent from the continental shelf to the ocean bottom, an area where upwellings, water mixing or shearing and other anomalies often develop.
- 11.124 Upwellings**
Zones where the warmer surface water is displaced, allowing cooler water rich in nutrients to rise to the surface, often generating much increased biological productivity.
- 11.125 Shoals**
Shallow waters over permanently submerged elevated features of the sea-floor.
- 11.2 SEABED**
Benthic communities of animals and algae occupying the sea floor in the infralittoral, circalittoral and deeper zones. This unit should be subdivided into a number of habitats characterized by depth, substrate, geographical location, water movement and the distinct biocenoses they support. A basic framework is outlined below; divisions such as those proposed by Augier (1982) for Mediterranean biocenoses can be easily, and without transformation, incorporated in it to provide further divisions.
(Augier, 1982, 1985; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988)
- 11.21 DEEP SEA FLOOR**
Bathyal, abyssal, hadal and hydro-thermal benthic communities, of the continental slope, the abyssal plain and its features, respectively.
- 11.22 SUBLITTORAL SOFT SEABEDS**
Mostly animal communities colonizing soft sediments such as mud, sand or gravel of the infralittoral and circalittoral zones.

- 11.23** **SUBLITTORAL PEBBLY SEABEDS**
Communities of mostly annual algae and invertebrates developing on pebble formations of the infralittoral and circalittoral zones.
- 11.24** **SUBLITTORAL ROCKY SEABEDS**
Varied, strongly stratified communities colonizing underwater cliffs, reefs and rocky continental shelf seabeds.
- 11.25** **SUBLITTORAL ORGANOGENIC CONCRETIONS**
Continental shelf colonies of lower plants or animals resulting in concretions and encrustations.
- 11.251** **Corallogenic concretions**
Communities forming and colonizing corallogenic concretions of calcified red algae in the circalittoral zone of the Mediterranean.
- 11.252** **Encrusting algae pavements**
Mediterranean communities associated with mediolittoral pavements of encrusting algae (*Lithospermum tortuosum*).
- 11.253** **Gastropod and polychaete ledges**
Infralittoral ledges built by gastropods or polychaetes.
- 11.254** **Mussel beds**
Communities of Atlantic and Mediterranean mussel beds.
- 11.26** **UNDERSEA CAVES**
- 11.3** **MARINE VASCULAR VEGETATION**
Zosteretea marinae, *Posidonietea*, *Halodulo-Thalassietea*
Beds of submerged marine vascular vegetation, except those of brackish seas.
- 11.31** **ATLANTIC EELGRASS MEADOWS**
Zosterion marinae: *Zosteretum marinae*
Eelgrass beds dominated by *Zostera marina*, established between the base of the intertidal zone and a depth of about 10 metres in Atlantic and North Sea waters.
(Westhoff and den Held, 1975; Tutin, 1980; Géhu, 1984; Géhu and Géhu-Franck, 1984a; Ellenberg, 1988; Oberdorfer, 1990)
- 11.32** **ATLANTIC DWARF EELGRASS MEADOWS**
Zosterion marinae: *Zosteretum noltii*
Eelgrass beds dominated by *Zostera noltii* or *Z. angustifolia*, mostly characteristic of the low part of the intertidal zone in Atlantic and North Sea waters, sometimes permanently submerged.
(Westhoff and den Held, 1975; Tutin, 1980; Géhu, 1984; Géhu and Géhu-Franck, 1984a; Wildpret de la Torre and del Arco Aguilar, 1987)
- 11.321** **Mainland Atlantic dwarf eelgrass meadows**
Formations of *Zostera noltii* or *Z. angustifolia* of the Atlantic and North Sea shores of continental Europe.
- 11.322** **Macaronesian dwarf eelgrass meadows**
Very local *Zostera noltii* formations of Fuerteventura and Lanzarote, near the southern limit of the Atlantic range of the genus.
- 11.33** **MEDITERRANEAN CYMODOCEA AND ZOSTERA BEDS**
Cymodoceion nodosae p.
Beds of *Cymodocea nodosa* and *Zostera noltii* or *Z. marina*, permanently submerged in waters down to 10 metres deep, often in sheltered areas behind *Posidonia* reefs.
(Campbell, 1976; Molinier and Martin, 1980; Augier, 1982; Géhu and Géhu-Franck, 1984a; Géhu, Costa *et al.*, 1984; Polunin and Walters, 1985)

- 11.331** **Mediterranean Cymodocea beds**
Cymodoceum nodosae
Cymodocea nodosa formations of muddy sands, monospecific or associated with either the alga *Caulerpa prolifera* or the phanerogam *Halophila stipulacea*.
- 11.332** **Mediterranean Zostera beds**
Giraudyo-Zosteretum noltii
Formations of the upper part of the infralittoral zone with *Zostera noltii* and the alga *Giraudya sphacelarioides*.
- 11.34** **POSIDONIA BEDS**
Posidonium oceanicae
Beds of the Mediterranean and thermo-Atlantic endemic, *Posidonia oceanica*, permanently submerged in waters down to 100 metres deep.
(Campbell, 1976; Molinier and Martin, 1980; Augier, 1982; Géhu and Franck, 1984a; Géhu, Costa *et al.*, 1984; Polunin and Walters, 1985; Harmelin, Vacelet and Pétron, 1987; Fiala-Médione, Pétron and Rives, 1987)
- 11.35** **MACARONESIAN CYMODOCEA BEDS**
Cymodoceion nodosae p.
Formations of *Cymodocea nodosa* or *Cymodocea* and *Caulerpa spp.*, in particular *Caulerpa prolifera*, occupying large surfaces on sandy substrates at depths of 1-15 metres, around the Macaronesian Islands.
(Wildpret de la Torre and del Arco Aguilar, 1987)
- 11.36** **HALOPHILA BEDS**
Deep water colonies of *Halophila spp.*
(Dandy, 1980; Augier, 1982; Wildpret de la Torre and del Arco Aguilar, 1987)
- 11.361** **Canarian Halophila beds**
Halophila decipiens colonies of Tenerife, at depths between 10 and 14 metres.
- 11.362** **Mediterranean Halophila beds**
Colonies of *Halophila stipulacea* invading the Mediterranean as a result of the opening of the Suez Canal; they have been reported from continental Greece, the Cyclades, Crete, Rhodes and Samos.
- 11.4** **BRACKISH SEA VASCULAR VEGETATION**
Ruppiaetea maritimae p.
Submerged or slightly emergent vascular vegetation of open brackish waters. Characteristic of open Baltic waters, *Ruppiaetea* communities may also occur in permanent pools of mud or sand flats (11.4 *p.*), as well as in inlets or estuaries where they should be coded as 12.4 or 13.4, respectively. Similar vegetation in landlocked pools is listed under 23.2.
(Westhoff and den Held, 1975; Nordiska ministerradet, 1984; Ellenberg, 1988; Oberdorfer, 1990)
- 11.41** **MARINE TASSELWEED COMMUNITIES**
Ruppion maritimae p.
Submerged *Ruppia maritima* (or *R. cirrhosa*) beds and *Chara* formations of the open Baltic and of pools on mud flats or sand flats of other seas.
- 11.42** **DWARF SPIKE-RUSH BEDS**
Scirpion parvuli p.
Emergent *Eleocharis parvula* formations of the open Baltic or of tidal flats.

12 Sea inlets

Bays and narrow channels, including sea lochs or loughs, fiords or fiards, rias and straits but excluding estuaries. Detailed habitats can be coded by transposing subdivisions of prefix 11, simply replacing prefix 11 by prefix 12.
(Wood, 1988)

13 Tidal rivers and estuaries

River channels below the tidal limit, including the water and the channel bed but not the fringing vegetation.

- 13.1. TIDAL RIVERS**
Portions of rivers subject to the tide, upstream from the estuary.
- 13.11 BRACKISH WATER**
- 13.12 FRESH WATER**
- 13.2 ESTUARIES**
Broadening of rivers entering the sea. Detailed habitats can be coded by transposing subdivisions of prefix 11.2, simply replacing prefix 11.2 by prefix 13.2.
- 13.3 SUBMERGED BEDS OF VASCULAR MARINE VEGETATION**
Subdivisions of 11.3 can be transposed to precise communities (13.31 to 13.36).
- 13.4 SUBMERGED BEDS OF VASCULAR BRACKISH VEGETATION**
Subdivisions of 11.4 can be transposed to precise communities (13.41 to 13.42).

14 Mud flats and sand flats

Sands and muds, submerged for part of every tide, devoid of vascular plants, but usually coated by blue algae and diatoms. They are of particular importance as feeding grounds for wildfowl and waders. The diverse intertidal communities of invertebrates and algae that occupy them can be used to define subdivisions of 14. Eelgrass communities that may be exposed for a few hours in the course of every tide have been listed under 11.3, 12.3 or 13.3, depending on the physical location of the flats.

15 Salt marshes, salt steppes and gypsum scrubs

Plant communities which are submerged by high tides at some stage of the annual tidal cycle. Also continental and coastal halophile and gypsophile communities.

15.1

SALT PIONEER SWARDS

Thero-Salicornietalia, *Frankenion pulverulentae*, *Saginion maritimae*

Formations of *Salicornia* and other annuals colonizing periodically inundated muds and sands of marine or interior salt marshes.

(Duvigneaud, 1967; Westhoff and den Held, 1975; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Géhu, Caron and Bon, 1975; Parent and Burny, 1981; Géhu, 1984; Géhu and Géhu-Franck, 1984a; Géhu, Costa *et al.*, 1984; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984; Drachenfels *et al.*, 1984; Dijkema *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Oberdorfer, 1990)

15.11

GLASSWORT SWARDS

Thero-Salicornietalia

Annual glasswort (*Salicornia* spp., *Microcnemum coralloides*) and seablite (*Suaeda maritima*) formations on periodically inundated muds of coastlands and inland salt-basins.

15.111

Atlantic glasswort swards

Annual *Salicornia* and *Suaeda* swards of the coastal saltmarshes of the North Sea, the Baltic and the North Atlantic.

15.1111

Low shore samphire flats

Salicornion dolichostachyo-fragilis

Colonies of non-reddening tetraploid glassworts *Salicornia dolichostachya*, *S. fragilis*, *S. decumbens* and of *Suaeda maritima* ssp. *flexilis*, occupying the lowest, dampest areas of northern and western coastal flats.

15.1112

Seablite-samphire communities

Salicornion europaeo-ramosissimae p. (*Thero-Suaedion* auct.)

Colonies of often much-branched, diploid glassworts *Salicornia ramosissima*, *S. europaea*, *S. obscura* i.a. and/or of *Suaeda maritima*, occupying higher, drier areas of coastal flats.

15.112

Continental glasswort swards

Salicornion europaeo-ramosissimae p.

Glasswort formations of inland saltmarshes of Germany, France and England (15.4).

15.1121

Continental glasswort seeps

Salicornietum vicensis

Colonies of the orange-turning *Salicornia emerici* var. *vicensis*, of unstable, fluid, seeping muds.

15.1122

Continental drier glasswort swards

Salicornietum ramosissimae lotharingiense, *Puccinellio distantis-Salicornietum europaeae* p.

Colonies of the reddening *Salicornia ramosissima* or of *S. europaea*, of firmer ground.

15.113

Mediterranean glasswort swards

Glasswort swards of Mediterranean and thermo-Atlantic coastal saltmarshes.

15.1131

Low-shore Mediterranean glasswort swards

Salicornion emerici p.

Formations dominated by the reddening tetraploid glasswort *Salicornia emerici* occupying long-inundated basins of Mediterranean, south-western French and Iberian coastal saltmarshes.

- 15.1132** **Venetian glasswort swards**
Salicornion emerici p.: Salicornietum veneti
Endemic, threatened *Salicornia veneta* swards of basins of the Venice lagoon.
- 15.1133** **Upper shore Mediterranean glasswort swards**
Salicornion patuli
Formations dominated by the reddening diploid glasswort *Salicornia patula* occupying firmer, drier muds of Mediterranean, south-western French and Iberian coastal saltmarshes.
- 15.114** **Iberian glasswort swards**
Microcnemion
Annual *Salicornia* and *Microcnemum coralloides* formations of interior Iberian salt basins.
- 15.1141** **Microcnemum swards**
Formations of the endemic *Microcnemum coralloides* ssp. *coralloides*, associated or not with *Salicornia europaea s.l.*, of interior salt basins of central and east-central Spain.
- 15.1142** **Iberian interior Salicornia swards**
Formations of *Salicornia europaea s.l.* of interior salt basins of Iberia.
- 15.12** **HALONITROPHILOUS FRANKENIA COMMUNITIES**
Frankenion pulverulentae
Formations of halonitrophilous annuals (*Frankenia pulverulenta*, *Suaeda splendens*, *Salsola soda*, *Cressa cretica*, *Parapholis incurva*, *P. strigosa*, *Hordeum marinum*, *Sphenopus divaricatus*) colonizing salt muds susceptible to temporary inundation and extreme drying, mostly characteristic of the Iberian peninsula, with irradiations notably in the Camargue, Italy, and on the Atlantic coast of France.
- 15.13** **SEA-PEARLWORT COMMUNITIES**
Saginion maritimae
Formations of annual pioneers (*Sagina maritima*, *Cochlearia danica*) of sands subject to variable salinity and humidity, in particular in the zone of contact between dune and salt marsh.
- 15.2** **CORDGRASS SWARDS**
Spartinion maritimae
Perennial pioneer *Spartina* grasslands of coastal salt muds.
(Westhoff and den Held, 1975; Rivas-Martinez *et al.*, 1980; Parent and Burny, 1981; Drachenfels *et al.*, 1984; Géhu and Géhu-Franck, 1984a; Dijkema *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987; Alcaraz Ariza and Peinado Lorca, 1987)
- 15.21** **FLAT-LEAVED CORDGRASS SWARDS**
Perennial pioneer grasslands of coastal salt muds, dominated by flat-leaved *Spartina maritima*, *S. townsendii*, *S. anglica*, *S. alterniflora*.
- 15.22** **RUSH-LEAVED CORDGRASS SWARDS**
Perennial pioneer grasslands of southern Iberian coastal salt muds, dominated by the junciform-leaved *Spartina densiflora*.
- 15.3** **ATLANTIC SALT MEADOWS**
Glauco-Puccinellietalia maritimae
Salt meadows of Baltic, North Sea, Channel and Atlantic shores. *Aster tripolium* can be present or abundant in most subdivisions.
(Géhu *et al.*, 1975; Géhu and Delzenne, 1975; Duvigneaud, 1975; Westhoff and den Held, 1975; Parent and Burny, 1981; Dijkema *et al.*, 1984; Drachenfels *et al.*, 1984; Géhu and Géhu-Franck, 1984a; Géhu, 1984, 1986; Noirfalise, 1986; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 15.31** **SALTMARSH GRASS MEADOWS**
Puccinellion maritimae
Bright green lawns of *Puccinellia maritima* of the lower and middle schorre.

15 Salt marshes, salt steppes and gypsum scrubs

- 15.32** **SALTMARSH GRASS COMMUNITIES**
Puccinellion maritimae p.
 Facies of the saltmarsh grass meadows, transitional or not to other communities, in which species other than *Puccinellia maritima* take on an important physiognomic role.
- 15.321** **Sea purslane-saltmarsh grass meadows**
 Facies of the saltmarsh grass meadows resulting from their invasion by *Halimione portulacoides*.
- 15.322** **Sea aster-saltmarsh grass meadows**
 Lower schorre communities dominated by the conspicuous *Aster tripolium*.
- 15.323** **Glasswort-saltmarsh grass meadows**
 Transitional communities of the lower schorre, with *Puccinellia maritima*, annual *Salicornia* and *Suaeda maritima*.
- 15.324** **Stalked orache beds**
 Formations dominated by the rare, threatened *Halimione pedunculata*, developing very locally in the *Puccinellion maritimae* of Denmark, Germany, the Netherlands, Belgium and France, extinct in the British Isles.
- 15.33** **UPPER SCHORRE COMMUNITIES**
Armerion maritimae
 Often relatively species-rich, grassy, flowery formations of upper salt meadows, with *Armeria maritima*, *Glaux maritima*, *Plantago maritima*, *Frankenia laevis*, *Artemisia maritima*, *Festuca rubra*, *Agrostis stolonifera*, *Juncus gerardii*, *Carex extensa* and *Blysmus rufus*. The dominance of various species induces distinctive facies, among which:
- 15.331** *Juncus gerardii*-rich or -dominated formations
- 15.332** *Plantago maritima*-dominated formations
- 15.333** *Festuca rubra* or *Agrostis stolonifera* swards
- 15.334** Thrift (*Armeria maritima*) swards
- 15.335** *Carex distans* beds
- 15.336** *Carex extensa*-rich formations
- 15.337** Sea lavender (*Limonium vulgare*) meadows
- 15.338** *Blysmus rufus*-rich formations
- 15.339** *Eleocharis uniglumis* or *E. palustris* beds
- 15.33A** *Juncus maritimus* beds
- 15.33B** Sea wormwood (*Artemisia maritima*) scrub
- 15.33C** *Potentilla anserina* carpets
- 15.33D** Sea-heath (*Frankenia laevis*) mats
- 15.33E** Upper schorre sea aster (*Aster tripolium*) beds
- 15.34** **PEARLWORT-SALTMARSH GRASS SWARDS**
Puccinellio-Spergularion salinae
Puccinellia swards with *Spergularia marina*, *Puccinellia distans*, *P. fasciculata*, *P. retroflexa*, *P. maritima*, *Triglochin maritima*, *Potentilla anserina* and *Halimione portulacoides*, occupying zones of varying salinity and humidity, in particular in estuarine saltmarshes.

- 15.35** **SALTMARSH COUCH BEDS**
Agropyron pungentis
Nitrophilous tall grass communities with *Elymus pycnanthus* (= *Agropyron pungens*) or *E. repens*.
- 15.36** **ATLANTIC SALTMARSH DRIFTLINES**
Annual formations of pioneers colonizing driftlines forming within saltmarshes, with *Atriplex littoralis*, *A. hastata*, *Beta maritima*, *Matricaria maritima*.
- 15.4** **CONTINENTAL SALT MEADOWS**
Puccinellietalia distantis
Salt meadows of salt basins of interior middle Europe. Continental saltmarshes are remarkable, extremely threatened communities occurring in a few isolated stations of Saxony and Lower Saxony, Schleswig-Holstein, Thuringe, Hesse, Lorraine, Auvergne and the Midlands. They comprise this unit and continental glasswort swards (15.112). (Duvigneaud, 1967; Drachenfels *et al.*, 1984; Géhu, 1984; Géhu and Rivas-Martinez, 1984; Géhu and Géhu-Franck, 1984a; Dejou, 1985; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 15.41** **INTERIOR SALTMARSH GRASS MEADOWS**
Puccinellion distantis
Meadows of *Puccinellia distans* occupying the lower levels of interior salt basins with fairly extended periods of inundation.
- 15.42** **INTERIOR SALTMARSH RUSH AND COUCH BEDS**
Juncion gerardii p.
Formations dominated by *Juncus gerardii* or *Elymus repens* of the upper levels of interior salt basins on damp, less saline soils.
- 15.43** **INTERIOR STALKED ORACHE BEDS**
Formations dominated by the threatened *Halimione pedunculata* restricted to saltmarshes east and south of the Harz.
- 15.5** **MEDITERRANEAN SALT MEADOWS**
Juncetalia maritimi
Salt meadows of the Mediterranean coasts and of interior Iberian salt basins. (Bolos and Molinier, 1958; De Jong, 1965; Bolos, Molinier and Montserrat, 1970; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975a; Rivas-Martinez and Costa, 1975; Castroviejo and Costa, 1975; Izco and Cirujano, 1975; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Lahondère, 1982; Géhu and Rivas Martinez, 1984; Géhu and Géhu-Franck, 1984a; Géhu, Costa *et al.*, 1984; Chiappini, 1985a; Peinado Lorca and Rivas-Martinez, 1987)
- 15.51** **MEDITERRANEAN TALL RUSH SALTMARSHES**
Juncion maritimi p.
Beds of *Juncus maritimus* or *J. acutus* of periodically inundated depressions, with *Carex extensa*, *Iris spuria*, *Gladiolus communis*, *Aster tripolium*, *Sonchus maritimus*, *S. crassifolius*.
- 15.52** **MEDITERRANEAN SHORT RUSH, SEDGE, BARLEY AND CLOVER SALTMARSHES**
Trifolion maritimi, Juncion maritimi p.
Humid meadows of low vegetation dominated by *Juncus gerardii*, *Carex divisa*, *C. extensa*, *Hordeum marinum* or *Trifolium spp.* and *Lotus spp.* of the edges of brackish lagoons.
- 15.53** **MEDITERRANEAN HALO-PSAMMOPHILE MEADOWS**
Plantaginion crassifoliae
Drier, dense formations of sandy soils at the foot of dunes, or between dunes and lagoons, with *Plantago crassifolia*, *Schoenus nigricans*, *Juncus acutus*, *J. littoralis*, *Spartina versicolor*, all of which may dominate and form physiognomically distinct, sometimes almost monospecific, facies.

- 15.54** INTERIOR IBERIAN SALT PAN MEADOWS
Puccinellion fasciculatae
Salt meadows peculiar to the lowest, wettest parts of interior Iberian depressions, dominated by *Puccinellia fasciculata* or *Aeluropus littoralis* in the very lowest areas, or, slightly higher, by *Juncus gerardii*. The higher, drier ground that surrounds them is occupied either by other salt meadow communities that are less differentiated from the coastal communities (15.51-15.53) or by salt scrubs (15.615).
- 15.55** MEDITERRANEAN SALT MARSH GRASS SWARDS
Puccinellion festuciformis
Dense formations of *Puccinellia festuciformis* and *Aeluropus littoralis* along Mediterranean coasts and coastal lagoons.
- 15.56** MEDITERRANEAN SALT MARSH DRIFTLINES
Thero-Suaedion
Communities of annuals forming on accumulations of organic debris in saltmarshes, with *Atriplex*, *Suaeda*, *Kochia*, *Salsola soda*.
- 15.57** SALT MARSH COUCH-WORMWOOD STANDS
Agropyro-Artemision coerulescentis i.a.
Formations of *Elymus* or *Artemisia* fringing Mediterranean and interior Iberian saline wetlands.
- 15.58** FINE-LEAVED RUSH BEDS
Arthrocnemetalia fruticosi p.
Medium-tall *Juncus subulatus* beds, often forming facies within *Arthrocnemum* scrubs.
- 15.6** SALT MARSH SCRUBS
Arthrocnemetea fruticosi
Scrubby formations of woody glassworts (*Arthrocnemum*), seablites (*Suaeda*), *Halimione*, *Halocnemum* or *Limoniastrum* of saltmarshes and of their immediate vicinity. (Bolos and Molinier, 1960; Bolos *et al.*, 1970; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Géhu and Delzenne, 1975; Géhu *et al.*, 1975; Castroviejo and Porta, 1975; Géhu and Géhu-Franck, 1977; Géhu *et al.*, 1978; Molinier and Martin, 1980; Parent and Burny, 1981; Géhu, 1984, 1986; Géhu and Rivas-Martinez, 1984; Rivas Martinez, Alcaraz *et al.*, 1984; Géhu, Costa *et al.*, 1984; Rivas-Martinez and Costa, 1984; Peinado Lorca *et al.*, 1984; Géhu and Géhu-Franck, 1984a; Chiappini, 1985a; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987)
- 15.61** MEDITERRANEAN SALT SCRUBS
Arthrocnemion fruticosi, *Suaedion brevifoliae*
Low shrubby expanses of woody glassworts, seablites, sea purslanes or *Halocnemum*, characteristic of temporarily inundated salt marshes of Mediterranean coasts, south-western Iberian coasts and interior Iberian basins. They can be further subdivided according to dominant species, generally associated with patterns of inundation. *Cistanche lutea* characterizes many southern formations.
- 15.611** Creeping glasswort mats
Arthrocnemion perennis: *Puccinellio festuciformis*-*Arthrocnemetum perennis*, *Halimion portulacoidis*-*Sarcocornietum alpini*
Prostrate *Arthrocnemum perenne* carpets of wettest areas of coastal marshes.
- 15.612** Shrubby glasswort thickets
Arthrocnemion fruticosi: *Puccinellio festuciformis*-*Arthrocnemetum fruticosi*, *Cistancho luteae*-*Arthrocnemetum fruticosi*
Formations of robust *Arthrocnemum fruticosum*, capable of forming extensive low, dense thickets.
- 15.613** Glaucous glasswort thickets
Arthrocnemion glauci
Shrubby formations of *A. glaucum*, often occupying somewhat drier sites such as shell banks in saline lagoons.

- 15.614** **Shrubby seablite thickets**
Arthrocnemion fruticosi: *Halimiono-Suaedetum verae*
Shrubs of *Suaeda vera* occupying drier elevations of coastal saltmarshes.
- 15.615** **Interior Iberian salt scrubs**
Suaedion brevifoliae
Formations of woody glassworts and seablites of Iberian interior salt basins.
- 15.6151** **Interior woody seablite scrubs**
Suaeda pruinosa (*S. fruticosa* var. *brevifolia*) formations of Iberian interior salt basins.
- 15.6152** **Interior glaucous glasswort scrubs**
Arthrocnemum glaucum formations of Iberian interior salt basins.
- 15.6153** **Interior creeping glasswort scrubs**
Arthrocnemum perenne formations of Iberian interior salt basins.
- 15.616** **Mediterranean sea-purslane-woody glasswort scrubs**
Halimione portulacoides-rich facies within Mediterranean *Arthrocnemum* communities.
- 15.617** **Halocnemum scrub**
Halocnemion strobilaceae
Rare and local formations dominated by the tall, often sparse, clumps of *Halocnemum strobilaceum*, usually associated with *Arthrocnemum glaucum*, sometimes with *A. fruticosum*, of south-eastern Spain, Sardinia, Sicily and Greece.
- 15.62** **ATLANTIC SALT SCRUBS**
Halimionion portulacoidis
Sea purslane, glasswort and seablite scrubs of northern Atlantic and North Sea coasts.
- 15.621** **Silver scrubs**
Halimionetum portulacoidis, *Bostrychio-Halimionetum portulacoidis*
Shrubby *Halimione portulacoides* communities of middle levels of Atlantic schorres.
- 15.622** **Atlantic creeping glasswort mats**
Puccinellio maritimae-Arthrocnemetum perennis p.
Arthrocnemum perenne-dominated formations of the British Isles, the Atlantic coasts of France and of Iberia, except for the extreme south-west of the peninsula.
- 15.623** **Atlantic shrubby seablite scrubs**
Agropyro-Suaedetum verae
Suaeda vera-dominated formations of the British Isles, the Atlantic coasts of France and of Iberia, except for the extreme south-west of the peninsula.
- 15.624** **Atlantic shrubby glasswort scrubs**
Puccinellio maritimae-Arthrocnemetum fruticosi
Arthrocnemum fruticosum-dominated formations of the Atlantic coasts of France and of Iberia, except for the extreme south-west of the peninsula.
- 15.63** **LIMONIASTRUM SCRUBS**
Limoniastrion monopetali i.a.
Formations of often large, silver-glaucous shrubs of *Limoniastrum monopetalum* with showy pink flowers in late spring, of drier parts of Mediterranean and Iberian salt marshes.
- 15.64** **CANARIAN SALTMARSH SCRUBS**
Arthrocnemetalia fruticosi p.
Low shrubby expanses of woody glassworts, seablites, sea purslanes or *Zygophyllum*, characteristic of temporarily inundated salt marshes of Canary Island coasts.
- 15.641** **Canarian creeping glasswort scrubs**
Formations of *Arthrocnemum perenne* occupying the lowest level of the salt marshes of the coasts of Fuerteventura, Lanzarote and Isla de Lobos.

15 Salt marshes, salt steppes and gypsum scrubs

- 15.642** *Zygophyllum saltmarshes*
Zygophyllo fontanesii-Arthrocnemetum macrostachyi
 Formations of the Canario-Saharan halophyte *Zygophyllum fontanesii*, associated with *Arthrocnemum glaucum*, of the higher level of the saltmarshes of the eastern islands and, very locally, of Alegranza and La Graciosa.
- 15.643** **Canarian *Salsola* saltmarshes**
 Formations of *Salsola longifolia*, often dense and sometimes up to 2 metres high, of Canary Island coastal marshes, barranco openings and lagoons.
- 15.7** **SEMI-DESERT SALT SCRUBS**
 Halophile shrub formations of dry ground in low-precipitation areas of the Iberian peninsula, Sicily and the Macaronesian Islands.
- 15.71** **CANARIAN XERO-HALOPHILOUS SCRUBS**
Chenoletalia tomentosae
 Shrubby formations of *Zygophyllum fontanesii*, *Chenoleoides tomentosa*, sea-heath, salt-worts and seabites of the vicinity of the coasts of the Canary Islands.
 (Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 15.711** **Canarian coastal scrub**
Chenoletalia tomentosa: Chenoleion tomentosae
 Formations of *Chenoleoides tomentosa*, *Suaeda vermiculata*, *Frankenia laevis*, *Zygophyllum fontanesii*, *Polycarpaea nivea*, *Atriplex halimus*, *A. glauca* and *Limonium spp.* forming a halophile belt in the littoral zone of the larger Canary Islands and, with somewhat modified composition, of the islets.
- 15.712** ***Zygophyllum* dry scrubs**
 Formations of *Zygophyllum fontanesii* of sandy stone fields and black sands of the coastal zone of the Canary Islands.
- 15.713** ***Salsola longifolia* dry scrubs**
 Formations of *Salsola longifolia* of dry coastal areas of the Canary Islands.
- 15.72** **MEDITERRANEAN HALO-NITROPHILOUS SCRUBS**
Salsolo-Peganetalia
 Nitrophilous scrubby formations typically of dry soils and arid climates, often greyish-white and semi-desert-like, sometimes including taller, denser brushes. They are most frequent in the eastern Iberian peninsula, where characteristic shrubs include *Peganum harmala*, *Artemisia herba-alba*, *Lycium intricatum*, *Capparis ovata* and the Chenopodiaceae *Salsola vermiculata*, *S. genistoides*, *S. verticillata*, *Suaeda pruinosa*, *Atriplex halimus*, *A. glauca*, *Camphorosma monspeliaca*, *Anabasis articulata* and *Haloxylon articulatum*.
 (Braun-Blanquet and Bolos, 1957; Delvosalle and Duvigneaud, 1962; Freitag, 1971; Bolos, 1973; Polunin and Smythies, 1973; Rivas-Martinez, 1977; Bellot, 1979; Brullo *et al.*, 1980; Peinado-Lorca *et al.*, 1984; Peinado and Martinez-Parras, 1984; Géhu, 1984; Géhu and Rivas Martinez, 1984; Peinado Lorca and Rivas-Martinez, 1987)
- 15.721** **Ebro sisallares**
 Interior, extensive and varied, halo-nitrophilous scrubs of the Ebro basin, comprising both dry ground sisallares proper, as well as various more hygrophile communities of edges of salt lagoons.
- 15.722** **Manchegan sisallares**
 Halo-nitrophilous scrubs of La Mancha, in the central Iberian peninsula, formed of communities related to those of the Ebro.
- 15.723** **Catalano-Valencian halo-nitrophilous scrubs**
 Local halo-nitrophilous scrubs of the coasts of Catalonia, Valencia and the Balearics.
- 15.724** **South-eastern Iberian matojares**
 Halo-nitrophilous scrubs, matojares and related communities, of the arid zone of south-eastern Spain, forming, with predesert scrubs (32.25) and localized gypsum scrubs (15.93), the unique vegetation of this highly distinctive region.

- 15.725** **Sicilian halo-nitrophilous scrubs**
Halo-nitrophilous scrubs of south-western Sicily, with *Salsola verticillata*, *Suaeda pruinosa*, *Reaumuria vermiculata*, *Capparis ovata* and the endemics *Limonium opulentum* and *Herniaria fontanesii* ssp. *empedocleana*.
- 15.8.** **MEDITERRANEAN SALT STEPPES**
Limonietaia
Associations rich in perennial, rosette-forming *Limonium* spp. or esparto grass, *Lygeum spartum*, occupying, along Mediterranean coasts and on the fringes of Iberian salt basins, soils temporarily permeated (though not inundated) by saline water and subject to extreme summer drying, with formation of salt efflorescences.
(Braun-Blanquet and Bolos, 1957; Bolos, 1973; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1984; Peinado-Lorca *et al.*, 1984; Géhu and Géhu-Franck, 1984a; Géhu, Costa *et al.*, 1984; Géhu, 1984; Rivas-Martinez and Costa, 1985; Peinado Lorca and Rivas-Martinez, 1987)
- 15.81** **SEA-LAVENDER SALT STEPPES**
Limonium-rich facies of the salt steppes.
- 15.82** **ESPARTO SALT STEPPES**
Saltmarsh and saltmarsh fringe formations of *Lygeum spartum* of coastal Crete, coastal and interior Iberia.
- 15.9** **IBERIAN GYPSUM SCRUBS**
Gypsophiletalia
Garrigues occupying gypsum-rich soils of the Iberian peninsula, usually very open and floristically characterized by the presence of numerous gypsophilous species, among which *Gypsophila struthium*, *G. hispanica*, *Centaurea hyssopifolia*, *Teucrium libanitis*, *Ononis tridentata*, *Lepidium subulatum*, *Herniaria fruticosa*, *Reseda stricta*, *Helianthemum squamatum*. They are often rich in thymes (*Thymus*), germanders (*Teucrium*), rockroses (*Helianthemum*), composites (*Centaurea*, *Jurinea*, *Santolina*), *Frankenia*.
(Rivas Goday, 1955; Delvosalle and Duvigneaud, 1962; Rivas Goday and Rivas-Martinez, 1968; Rivas-Martinez and Costa, 1970; Bolos, 1973; Bellot, 1979; Géhu, 1984; Peinado Lorca and Rivas-Martinez, 1987)
- 15.91** **CENTRAL IBERIAN GYPSUM SCRUBS**
Lepidion subulati
Low garrigues dotted with occasional tall bushes, developed on gypseous soils which are often covered by a crust of lichens, generally rich in *Centaurea hyssopifolia* and often in *Gypsophila struthium*, *Lepidium subulatum*, *Thymus zygis* or *Jurinea pinnata*. They are limited to the Meseta and eastern Andalusia.
- 15.911** **Meseta gypsum scrubs**
Formations of the central Meseta dominated by, or rich in, *Centaurea hyssopifolia*.
- 15.912** **Eastern Andalusian gypsum scrubs**
Formations of eastern Andalusia (Armeria, Granada) dominated by, or rich in, *Centaurea hyssopifolia*, *Jurinea pinnata* or *Gypsophila struthium*.
- 15.913** **Dueran gypsum scrubs**
Formations of the central Duero with *Linum suffruticosum* and *Lepidium subulatum*.
- 15.92** **EBRO GYPSUM SCRUBS**
Gypsophilion hispanicae
Open low garrigues of eroded gypsiferous hills of the Ebro basin and of the upper Turia region, with *Gypsophila hispanica*.
- 15.921** ***Gypsophila hispanica* garrigues**
Open formations dominated by, or very rich in, *Gypsophila hispanica*, the most widespread north-eastern gypsum scrub component.
- 15.922** ***Helianthemum squamatum* garrigues**
Formations of *Helianthemum squamatum*, often very homogeneous.

15.923

Ononis tridentata garrigues

Formations of somewhat deeper calcaro-gypsiferous soils, rich in *Ononis tridentata*.

15.93

SOUTH-EASTERN GYPSUM SCRUBS

Thymo-Teucrium verticillati

Low, open thyme, germander and rockrose garrigues colonizing poorly developed gypsiferous soils of the arid south-east of the Iberian peninsula (Alicante and Murcia). Characteristic elements are *Teucrium libanitis* (*T. verticillatum*), *T. polium*, *T. pumilum*, *T. carthaginense*, *Thymus longiflorus*, *T. antoninae*, *Helianthemum lavandulifolium* (*H. racemosum*), *H. squamatum*, *Gypsophila hispanica*, *G. struthium*, *Astragalus alopecuroides*. Grasses (*Lygeum*, *Stipa*, *Brachypodium*), wormwood (*Artemisia*) and Chenopodiaceae may be locally prominent.

16 Coastal sand-dunes and sand beaches

Sand-covered shorelines in general, but in particular, onshore areas of sand created by the action of wind and often colonized and stabilized by communities of coarse maritime grasses.

- 16.1 SAND BEACHES**
Gently sloping sand-covered shorelines fashioned by wave action.
- 16.11 UNVEGETATED SAND BEACHES**
Sandy beaches devoid of phanerogamic vegetation. Mediolittoral (intertidal) and supralittoral invertebrate communities can be used to define subdivisions.
(Augier, 1982)
- 16.12 SAND BEACH ANNUAL COMMUNITIES**
Cakiletea maritima (*Atriplici-Salsolion kali* = *Salsolo-Honkenyion peploidis*, *Thero-Suaedion*, *Euphorbion peplis p.*)
Formations mostly of annuals occupying accumulations of drift material and sands rich in nitrogenous organic matter; characteristic are *Suaeda maritima*, *Bassia hirsuta*, *Cakile maritima*, *Salsola kali*, *Beta maritima*, *Atriplex spp.*, *Glaucium flavum*, *Mertensia maritima*, *Polygonum spp.* and, along Mediterranean coasts, *Euphorbia peplis*, *E. paralias*.
(Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Molinier and Martin, 1980; Lahondère, 1980; Parent and Burny, 1981; Géhu and Géhu-Franck, 1984a; Géhu, Costa *et al.*, 1984; Nordiska ministerradet, 1984; Géhu, 1984, 1985; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 16.13 SAND BEACH PERENNIAL COMMUNITIES**
Honkenyo-Elymion
Boreal halo-nitrophilous perennial vegetation of the upper beach formed by *Leymus (Elymus) arenarius*, *Ammophila arenaria*, *Honkenya peploides*, *Elymus farctus*, *E. repens*, *Mertensia maritima*, accompanied by *Atriplex spp.*, *Cakile maritima*, *Petasites spurius*, limited to the Baltic and the northern North Sea.
(Nordiska ministerradet, 1984; Géhu, 1985; Oberdorfer, 1990)
- 16.2. DUNES**
Onshore wind-carried sand deposits arranged in cordons of ridges parallel to the coast.
- 16.21 SHIFTING DUNES**
Agropyron juncei, *Ammophilon arenariae*, *Zygophyllion fontanesii*
Mobile sands, unvegetated or occupied by open grasslands; they may form tall dune ridges or, particularly along the Mediterranean, be limited to a fairly flat upper beach, still subject in part to inundation.
(Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Diez *et al.*, 1975; Westhoff and den Held, 1975; Lahondère, 1980; Molinier and Martin, 1980; Parent and Burny, 1981; Géhu, Costa *et al.*, 1984; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Ellenberg, 1988; Machado, *in litt.*, 1989; Oberdorfer, 1990)
- 16.211 Embryonic dunes**
Agropyron juncei (*Agropyro-Honkenyion*)
The first stages of dune construction, constituted by ripples or raised sand surfaces of the upper beach or by a seaward fringe at the foot of the tall dunes.
- 16.2111 Atlantic embryonic dunes**
Elymo-Agropyretum juncei, *Euphorbio-Agropyretum juncei*
Embryonic dunes of the Atlantic, the North Sea and the Baltic coasts, with *Elymus farctus* (*Agropyron junceum*) accompanied by *Leymus arenarius* in the north, by *Euphorbia paralias* on middle and southern Atlantic shores.

- 16.2112** **Mediterranean embryonic dunes**
Agropyron juncei: *Agropyretum mediterraneum*
 Embryonic dunes of the Mediterranean coasts, on which *Elymus farctus* is accompanied by *Sporobolus pungens*, *Euphorbia peplis*, *Otanthus maritimus*, *Medicago marina*, *Anthemis maritima*, *A. tomentosa*, *Eryngium maritimum*, *Pancreatium maritimum*.
- 16.212** **White dunes**
Ammophilion arenariae, *Zygophyllion fontanesii*
 Mobile dunes forming the seaward cordon or cordons of dune systems.
- 16.2121** **Atlantic white dunes**
Ammophilion arenariae: *Elymo-Ammophiletum*, *Euphorbio-Ammophiletum*, *Othanto-Ammophiletum*
 White dunes of the North Sea, the Baltic and the Atlantic coasts, dominated, when vegetated, by marram grass (*Ammophila arenaria*) accompanied by, among others, *Eryngium maritimum*, *Euphorbia paralias*, *Calystegia soldanella*, *Otanthus maritimus*.
- 16.2122** **Mediterranean white dunes**
Ammophilion arenariae: *Echinophoro-Ammophiletum*
 White dunes of the Mediterranean coasts, dominated, when vegetated, by marram grass (*Ammophila arenaria*) accompanied by, among others, *Echinophora spinosa*, *Eryngium maritimum*, *Euphorbia paralias*, *Cutandia maritima*, *Medicago marina*, *Anthemis maritima*.
- 16.2123** **Canarian white dunes**
Zygophyllion fontanesii
 Mobile dunes of the Canary Islands, with *Zygophyllum fontanesii*, *Euphorbia paralias*, *Polycarpea nivea*, *Cyperus capitatus*, *Ononis natrix*, *Convolvulus caput-medusae*, *Polygonum maritimum* and the threatened Lanzarote endemic lily *Androcymbium psammophilum*.
- 16.22** **GREY DUNES**
 Fixed dunes, stabilized and colonized by more or less closed perennial grasslands. (Zarzycki, 1961; Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Diez *et al.*, 1975; Géhu and Foucault, 1977; Rivas-Martinez, 1977; Lahondère, 1980; Molinier and Martin, 1980; Parent and Burny, 1981; Géhu, Costa *et al.*, 1984; Chiappini, 1985a; Veri and Pacioni, 1985; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Ellenberg, 1988; Machado, *in litt.*, 1989; Oberdorfer, 1990)
- 16.221** **Northern grey dunes**
Galio-Koelerion albescentis (*Koelerion albescentis*), *Corynephorion canescentis* p., *Sileno conicae-Cerastion semidecandri*
 Grasslands of Baltic, North Sea, Channel and northern Atlantic fixed dunes.
- 16.2211** **Tortula moss dune communities**
 Calciphile communities with *Koeleria*, *Galium verum*, *Viola curtisii*, *Ononis repens*, *Festuca rubra*, and moss (e.g. *Tortula ruraliformis*) and lichen carpets.
- 16.2212** **Grey-hairgrass dune communities**
 Communities of less calcareous or decalcified slopes rich in *Corynephorus canescens* and *Viola canina*.
- 16.2213** **Mouse-ear dune communities**
 Short-lived, warmth-loving mouse-ear dune communities with *Cerastium diffusum*, *C. semidecandrum*, *C. subtetrandrum*, *Erodium lebelii*, *Phleum arenarium*, *Silene conica*.
- 16.222** **Biscay grey dunes**
Euphorbio-Helichryson stoechadis
 Fixed dune grasslands infiltrated by dwarf bushes of French Brittany and the coast of the Bay of Biscay, with *Helichrysum stoechas*, *Artemisia campestris*, *Ephedra distachya*.

- 16.223 Ibero-Mediterranean grey dunes**
Crucianellion maritimae
Fixed dunes of the western Mediterranean and of the thermo-Atlantic coasts of Portugal and south-western Spain, with *Crucianella maritima* and *Pancratium maritimum*.
- 16.224 Greek fixed dunes**
Formations of Greece with *Euphorbia terracina* and *Silene nicaeensis* or *Ephedra distachya* and *Silene subconica*.
- 16.225 Dune Mesobromion grasslands**
Dunal grasslands composed of species characteristic of dry calcareous grasslands (34.32), particularly of northern Brittany (*Galio maritimi-Brachypodietum pinnati*).
- 16.226 Dune thermophile fringes**
Trifolio-Geranietea sanguinei: *Galio maritimi-Geranium sanguinei*
Geranium sanguineum formations (34.4) incorporated within grey dune systems of the British Isles and Brittany.
- 16.227 Dune fine-grass annual communities**
Thero-Airion p., *Nardo-Galion saxatile p.* (*Botrychio-Polygaletum*), *Tuberarion guttatae p.*
Sparse pioneer formations (35.2, 35.3) of fine grasses rich in spring-blooming therophytes characteristic of oligotrophic, superficial soils.
- 16.228 Dune malcolmia annual-herb communities**
Malcolmietalia
Associations with many small annuals and often abundant ephemeral spring bloom (35.4), with *Malcolmia lacera*, *M. ramosissima*, *Evax astericiflora*, *E. lusitanica*, *Anthyllis hamosa*, *Linaria pedunculata*, of deep sands in dry interdunal depressions of Iberia, southern France and Italy.
- 16.229 Dune Mediterranean xeric grasslands**
Thero-Brachypodietalia p.
Dunal formations of 34.5.
- 16.22A Canarian fixed dunes**
Traganion moquini
Fixed dunes of the Canary Islands, forming, mostly in the centre and east of the archipelago, extensive systems (jables), with *Traganum moquini*, *Suaeda vera*, *Atriplex halimus*, *A. glauca* var. *ifniensis*, *Salsola longifolia*, *S. vermiculata*.
- 16.23 CROWBERRY BROWN DUNES**
Empetrion nigri
Decalcified dunes colonized by *Empetrum nigrum* heaths, of the Frisian, German, Danish and Scottish coasts.
(Westhoff and den Held, 1975; De Smidt, 1981; Géhu, 1985)
- 16.24 HEATHER BROWN DUNES**
Calluno-Ulicetea p.
Decalcified dunes of France and Britain, colonized by heaths of the *Calluno-Genistion* or the *Ulicion minoris*, and of Iberia, colonized by heaths of the *Ericion umbellatae*.
(Géhu, 1985)
- 16.241 East Anglian ling dunes**
Carici arenariae-Callunetum
Calluna vulgaris-Carex arenaria heaths of East Anglian inner dunes.
- 16.242 French ling dunes**
Carici trinervis-Callunetum
Calluna vulgaris-Carex trinervis heaths of northern French inner dunes.
- 16.243 British bell heather dunes**
Carici arenariae-Ericetum cinereae
Erica cinerea-Carex arenaria heaths of decalcified dunes of the west of the British Isles.

- 16.244** **French bell heather dunes**
Festuco vasconensis-Ericetum cinereae
Erica cinererea-Festuca vasconensis heaths of dry dunes of south-western France.
- 16.245** **French Dorset heath dunes**
Arrhenathero thorei-Ericetum ciliaris
Erica ciliaris-Pseudarrhenatherum longifolium (Arrhenatherum thorei) heaths of more humid dunes of south-western France.
- 16.246** **Iberian green heather dunes**
Erico scopariae-Ulicetum australis
Erica scoparia-Ulex parviflorus ssp. *eriocladus (U. australis)* heaths of south-western Iberian dunes.
- 16.247** **Iberian Dorset heath dunes**
Erico ciliaris-Ulicetum australis
Erica ciliaris-Ulex parviflorus ssp. *eriocladus* heaths of more humid south-western Iberian dunes.
- 16.25** **DUNE THICKETS**
Prunetalia spinosae p. (*Ligustro-Hippophaeion rhamnoidis, Lonicerion periclymeni, Pruno-Rubion ulmifolii* p., *Sam buco-Berberidion*)
 Dense formations of large shrubs including sea-buckthorn, privet, elder, willow, gorse or broom, often festooned with creepers such as honeysuckle or white bryony. Codes of 31.8 can be used, in addition to 16.252, to specify the habitat.
 (Westhoff and den Held, 1975; Lahondère, 1980; Parent and Burny, 1981; Géhu, 1985)
- 16.251** **Sea-buckthorn dune thickets**
Hippophae rhamnoides formations of forest colonization in both dry and humid dune depressions, mostly in Denmark, Germany, The Netherlands, Belgium and the British Isles.
- 16.252** **Mixed dune thickets**
 Pre-forest thickets other than heaths, sea-buckthorn or creeping willow (*Ulex, Sarothamnus, Rubus, Ligustrum, Daphne*).
- 16.26** **CREEPING-WILLOW MATS**
Salicion arenariae
Salix arenaria formations of both dry and humid dune depressions.
 (Géhu, 1985)
- 16.27** **DUNE JUNIPER THICKETS AND WOODS**
Juniperion lyciae; Berberidion p.
 Juniper formations (*Juniperus phoenicea, J. lycia, J. macrocarpa, J. transtagana*) of dune slacks and slopes in Mediterranean and thermo-Atlantic areas; *J. communis* formations of calcareous Jutland dunes.
 (Garcia and Purroy, 1973; Diez *et al.*, 1975; Westhoff and den Held, 1975; Rivas-Martinez *et al.*, 1980; Géhu, 1985; Peinado Lorca and Rivas-Martinez, 1987)
- 16.271** **Dune prickly juniper thickets**
Rhamno-Juniperetum macrocarpae i.a.
Juniperus oxycedrus ssp. *macrocarpa* thickets and low woods of the outer belt of the juniper woods of fixed Mediterranean and Mediterranean-Atlantic dunes.
- 16.272** **Lycian juniper woods**
Rhamno-Juniperetum lyciae i.a.
Juniperus phoenicea ssp. *lycia* thickets and woods of the inner belt of the juniper woods of fixed Mediterranean and Mediterranean-Atlantic dunes.
- 16.273** **Rufescent juniper thickets**
 Scrubs of the fastigate *Juniperus oxycedrus* ssp. *transtagana* of the dunes of south-western Portugal.

- 16.274** **Common juniper dune thickets**
Juniperus communis scrubs of the calcareous dunes of Jutland.
- 16.28** **DUNE SCLEROPHYLLOUS SCRUBS**
Ononido-Rosmarinetea p., *Quercetea ilicis p.*, *Cisto-Lavanduletea p.*
Sclerophyllous scrubs established on dunes in the Mediterranean region. Codes of 32 may be used in addition to 16.28 to specify the habitat.
- 16.29** **WOODED DUNES**
Dunes colonized by woodland or riparian thickets. Codes of 41.5, 41.7, 42, 44, 45 can be used, in addition to 16.29, to specify the habitat.
(Diez *et al.*, 1975; Lahondère, 1980; Géhu, 1985)
- 16.3** **HUMID DUNE-SLACKS**
Humid depressions of the dunal systems. The most important habitats are included in the following units. If the divisions proposed are not sufficient, appropriate codes from 22.4, 22.3, 54.2, 54.4, 53 can be used in conjunction with them. Humid dune-slacks are extremely rich and specialized habitats very threatened by the lowering of water tables.
(Duvigneaud, 1947; Lebrun *et al.*, 1949; Herbauts, 1971; Westhoff and den Held, 1975; Lahondère, 1980)
- 16.31** **DUNE-SLACK POOLS**
Fresh-water aquatic communities (see 22.4) of permanent dune-slack water bodies.
- 16.32** **DUNE-SLACK PIONEER SWARDS**
Juncenion bufonii p.: *Gentiano-Erythraetum littoralis*
Pioneer formations of humid sands with *Samolus valerandi*, *Centaurium spp.*, *Blackstonia perfoliata*, *Juncus bufonius* (see 22.322).
- 16.33** **DUNE-SLACK FENS**
Calcareous and, occasionally, acidic fen formations (see 54.2, 54.4, in particular 54.21, 54.2H, 54.49), often invaded by creeping willow, occupying the wettest parts of dune-slacks.
- 16.34** **DUNE-SLACK GRASSLANDS**
Humid grasslands and rushbeds (see 37.31, 37.4) of dune-slacks, also often with creeping willows (*Salix rosmarinifolia*, *S. arenaria*).
- 16.35** **DUNE-SLACK REEDBEDS AND SEDGEBEDS**
Reedbeds and tall-sedge communities (see 53.1, 53.2, 53.3) of dune-slacks.

17 Shingle beaches

Beaches covered by pebbles, or sometimes boulders, usually formed by wave action.

- 17.1 UNVEGETATED SHINGLE BEACHES**
Shingle beaches devoid of phanerogamic vegetation. Mediolittoral (intertidal) and supralittoral invertebrate communities can be used to define subdivisions.
(Augier, 1982)
- 17.2 SHINGLE BEACH DRIFT LINES**
Cakiletea maritima p.
Formations of annuals occupying accumulations of drift material and gravels rich in nitrogenous organic matter; characteristic are *Cakile maritima*, *Salsola kali*, *Atriplex* spp. (particularly *A. glabriuscula*), *Polygonum* spp., *Euphorbia pepelis*, *Mertensia maritima*, *Glaucium flavum*, *Matthiola sinuata*.
(Nordiska ministerradet, 1984; Géhu, 1984, 1985; Costa, 1987)
- 17.3 SEA KALE COMMUNITIES**
Honkenyo-Crambion
Halo-nitrophilous perennial vegetation of the upper beach formed by *Crambe maritima*, *Honkenya peploides* and species characteristic of the regional communities as indicated below.
(Vanden Bergen, 1964; Nordiska ministerradet, 1984; Géhu, 1985, 1986; Oberdorfer, 1990)
- 17.31 BALTIC SEA KALE COMMUNITIES**
Elymo-Crambetum
Crambe-Honkenya formations with *Leymus arenarius* of the coasts of the southern Baltic, the Kattegat and the baelts.
- 17.32 CHANNEL SEA KALE COMMUNITIES**
Lathyro-Crambetum
Crambe-Honkenya formations with *Lathyrus japonicus* of the southern North Sea and Channel coasts of south-western England and, very locally, the Channel coast of France.
- 17.33 ATLANTIC SEA KALE COMMUNITIES**
Crithmo-Crambetum
Crambe-Honkenya formations with *Crithmum maritimum* of Brittany, the Cotentin peninsula and Anglesey.
- 17.4 GRAVEL BANK HEATHS AND GRASSLANDS**
Grasslands and heaths of the landward expanses of large gravel banks.
(Vanden Bergen, 1964; Nordiska ministerradet, 1984; Géhu, 1985, 1986)
- 17.41 GRAVEL BANK FALSE OATGRASS SWARDS**
Swards of *Arrhenatherum elatius* of gravel banks.
- 17.42 GRAVEL BANK BROOM MATS**
Prostrate *Cytisus scoparius* formations of gravel banks.

18 Cliffs and rocky shores

Rock exposures adjacent to the sea or to saline lakes, or separated from them by a narrow shoreline. In addition to their botanical significance, they are often important as nesting sites for sea birds.

- 18.1 BARE CLIFFS**
Cliffs and rocky shores devoid of vascular vegetation. The mediolittoral (intertidal or wave-washed) and supralittoral (spray) zones are inhabited by rich and diverse communities of invertebrates and algae that can be used to define subdivisions. A basic framework is proposed below; further subdivisions, such as the biocenoses and facies listed by Augier (1982) for the Mediterranean, can be easily integrated. (Augier, 1982; Mitchell, 1987; Wood, 1988)
- 18.11 MEDIOLITTORAL FRINGE ROCKS**
Cliffs and rocks of the lowest part of the mediolittoral zone, occupied by communities transitional to those of the infralittoral zone.
- 18.12 LOWER MEDIOLITTORAL ROCKS**
Cliffs and rocks of the lower part of the mediolittoral zone, occupied, in particular, by encrusting algae.
- 18.13 UPPER MEDIOLITTORAL ROCKS**
Cliffs and rocks of the higher part of the mediolittoral zone, occupied by communities characterized, in particular, by cirriped crustaceans and soft algae.
- 18.14 MEDIOLITTORAL CAVES AND OVERHANGS**
Mediolittoral overhangs, crevices and caves.
- 18.15 MEDIOLITTORAL ROCK POOLS**
Permanent saline pools of the mediolittoral zone, fed by flood tides (tide pools).
- 18.16 SUPRALITTORAL ROCKS**
Cliffs and rocks of the supralittoral spray zone, mostly occupied by lichens (*Verrucaria i.a.*).
- 18.17 SUPRALITTORAL ROCK POOLS**
Pools of variable salinity fed by rainwater, spray and occasionally waves.
- 18.2 VEGETATED SEA CLIFFS AND ROCKY SHORES**
Cliffs and rocky shores colonized by disjunct assemblages of aerohaline chasmophytes or by more or less closed aerohaline grasslands.
- 18.21 ATLANTIC CLIFF COMMUNITIES**
Crithmo-Armerietalia
Vegetated cliffs of the Atlantic, Channel, Irish and North Sea coasts with *Crithmum maritimum*, *Armeria maritima*, *Limonium spp.*, *Brassica oleracea*, *Silene maritima*, *Cochlearia officinalis*, *Plantago maritima*, *Festuca rubra ssp. pruinosa*, *Daucus spp.*, *Matricaria maritima*, *Asplenium marinum*, *Spergularia rupicola*, *Inula crithmoides*, *Sedum anglicum*, *Rhodiola rosea*, *Lavatera arborea*.
(Vanden Bergen, 1964; Guinochet and Vilmorin, 1973; Géhu, 1984; Géhu and Géhu-Franck, 1984a, 1984b; Géhu, Franck and Scoppola, 1984; Polunin and Walters, 1985)

18 Cliffs and rocky shores

18.22 MEDITERRANEAN CLIFF COMMUNITIES

Crithmo-Limonietalia

Vegetated cliffs and rocky shores of the Mediterranean and south-western Iberia, with *Crithmum maritimum*, *Plantago subulata*, *Silene sedoides*, *Sedum litoreum*, *Limonium spp.*, *Armeria spp.*, *Euphorbia spp.*, *Daucus spp.*, *Asteriscus maritimus*. Many *Limonium* species, in particular, are endemics of extremely local occurrence.

(Guinochet and Vilmorin, 1973; Horvat *et al.* 1974; Brullo *et al.*, 1977; Molinier and Martin, 1980; Géhu, 1984; Géhu, Franck and Scoppola, 1984; Polunin and Walters, 1985)

18.23 MACARONESIAN CLIFF COMMUNITIES

Frankenio-Astidamietalia latifoliae

Sea-cliffs of the Atlantic islands (Canaries, Madeira), with *Crithmum maritimum*, *Astydamia latifolia*, *Schizogyna sericea*, *Andryala glutinosa*, *Plantago coronopus*, *Tolpis fruticosa*, *Aizoon canariense*, *Campylanthus salsoloides*, *Limonium pectinatum*, *Frankenia ericifolia*, *Reichardia ligulata*, *Argyranthemum frutescens*, *Lotus spp.*, *Asplenium marinum*.

(Delvolsalle, 1964; Duvigneaud, 1977; Bramwell and Bramwell, 1983; Géhu, 1984; Wildpret de la Torre and del Arco Aguilar, 1987)

18.24 AZOREAN CLIFF COMMUNITIES

Festucion petraeae

Communities of the cliffs of the Azores dominated by the endemic *Festuca petraea*.

(Machado, *in litt.*, 1989)

18.3 VEGETATED CLIFFS OF SALINE LAKES

Crithmo-Limonietalia: Limonietum secundiramei

Endemic *Limonium secundirameum*-dominated formations of the cliffs overlooking Bagno dell' Acqua, Pantelleria.

(Brullo *et al.*, 1977)

19 Islets and rock stacks

Small islands in the sea or in large bodies of water, mostly important as sites for water bird colonies. Other codes, in particular those of 18, can be used to indicate the habitats supported.

1A Machair

Plains behind dunes especially characteristic of the western seaboard of the Outer Hebrides. Wind-blown calcareous sands deposited on peat support a flower-rich, and correspondingly insect-rich, dune grassland studded with shallow lochs and cultivated on a strip rotation. The grassland is dominated by *Poa pratensis* and *Festuca rubra*, accompanied by *Thalictrum minus*, *Thymus drucei*, *Bellis perennis*, *Prunella vulgaris*, *Erodium cicutarium*, *Trifolium* spp., *Euphrasia* spp. and many orchids, among which *Dactylorhiza fuchsii* ssp. *hebridensis*, *D. purpurella*, *Gymnadenia conopsea*, *Coeloglossum viride*, *Platanthera chlorantha* and *Orchis mascula* are the most prominent. This grassland harbours a plant community of very restricted distribution comprising vulnerable species; *Cochlearia scotica*, *Euphrasia marshallii* and *Dactylorhiza fuchsii* ssp. *hebridensis* are endemic. Other elements of the ecosystem, such as pools and fallow fields, can be noted by addition of codes from other units (22, 16.2, 34, 37, 53, 54, 82, 87). As a whole, machair is an essential habitat for breeding waders such as *Haematopus ostralegus*, *Vanellus vanellus*, *Charadrius hiaticula*, *Calidris alpina*, *Tringa totanus* and *Gallinago gallinago*; it supports the healthiest European population of the threatened corncrake *Crex crex*.

(Ritchie, 1976, 1979; Glentworth, 1979; Currie, 1979; Dickinson and Randall, 1979; Fuller *et al.*, 1979; Fuller, 1982; P. R. Evans, *in litt.*, 1985)

2 Non-marine waters



21 Lagoons

Saline or hypersaline coastal waters, often formed from sea inlets by silting and cut off from the sea by sand or mud banks. The presence of vegetation can be indicated by addition of codes 23.21 or 23.22.

22 Standing fresh water

Lakes, ponds and pools of natural origin containing fresh (i.e. non-saline) water. Man-made fresh water bodies, including reservoirs and canals.

- 22.1 FRESH WATERS**
The water body itself, regardless of vegetation belts.
- 22.11 LIME-DEFICIENT OLIGOTROPHIC WATERS**
Usually greenish to brownish clear waters poor in dissolved bases (pH often 5-6).
(Duvigneaud, 1980; Vanden Berghen, 1982; Ellenberg, 1988)
- 22.12 MESOTROPHIC WATERS**
Richer waters (pH often 6-7).
(Vanden Berghen, 1982)
- 22.13 EUTROPHIC WATERS**
Usually dirty grey to blue-green, more or less turbid, waters particularly rich in dissolved bases (pH usually > 7).
(Duvigneaud, 1980; Vanden Berghen, 1982; Ellenberg, 1988)
- 22.14 DYSTROPHIC WATERS**
Acidic waters with high humus content and often brown tinted (pH often 3-5).
(Duvigneaud, 1980; Vanden Berghen, 1982; Ellenberg, 1988)
- 22.15 LIME-RICH OLIGO-MESOTROPHIC WATERS**
Usually blue to greenish, very clear, waters poor (to moderate) in nutrients, base-rich (pH often > 7.5).
(Ellenberg, 1988)
- 22.2 UNVEGETATED MUDS OR SHINGLES**
Unvegetated lake-bottoms or lake-shores and muds or shingle temporarily exposed by artificial or natural fluctuations of the water level, often important as feeding grounds for migrating waders.
- 22.3 AMPHIBIOUS COMMUNITIES**
Temporarily exposed lake bottoms or lake shores and other periodically or occasionally inundated muddy, sandy or stony basins colonized by phanerogamic vegetation (see also 22.432).
- 22.31 NORTHERN PERENNIAL AMPHIBIOUS COMMUNITIES**
Littorelletalia
Carpets of perennials submerged for a considerable part of the year in oligotrophic or mesotrophic lakes, ponds and pools of the Euro-Siberian zone.
(Lebrun *et al.*, 1949; Tüxen and Oberdorfer, 1958; Rivas-Martinez, 1963, 1975c; Duvigneaud, 1972, 1986; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Brasseur *et al.*, 1977; Schumacker *et al.*, 1977; Bournérias, 1979, 1984; Pignatti, 1982; Géhu, 1984; Nordiska ministerradet, 1984; Dupias, 1985; Ozenda, 1985; Duvigneaud *et al.*, 1986; Vigo and Ninot, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 22.311 Shoreweed lawns, lobelia ponds, quillwort swards**
Eleocharition acicularis p. (Littorellion), *Lobelion*, *Isoetion lacustris*
Littorella uniflora, *Lobelia dortmanna* and *Isoetes spp.* formations of oligotrophic waters.
- 22.3111 Shoreweed lawns**
Dense, almost monospecific *Littorella uniflora* lawns of lake shores subject to great annual variations of the water level and long emergence, and other *Littorella*-dominated associations.

- 22.3112 Lobelia ponds**
Lobelia dortmanna colonies of shallow oligotrophic, moderately acid ponds.
- 22.3113 Euro-Siberian quillwort swards**
Clear-water quillwort swards formed by the northern European and montane *Isoetes lacustris* and *I. echinospora* or by the very local endemics *I. tenuissima* of central-western France and *I. brochonii* of the eastern Pyrenees.
- 22.3114 Floating bur-reed communities**
Sparganium angustifolium formations of, in particular, subalpine ponds.
- 22.312 Spike-rush shallow-water swards**
Eleocharition acicularis (*Eleocharitetum acicularis* i.a.) p.
Eleocharis acicularis beds on more organic soils in mesotrophic waters.
- 22.313 Acid pool fringe shallow-water swards**
Hydrocotylo-Baldellion p. (*Helodo-Sparganion*)
Eleocharis multicaulis, *Scirpus fluitans*, *Juncus bulbosus*, *Hypericum elodes*, *Pilularia globulifera*, *Deschampsia setacea*, *Ranunculus flammula*, *R. ololeucos*, *Potamogeton polygonifolius*, *Apium inundatum*, *Littorella uniflora* communities of acid pools and their transition zones.
- 22.314 Peaty shores shallow-water swards**
Hydrocotylo-Baldellion p.
Baldellia ranunculoides and *Hydrocotyle* formations of peaty soils.
- 22.315 Shore hairgrass swards**
Deschampsion littoralis
Deschampsia littoralis agg. formations of peri-Alpine lakes.
- 22.3151 Peri-Alpine shore hairgrass swards**
Deschampsia littoralis swards of the shores of Lake Geneva and of a few lakes of the southern Alpine periphery (Lago di Poschiavo, Lago di Cavazzo).
- 22.3152 Lake Constance shore hairgrass swards**
Deschampsia rhenana swards of Lake Constance.
- 22.32 NORTHERN DWARF ANNUAL AMPHIBIOUS SWARDS**
Cyperetalia fusci (*Nanocyperetalia*)
Dwarf oligo-mesotrophic Euro-Siberian annual communities of recently emerged muds and sands.
(Lebrun *et al.*, 1949; Rivas-Martinez, 1963; Ellenberg, 1963, 1988; Braun-Blanquet, 1967; Duvigneaud, 1972; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Géhu, 1984; Duvigneaud, 1986; Duvigneaud *et al.*, 1986; Oberdorfer, 1990)
- 22.321 Dwarf spike-rush communities**
Elatino-Eleocharitenion ovatae
Rare communities colonizing the fluid muds of drying ponds and characterized by *Eleocharis ovata*, *E. carniolica*, *Carex bohemica*, *Scirpus supinus*, *Lindernia procumbens*, *Limosella aquatica*, *Cyperus fuscus*, *Peplis portula*, *Juncus tenageia*, *Elatine hexandra*, *E. hydropiper*.
- 22.322 Dune-slack pioneer swards**
Juncenion bufonii p.: *Gentiano-Erythraetum littoralis*
Formations with *Centaureum* spp., *Blackstonia perfoliata*, *Samolus valerandi* of wet sands in dune slacks belong to this group of communities; they have been listed under 16 (16.32).

- 22.323 Dwarf toad-rush communities**
Juncenion bufonii, *Radiolenion linoidis*
 Associations, often very limited in extent, appearing in the drying phase of temporary pools, flooded ruts of forest paths, wet heath paths, humid forest cuts, seeping mowed lawns and other sufficiently lit temporarily inundated, most often acidic, soils, characterized by *Juncus bufonius*, *Scirpus setaceus*, *Cyperus flavescens*, *Centunculus minimus*, *Spergularia segetalis*, *Centaureum pulchellum*, *Blackstonia perfoliata*, *Samolus valerandi*, *Cicendia filiformis*, *Radiola linoides* and *Illecebrum verticillatum*.
- 22.3231 Toad-rush swards**
 Communities dominated by *Juncus bufonius*.
- 22.3232 Small galingale swards**
Cyperetum flavescens, *Samolo-Cyperetum fusci* i.a.
 Medio-European communities dominated by the annual galingales *Cyperus flavescens*, *C. fuscus* and *C. michelianus*.
- 22.3233 Wet ground dwarf herb communities**
Centunculo-Anthocerotetum, *Stellario uliginosae-Scirpetum setaceae*, *Erythraeo-Blackstonietum*, *Ranunculo-Radioletum linoidis*, *Cicendietum filiformis*, *Spergulario-Illecebretrum verticillati* i.a.
 Varied communities, some very rare and threatened, of small annuals of wet ground.
- 22.33 BUR MARIGOLD COMMUNITIES**
Bidention tripartitae
 Taller annual communities colonizing nitrogen-rich muds of dry medio-European ponds and lakes, formed by *Bidens* spp., *Rorippa palustris* (*R. islandica*), *Chenopodium* spp., *Polygonum* spp., *Rumex maritimus*, *R. palustris*, *Ranunculus sceleratus*, *Senecio congestus*, *Catabrosa aquatica*, *Leersia oryzoides*.
 (Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Schumacker *et al.*, 1977; Géhu, 1984; Duvigneaud, 1986; Duvigneaud *et al.*, 1986; Oberdorfer, 1990)
- 22.34 SOUTHERN AMPHIBIOUS COMMUNITIES**
Isoetalia
 Perennial and annual communities of Mediterranean, thermo-Atlantic and Macaronesian temporary ponds and river banks.
 (Bolos and Molinier, 1960; Braun-Blanquet, 1967; Aubert and Loisel, 1971; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Bellot Rodriguez, 1979; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Harant and Jarry, 1983; Géhu, 1984; Peinado-Lorca *et al.*, 1984; Ladero *et al.*, 1984)
- 22.341 Short Mediterranean amphibious swards**
Isoetion
 Formations of Mediterranean, thermo-Atlantic and Macaronesian entirely or partially summer-dry ponds, pools and ditches with *Isoetes* spp., *Marsilea quadrifolia*, *M. strigosa*, *Pilularia globulifera*, *P. minuta*, *Mentha pulegium*, *Lythrum hyssopifolia* s.l., *Trifolium filiforme*, *Peplis erecta*, *Teucrium cravense*, *Serapias lingua*, *Juncus bufonius*, *J. capitatus*, *J. pygmaeus*, *J. fasciculatus*, *Scirpus savii*, sometimes (rocky edges of fast rivulets) *Spiranthes aestivalis* and *Anagallis tenella*.
- 22.3411 Terrestrial quillwort communities**
Isoetes histrix, *I. duriei* formations of ephemeral waters.
- 22.3412 Mediterranean aquatic quillwort swards**
 Communities formed by *Isoetes boryana*, *I. delilei*, *I. heldreichii*, *I. velata*, *I. azorica* or *I. malinverniana* in fluctuating waterbodies.
- 22.3413 Azorean quillwort swards**
 Endemic *Isoetes azorica* communities of pools and small lakes of the Azores.

22 Standing fresh water

- 22.3414** **Mediterranean small galingale swards**
Mediterranean and thermo-Atlantic formations dominated by *Cyperus fuscus*, *C. flavescens* or *C. michelianus*.
- 22.3415** **Mediterranean *Fimbristylis* swards**
Formations dominated by *Fimbristylis bisumbellata*, often with *Cyperus* spp..
- 22.3416** **Mediterranean *Chaetopogon* swards**
Formations dominated by *Chaetopogon fasciculatus*.
- 22.3417** **Bog pimpernel-summer lady's tresses communities**
Spiranthes-Anagallium tenellae
Formations of the sandy, rocky edges of rivulets of the Mediterranean region.
- 22.3418** **Mediterranean amphibious small herb communities**
Other, often highly ephemeral, annual communities of temporarily inundated or wet terrain.
- 22.342** **Tall Mediterranean amphibious swards**
Preslia cervinae
Vegetation of tall annuals of terrain covered by deep waters during long periods, with *Eryngium corniculatum* and *Mentha cervina*.
- 22.343** **Halo-nitrophile Mediterranean amphibious swards**
Heleochoilon
Slightly halophile and nitrophile post-estival vegetation of temporarily inundated terrains, with *Crypsis schoenoides*, *C. aculeata*, *C. alopecuroides* and *Centaureum spicatum*.
- 22.344** ***Serapias* grasslands**
Serapion
Meso-hygrophilic grasslands of crystalline Provence, with *Carex divisa* ssp. *chaetophylla*, often dominant, *Briza minor*, *Oenanthe lachenalii* and numerous *Serapias* (*S. lingua*, *S. neglecta*, *S. vomeracea*).
- 22.4** **AQUATIC VEGETATION**
Areas of lakes, ponds, pools or canals occupied by floating or permanently submerged vegetation.
- 22.41.** **FREE-FLOATING VEGETATION**
Lemna minoris (Hydrocharition)
Free-floating surface communities of waters more or less rich in nutrients.
(Ellenberg, 1963, 1988; Duvigneaud, 1972; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Noirefalise and Dethioux, 1977; Rivas-Martinez *et al.*, 1980; Vanden Berghen, 1982; Margot, 1983; Peinardo Lorca *et al.*, 1984; Géhu, 1984; Oberdorfer, 1990)
- 22.411** **Duckweed covers**
Communities of duckweed (*Lemna*, *Spirodela*, *Wolffia*), small ferns (naturalized *Azolla*) or liverworts (*Riccia*, *Ricciocarpus*).
- 22.412** **Frogbit rafts**
Formations rich in *Hydrocharis morsus-ranae*.
- 22.413** **Water-soldier rafts**
Formations dominated by *Stratiotes aloides*.
- 22.414** **Bladderwort colonies**
Formations of bladderworts (*Utricularia australis*, *U. vulgaris*).
- 22.415** **Salvinia covers**
Often dense and extensive mats dominated by the fern *Salvinia natans*.
- 22.416** **Aldrovanda communities**
Formations harbouring the carnivorous, free-floating Droseraceae *Aldrovanda vesiculosa*

- 22.42** **ROOTED SUBMERGED VEGETATION**
Potamogetonion (Potamion)
 Pondweed (*Potamogeton*)-dominated formations of submerged, rooted, perennial phanerogams with often emerging flower spikes.
 (Ellenberg, 1963, 1988; Duvigneaud, 1972; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Brasseur *et al.*, 1977; Bellot Rodriguez, 1979; Bournérias, 1979, 1984; Margot, 1983; Géhu, 1984; Peinado Lorca *et al.*, 1984; Delescaille, 1987; Oberdorfer, 1990)
- 22.421** **Large pondweed beds**
Magnopotamion
 Associations of large pondweeds (*Potamogeton lucens*, *P. praelongus*, *P. zizii*, *P. perfoliatus*) characteristic of deep, open waters.
- 22.422** **Small pondweed communities**
Parvopotamion
 Formations of smaller pondweeds, waterweed, hornwort, and other submerged rooted vegetation (*Potamogeton crispus*, *P. filiformis*, *P. pusillus* group, *Groenlandia densa*, *Ranunculus circinatus*, *Ceratophyllum*, *Elodea*, *Najas*, *Zannichellia*, *Vallisneria*, *Hydrilla*) that colonize shallower, more sheltered waters.
- 22.43** **ROOTED FLOATING VEGETATION**
Nymphaeion albae, *Callitricho-Batrachion*, *Potamion graminei*
 Formations dominated by rooted aquatic plants with floating leaves.
 (Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Rivas-Martinez, 1975; Noifalaise and Dethioux, 1977; Brasseur *et al.*, 1977, 1978; Bournérias, 1979, 1984; Bellot Rodriguez, 1979; Margot, 1983; Géhu, 1984; Peinado Lorca *et al.*, 1984; Oberdorfer, 1990)
- 22.431** **Floating broad-leaved carpets**
Nymphaeion albae
 Formations of rooted aquatic plants with large floating leaves, often with a stratum of submerged species (*Ceratophyllum*, *Myriophyllum*, *Potamogeton*) and occasionally free-floating *Utricularia*, characteristic of large, permanent water bodies.
- 22.4311** **Waterlily carpets**
 Formations of *Nymphaea alba*, *N. candida*, *Nuphar lutea* or *N. pumila*.
- 22.4312** **Water chestnut carpets**
 Formations of *Trapa natans*.
- 22.4313** **Fringed waterlily carpets**
 Formations of *Nymphoides peltata*.
- 22.4314** **Broad-leaved pondweed carpets**
 Formations of *Potamogeton natans*.
- 22.4315** **Bistort carpets**
 Formations of *Polygonum amphibium*.
- 22.432** **Shallow-water floating communities**
Callitricho-Batrachion
 Communities dominated by water starworts (*Callitriche*) or water crowfoots (*Ranunculus peltatus*, *R. aquatilis*, *R. baudotii*, *R. hederaceus*) with both submerged and floating leaves, or by *Hottonia palustris*, characteristic mostly of shallow waters with fluctuating water levels, susceptible to occasional drying.
- 22.433** **Oligotrophic pondweed communities**
Potamion graminei
 Sparse formations of narrow-leaved floating pondweeds (*Potamogeton polygonifolius*, *P. gramineus*, *P. alpinus*), water starworts (*Callitriche*), water crowfoots (*Ranunculus ololeucos*, *R. omiophyllum*), floating water plantain (*Luronium natans*), least bur-reed (*Sparganium minimum*) of shallow, oligotrophic, clean, fluctuating, but usually permanent, often small, waterbodies.

22.44

CHANDELIER ALGAE SUBMERGED CARPETS

Charetea fragilis

Charophyte, *Chara* and *Nitella*, algal carpets of the bottom of unpolluted lime-rich lakes. (Westhoff and den Held, 1975; Peinado Lorca *et al.*, 1984; Ellenberg, 1988; Oberdorfer, 1990)

22.441

Chara carpets

22.442

Nitella carpets

22.45

PEATMOSS-BLADDERWORT BOG POOLS

Sphagno-Utricularion (Utricularion intermedio-minoris)

Floating formations of *Sphagnum*, *Scorpidium*, *Utricularia minor*, *U. intermedia*, *U. ochroleuca*, typical habitat of *Sparganium minimum*. (Ellenberg, 1988; Oberdorfer, 1990)

22.5

TEMPORARY WATER BODIES

Bodies of water that are completely and recurrently emptied of water for part of the time such as Irish furloughs. The characteristics of each stage of the cycle can be defined by use of codes of 22.1, 22.2, 22.3, 22.4, and, if appropriate 37, 38, 53, 54, or 8.

23 Standing brackish and salt water

Brackish, saline or hypersaline lakes, pools and ditches.

- 23.1 UNVEGETATED BRACKISH AND SALT WATERS**
Open water with no (or no detected) floating or submerged vegetation other than algae.
- 23.11 OPEN WATER WITHOUT CHAROPHYTE CARPETS**
- 23.12 CHAROPHYTE ALGAL CARPETS**
- 23.2 VEGETATED BRACKISH AND SALT WATERS**
Expanses of water with submerged or emergent vascular vegetation.
- 23.21 SUBMERGED FORMATIONS**
- 23.211 Tasselweed communities**
Ruppion maritimae p.
Ruppia, *Zannichellia* and *Najas* beds with associated *Ranunculus baudotii*, *Potamogeton pectinatus* and *Callitriche* spp.
(Westhoff and den Held, 1975; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Nordiska ministerradet, 1984; Polunin and Walters, 1985; Peinado Lorca and Rivas-Martinez, 1987)
- 23.212 Lagoon communities of marine vegetation**
Zostera, *Posidonia*, *Cymodocea* beds of coastal lagoons.
- 23.22 LAGOON DWARF SPIKE-RUSH BEDS**
Scirpion parvuli p.
Emergent formations of *Eleocharis parvula*.
(Nordiska ministerradet, 1984)

24 Running water

All rivers and streams.

- 24.1 RIVER COURSE**
River courses, regardless of submerged vegetation. The subdivisions are based on slope, width and water temperature according to usual ichthyological practice. Classifications based on flora, such as that of Holmes (1983) for British streams, give broadly similar results. For each of the divisions below, subdivisions can be introduced to take into account the morphodynamics of the stream as proposed, for instance, by Malavoi (1989). (Lelek, 1980; Philippart and Vranken, 1983; Holmes, 1983; Malavoi, 1989)
- 24.11 RIVULETS**
The highest reaches of mountain rivulets. Crenon zone.
- 24.12 TROUT ZONE**
Upper and middle (epirhithral and metarhithral) zones of mountain and hill creeks. 'Group D' rivers of Holmes (1983).
- 24.13 GRAYLING ZONE**
Lower (hyporhithral) zone of mountain and hill creeks. 'Group C' rivers of Holmes (1983).
- 24.14 BARBEL ZONE**
Upper (epipotamal) zone of lowland rivers. 'Group B' rivers of Holmes (1983).
- 24.15 BREAM ZONE**
Middle and lower (metapotamal and hypopotamal) zones of lowland rivers. 'Group A' rivers of Holmes (1983).
- 24.16 INTERMITTENT STREAMS**
Watercourses of which the flow is interrupted for part of the year, leaving a dry bed or pools; conditions during the period of flow can be indicated by one of the previous codes.
- 24.2 RIVER GRAVEL BANKS**
Small stone deposits of river beds.
- 24.21 UNVEGETATED RIVER GRAVEL BANKS**
Gravel banks devoid of vegetation.
- 24.22 VEGETATED RIVER GRAVEL BANKS**
Epilobietalia fleischeri (*Myricarietalia germanicae*) *i.a.*
Gravel banks of rivers occupied by specialized pioneer vegetation, at least in alpine and Mediterranean water courses, as well as any subsequent stages in the colonization sequence.
(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Braun-Blanquet, 1973b; Molinier and Martin, 1980; Vanden Berghen, 1982; Géhu, 1984; Polunin and Walters, 1985; Oberdorfer, 1990)
- 24.221 Subalpine willowherb stream community**
Epilobietum fleischeri
Subalpine and abyssal stations of herbaceous or suffrutescent vegetation with *Epilobium fleischeri*, *Saxifraga aizoides*, *S. caerulea*, *Gypsophila repens*, *Dryas octopetala*.
- 24.222 Alpine gravel bed community**
Chondriletum chondrilloidis
Open and unstable groupings of alpine and subalpine plants colonizing the downstream edge of gravel islands in mountain streams, including *Chondrilla chondrilloides*.

- 24.223 **Willow-tamarisk brush**
Salici-Myricarietum
Myrica germanica and *Salix* spp. formations of montane or dealpine river gravels (44.111).
- 24.224 **Gravel bank thickets and woods**
Salix, *Hippophae*, *Alnus* or *Betula* thickets or woods on stream gravels, which can be further described by use of the codes of 44.
- 24.225 **Mediterranean gravel beds**
Glaucion flavi
Formations with tamarisk (*Myricaria germanica*), rocket (*Erucastrum nasturtifolium*), yellow horned-poppy (*Glaucium flavum*), evening primrose (*Oenothera biennis*) of Mediterranean gravel beds.
- 24.226 **Lowland river gravels**
Less specialized communities of lowland and hill river gravels (e.g. *Filipendulo-Petastion*).
- 24.3 **RIVER SAND BANKS**
Sand deposits in river beds, particularly significant in large river systems such as the Loire.
- 24.31 **UNVEGETATED RIVER SAND BANKS**
River sand banks devoid of vegetation.
- 24.32 **VEGETATED RIVER SAND BANKS**
Sparsely-vegetated to wooded sand banks of large rivers. Appropriate codes from 22.3, 31 and 44 can be used to specify habitats.
- 24.4 **SUBMERGED RIVER VEGETATION**
Ranuncion fluitantis
Beds of water crowfoots, pondweeds, water starworts and other aquatic vegetation of streams comprising in particular *Butomus umbellatus* f. *vallisneriifolius*, *Callitriche cophocarpa*, *C. hamulata*, *C. obtusangula*, *C. stagnatilis*, *Groenlandia densa*, *Potamogeton coloratus*, *P. helveticus*, *P. natans* var. *prolixus*, *P. nodosus*, *Ranunculus fluitans*, *R. penicillatus*, *R. trichophyllus*, *Sagittaria sagittifolia* var. *vallisneriifolia*, *Schoenoplectus lacustris* var. *fluitans*, *Sparganium emersum* ssp. *fluitans*. For fringing vegetation use codes of 53.
(Ellenberg, 1963, 1988; Noirfalise and Dethioux, 1977; Haslam, 1978; Bournérias, 1979, 1984; Haslam and Wolseley, 1982; Mériaux, 1982; Holmes, 1983; Polunin and Walters, 1985; Wolff, 1987; Peinado Lorca and Rivas-Martinez, 1987; Oberdorfer, 1990)
- 24.41 **ACID OLIGOTROPHIC RIVER VEGETATION**
Communities characterized in particular by *Myriophyllum alternifolium*, *Potamogeton polygonifolius*, *Callitriche hamulata*, *Littorella uniflora*.
- 24.42 **LIME-RICH OLIGOTROPHIC RIVER VEGETATION**
Communities characterized in particular by *Potamogeton coloratus* and *Chara hispida*.
- 24.43 **MESOTROPHIC RIVER VEGETATION**
Communities characterized in particular by *Sium erectum* f. *submersa*, *Mentha aquatica* f. *submersa*, *Groenlandia densa*, *Ranunculus peltatus*, *R. penicillatus*, *R. trichophyllus*, *Callitriche truncata*, *C. stagnalis*.
- 24.44 **EUTROPHIC RIVER VEGETATION**
Communities characterized in particular by *Ranunculus fluitans*, *Zannichellia palustris* f. *fluviatilis*, *Potamogeton nodosus*, *Callitriche obtusangula*, *Fontinalis antipyretica*.
- 24.5 **RIVER MUD BANKS**
Alluvial muds exposed by stream level fluctuations (see also 37.7).
- 24.51 **UNVEGETATED RIVER MUD BANKS**
Bare alluvial muds.

24 Running water

24.52

EURO-SIBERIAN ANNUAL RIVER MUD COMMUNITIES

Bidention p., *Chenopodium rubri p.*

Pioneer formations of annuals on nitrogen-rich muds of middle European rivers (*Bidens spp.*, *Rorippa spp.*, *Chenopodium spp.*, *Polygonum spp.*, *Xanthium spp.*).

(Lebrun *et al.*, 1949; Ellenberg, 1963; Guinochet and Vilmorin, 1973; Géhu, 1984; Duvigneaud, 1986; Oberdorfer, 1990)

24.53

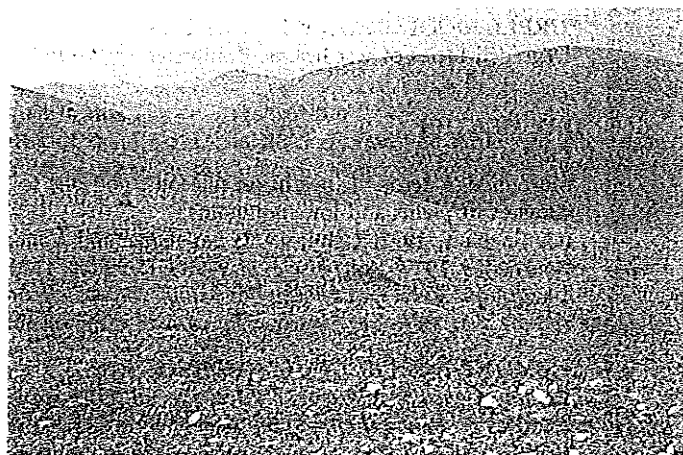
MEDITERRANEAN RIVER MUD COMMUNITIES

Paspalo-Agrostidion

Nitrophilous annual and perennial grass and sedge formations of the alluvial banks of great Mediterranean rivers, with *Paspalum paspaloides*, *P. vaginatum*, *Polypogon viridis* (= *Agrostis semiverticillata*), *Cyperus fuscus*.

(Guinochet and Vilmorin, 1973; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Alcaraz Ariza and Peinado Lorca, 1987)

 **Scrub and grassland**



31 Heath and scrub

Temperate shrubby areas: Atlantic and alpine heaths, subalpine bush and tall herb communities, deciduous forest recolonization, hedgerows, dwarf conifers.

31.1

WET HEATHS

Ericion tetralicis; *Ulicion minoris* p.; *Genistion micrantho-anglicae* p.

Humid, peaty or semi-peaty heaths (other than blanket bogs).

(Lebrun *et al.*, 1949; Ellenberg, 1963; Depasse *et al.*, 1970; Géhu, 1973; Westhoff and den Held, 1975; Noirfalise and Vanesse, 1976; De Sloover *et al.*, 1978; Rivas-Martinez, 1979; Gimingham *et al.*, 1979; Bournérias, 1979; Noirfalise *et al.*, 1980; de Smidt, 1981; Polunin and Walters, 1985)

31.11

NORTHERN WET HEATHS

Wet heaths with *Erica tetralix* and sphagnum.

31.12

SOUTHERN WET HEATHS

Wet heaths with *Erica tetralix* and *E. ciliaris* and sphagnum.

31.13

PURPLE MOORGRASS WET HEATHS

Degraded facies of wet heaths, dominated by *Molinia caerulea*.

31.2

DRY HEATHS

Calluno-Ulicetea

Mesophile or xerophile heaths on siliceous, podsollic soils in moist Atlantic and sub-Atlantic climates of plains and low mountains.

(Gimingham, 1972; Géhu, 1973; Noirfalise and Vanesse, 1976; Gimingham *et al.*, 1979; Bournérias, 1979; Noirfalise *et al.*, 1980; Ratcliffe, 1980; Polunin and Walters, 1985; Webb, 1986)

31.21

SUBMONTANE VACCINIUM HEATHS

Calluno-Genistion pilosae p.; *Vaccinion vitis-idaeae* p.

Heaths rich in *Vaccinium* spp., usually with *Calluna vulgaris*, of the northern and western British Isles, the Hercynian ranges and the lower levels of the Alps, the Pyrenees and the Cordillera Cantabrica.

(Lebrun *et al.*, 1949; Ellenberg, 1963; Schumacker, 1973; Noirfalise and Vanesse, 1976; De Sloover *et al.*, 1978; Rivas-Martinez, 1979; Gimingham *et al.*, 1979; Noirfalise *et al.*, 1980; Ratcliffe, 1980; Webb, 1986; Noirfalise, 1987; Salomez, *in litt.* 1990)

31.211

Northern isles *Vaccinium* heaths

Calluna-Empetrum hermaphroditum-Vaccinium vitis-idaea heaths of the Orkneys and Shetlands.

31.212

Upland British *Vaccinium* heaths

Upland *Vaccinium-Empetrum* heaths of northern and western Britain, with *Vaccinium myrtillus* or *V. vitis-idaea* and *Empetrum nigrum* or *E. hermaphroditum*. They can be further subdivided according to the Ratcliffe (1980) classification, as follows:

31.2121

British southern bilberry heaths

Southern *Vaccinium myrtillus* dominated heaths characteristic of well-drained sub-montane sites south of the Highlands.

31.2122

British chionophilous bilberry heaths

Vaccinium myrtillus dominated heaths of areas with prolonged snow cover in the eastern and central Highlands, Cheviots and Moffat-Tweedsmuir hills with *Empetrum hermaphroditum* and *Vaccinium uliginosum*.

- 31.2123** **British species-rich bilberry heaths**
Species-rich *Vaccinium myrtillus* heaths with *Alchemilla alpina* and abundant grasses, mainly of the central and south-western Highlands, with outliers in northern English and Welsh uplands.
- 31.2124** **British mat-grass-bilberry heaths**
Vaccinium myrtillus-Nardus stricta heaths of northern England and Wales.
- 31.2125** **British mountain crowberry-bilberry heaths**
Vaccinium myrtillus heaths with abundant *Empetrum hermaphroditum*, *Carex bigelowii*, bryophytes and lichens mostly associated with large shallow snow beds in the central and western Highlands, with related outliers in England and Wales.
- 31.2126** **British lichen-bilberry heaths**
Vaccinium myrtillus-Empetrum heaths rich in *Cetraria* and *Cladonia* lichens, but poor in bryophytes, mostly of the eastern and central Highlands.
- 31.2127** **British cowberry heaths**
Vaccinium vitis-idaea heaths, generally species-poor, mainly of the Peak District and eastern Wales.
- 31.2128** **British ling-liverwort heaths**
Tall *Calluna vulgaris-Vaccinium* heaths with a ground layer dominated by leafy liverworts, characteristic of the north-west Highlands, with fragmentary stands in more southerly western uplands.
- 31.213** **Hercynian *Vaccinium* heaths**
Submontane heaths of the Vosges, the Black Forest, the Ardennes, the Eifel and other Hercynian ranges of Germany, with *Calluna vulgaris*, *Vaccinium myrtillus*, *V. vitis-idaea*, *V. uliginosum* and montane lycopodes.
- 31.214** **Sub-montane Alpine *Vaccinium* heaths**
Vaccinium spp. heaths of the collinar and montane levels of the Alps with *Calluna vulgaris*, *Artemisia alba*, *Silene otites*, *Campanula spicata* and other thermophile species.
- 31.215** **Submontane Pyreneo-Cantabrian *Vaccinium* heaths**
Vaccinium-rich heaths of the collinar and montane levels of the Pyrenees and the Cordillera Cantabrica.
- 31.22** **SUB-ATLANTIC *CALLUNA-GENISTA* HEATHS**
Calluno-Genistion pilosae p.
Low *Calluna* heaths often rich in *Genista*, mostly of the North Sea lowlands. Similar formations occurring in British upland areas, montane zones of high mountains of the western Mediterranean basin and high rainfall influenced Adriatic areas are most conveniently listed here.
(Lebrun *et al.*, 1949; Ellenberg, 1963; Depasse *et al.*, 1970; Géhu, 1973; Westhoff and den Held, 1975; Noirfalise and Vanesse, 1976; Gruber, 1978; Gimingham *et al.*, 1979; Bournérias, 1979; Rivas-Martinez, 1979; Noirfalise *et al.*, 1980; Ratcliffe, 1980; Groppali *et al.*, 1980; De Smidt, 1981; Feoli *et al.*, 1981; Bassilana, 1984; Webb, 1986; Ardito, 1989; Salomez, *in litt.* 1990)
- 31.221** **Northern *Calluna-Genista* heaths**
Danish, German and northern Dutch (north of the Rhine) heaths with *Calluna vulgaris*, *Genista anglica*, *G. pilosa* and with *Vaccinium* and *Empetrum* present.
- 31.222** **Elbe *Calluna-Genista* heaths**
Elbe basin formations with *Genista germanica*.
- 31.223** **Campino-Flandrian *Calluna-Genista* heaths**
Southern Dutch, Belgian and north-western French heaths with *Calluna vulgaris*, *Genista anglica* and *G. pilosa*.

- 31.224** Campino-Flandrian *Erica cinerea* heaths
Erica cinerea-dominated formations of the Southern Dutch, Belgian and north-western French range of the *Calluna-Genista* heaths.
- 31.225** British *Calluna-Genista* heaths
British heaths with *Calluna vulgaris* or *Erica cinerea* and often *Genista anglica*. They include in particular:
- 31.2251** East Anglian *Calluna-Festuca* heaths
Lowland, species-poor *Calluna vulgaris-Festuca ovina* heaths of East Anglia and adjacent areas.
- 31.2252** Spring squill heath
Maritime *Calluna vulgaris-Erica cinerea* heaths with *Scilla verna*, of the coasts of south-western England, western Wales, Cumbria, Scotland and the isles.
- 31.2253** British *Calluna-Sieglingia* heaths
Species-rich *Calluna vulgaris-Danthonia (Sieglingia) decumbens* heaths.
- 31.2254** English *Calluna-Deschampsia* heaths
Species-poor *Calluna vulgaris-Deschampsia flexuosa* heaths of northern Pennine foothills, North Yorkshire moors and west Midlands.
- 31.2255** British *Calluna-bearberry* heaths
Arctostaphylos uva-ursi-Calluna vulgaris heaths with *Genista anglica* and often *Erica cinerea* and *Vaccinium vitis-idaea* of eastern Highlands, Teesdale, Lake District and Orkney.
- 31.2256** Upland *Calluna-bell heather* heath
Submontane heather-moors dominated by *Calluna vulgaris*, with varying amounts of *Erica cinerea* and *Vaccinium vitis-idaea*, related to 31.212.
- 31.2257** Highland prostrate *Calluna* heath
Wind-clipped, prostrate *Calluna vulgaris* or *Calluna* and lichen mats, of montane passes and lower summits of the Highlands and other isolated upland areas.
- 31.2258** Southern English *Calluna-bristle bent* heath
Calluna vulgaris-Agrostis curtisii heaths of Dorset and Hampshire.
- 31.226** Montane *Calluna-Genista* heaths
Heaths of the montane zone (beech forest level) of the Central Massif, Pyrenees and south-western Alps with *Genista anglica*, *G. pilosa*, *Vaccinium myrtillus*.
- 31.227** *Empetrum nigrum* heaths
Coastal non-dunal *Calluna* and *Empetrum nigrum* heaths of the Baltic, the North Sea and Scotland.
- 31.228** Illyrian heaths
Illyrian heaths with *Calluna vulgaris* and *Genista germanica*.
- 31.229** Po basin heaths
Calluna vulgaris heaths of the fluvio-glacial terraces that constitute the high plains of the Po river system.
- 31.22A** *Genista sagittalis* heaths
Calluna vulgaris-Genista sagittalis heaths of the south-western Alps.
- 31.23** ATLANTIC *ERICA-ULEX* HEATHS
Ulicenion minoris; *Daboecenion cantabricae* p.; *Ulicenion maritimae* p.
Heaths rich in gorse (*Ulex*) of the Atlantic margins.
(Tüxen and Oberdorfer, 1958; Dendaletche, 1973; Géhu, 1973, 1975, 1984; Noirfalise and Vanesse, 1976; Gimingham *et al.*, 1979; Rivas-Martinez, 1979; Polunin and Walters, 1985; Webb, 1986; Izco, 1987)

- 31.231 Maritime gorse heaths**
Wind-swept heaths with prostrate, cushiony *Ulex maritimus* and numerous other maritime ecotypes (*Cytisus scoparius* subsp. *maritimus*, *Ulex gallii* f. *humilis*, *Erica vagans*) of the immediate proximity of the ocean: Brittany, Cornwall, Cotentin, southern Ireland, Cantabrian coast.
- 31.232 Gallo-Irish *Ulex gallii*-*Erica cinerea* heaths**
Widespread Irish and Welsh Atlantic heaths, with *Ulex gallii* and *Erica cinerea*.
- 31.233 Irish *Erica mackaiana* heaths**
Western Irish heaths comprising the northern, isolated populations of *Erica mackaiana*.
- 31.234 Northern *Erica vagans* heaths**
Irish, Cornish and Armorican heaths, other than cushiony maritime formations, containing *Erica vagans*, northern irradiation of 31.241.
- 31.2341 Armorican *Erica vagans* heaths**
Heaths of Brittany, other than prostrate coastal ones, containing the uncommon and local *Erica vagans*.
- 31.2342 Lizard *Erica vagans* heaths**
Extensive *Erica vagans*-dominated communities of the Lizard peninsula of Cornwall.
- 31.23421 Lizard tall heath**
Erica vagans-*Schoenus nigricans* heath of moist, shallow depressions of the Lizard plateau, dominated by Cornish heath.
- 31.23422 Lizard mixed heath**
Erica vagans-*Ulex europaeus* heath of well-drained areas of the Lizard plateau, dominated by Cornish heath and common gorse.
- 31.235 Anglo-Armorican western gorse heaths**
Armorican, Cotentin and western English heaths with *Ulex gallii* and *Erica cinerea* or *Erica ciliaris*.
- 31.2351 Anglo-Armorican *Ulex gallii*-*Erica cinerea* heaths**
Driest variants of the Atlantic western gorse Anglo-Armorican heaths.
- 31.2352 Anglo-Armorican *Ulex gallii*-*Erica ciliaris* heaths**
More mesophile western gorse heaths, marked by the replacement of *Erica cinerea* by *E. ciliaris*.
- 31.2353 Anglo-Armorican *Ulex gallii*-*Calluna* heaths**
Calluna vulgaris facies of the Anglo-Armorican western gorse heaths.
- 31.2354 *Ulex gallii*-bristle bent heaths**
Southern English, short, often grassy heaths in which *Ulex gallii* is accompanied by *Erica spp.* and various grasses, in particular *Agrostis curtisii*.
- 31.236 Cantabro-Pyrenean *Erica mackaiana*-*E. ciliaris* heaths**
Heaths with *Ulex gallii*, *Erica mackaiana*, *E. ciliaris*, *Daboecia cantabrica* of the beech level of the Pyrenees and the Cantabrian chain and, very locally, of Galicia; *Ulex europaeus* and *Erica mackaiana* heaths of the calcareous Picos de Europa.
- 31.237 Cantabro-Pyrenean *Erica vagans*-*E. cinerea* heaths**
Heaths with *Ulex gallii*, *Erica vagans*, *E. cinerea* and *Pseudarrhenatherum longifolium* of the French and Spanish Basque coast and of the beech level of the Atlantic Pyrenees and of the Cantabrian chain, mostly on mildly acid or slightly calcareous soils.
- 31.238 Anglo-Norman dwarf gorse heaths**
Heaths with *Ulex minor* and *Erica cinerea* or *E. ciliaris* of interior and oriental Brittany, the Perche, Normandy, the Paris Basin, southern and south-eastern England.

- 31.2381** Anglo-Norman *Ulex minor-Erica cinerea* heaths
Driest variants of the dwarf gorse Anglo-Norman heaths.
- 31.2382** Anglo-Norman *Ulex minor-Erica ciliaris* heaths
More mesophile dwarf gorse heaths, marked by the replacement of *Erica cinerea* by *E. ciliaris*.
- 31.2383** Anglo-Norman *Ulex minor-Calluna vulgaris* heaths
Calluna vulgaris facies of the Anglo-Norman dwarf gorse heaths.
- 31.239** Aquitano-Ligerian dwarf gorse heaths
Heaths with *Ulex minor* and *Erica cinerea*, *E. ciliaris* or *E. scoparia* of Aquitaine, Saintonge, Poitou, Sologne and the Loire region.
- 31.2391** Aquitano-Ligerian *Ulex minor-Erica cinerea* heaths
Driest variants of the dwarf gorse Aquitano-Ligerian heaths.
- 31.2392** Aquitano-Ligerian *Ulex minor-Erica ciliaris* heaths
More mesophile dwarf gorse heaths, marked by the replacement of *Erica cinerea* by *E. ciliaris*, accompanied or not by *E. scoparia*.
- 31.2393** Aquitano-Ligerian *Ulex minor-Erica scoparia* heaths
Mesophile dwarf gorse heaths with *Erica scoparia* and no *E. ciliaris*.
- 31.24** IBERO-ATLANTIC *ERICA-ULEX-CISTUS* HEATHS
Daboecenion cantabricae p.; *Ericenion umbellatae* p., *Ericenion aragonensis*; *Ulicion maritimae* p.; *Genistion micrantho-anglicae* p.
Aquitanian heaths with rock-roses. Iberian heaths with numerous species of heathers (notably *Erica umbellata*, *E. aragonensis*) and brooms, rock-roses and often *Daboecia*. When the rock-roses and other Mediterranean shrubs become dominant they should be classified under sclerophyllous scrubs (32).
(Tüxen and Oberdorfer, 1958; Géhu, 1973; Polunin and Smythies, 1973; Noifalaise and Vanesse, 1976; Gimingham *et al.*, 1979; Rivas-Martinez, 1979; Penas and Díaz Gonzalez, 1985; Izzo, 1987; Bayer and Lopez Gonzalez, 1989)
- 31.241** Biscay heaths
Coastal and collinar *Erica-Ulex-Cistus* heaths of the periphery of the Bay of Biscay.
- 31.2411** Aquitanian *Erica-Cistus* heaths
Erica cinerea and *Cistus salvifolius* heaths of the Aquitanian coast, with irradiations in the Landes and to the Montagne noire and Minervois.
- 31.2412** Gascony-Sologne arid heaths
Arid *Erica cinerea* heaths of interior sandy hills and dunes of the Landes of Gascony and of Sologne gravels, with *Halimium alyssoides*.
- 31.2413** Northern Iberian heaths
Erica vagans, *E. cinerea* and sometimes *E. ciliaris* heaths, with *Calluna vulgaris* and *Ulex europaeus*, of the coasts, hills and lower montane areas of the Atlantic slope of Cantabria, the Asturias and Galicia.
- 31.242** Luso-Galician heaths
Atlantic Galician and Portuguese *Erica cinerea*, *E. umbellata* and *Ulex europaeus* heaths.
- 31.2421** Luso-Galician collinar heaths
Coastal and collinar, thermo-Atlantic Galician and northern Portuguese heaths with *Erica cinerea*, *E. umbellata*, *Ulex minor*, *Ulex europaeus*, *U. micranthus*, *Cistus salvifolius* and *Halimium alyssoides*.
- 31.2422** Luso-Galician maritime heaths
Cushiony heaths with *Ulex europaeus* ssp. *latebracteatus* f. *humilis* and *Erica cinerea* of cliff-tops of Galicia, north and central Portugal (southern vicariant of 31.231).

- 31.243** Cabreran heaths
Low *Calluna vulgaris*-rich heaths of interior north-western mountains, limited to the Sierra de la Cabrera and the neighbouring Sierra Segundera, Pena Trevinca and Sierra del Teleno.
- 31.2431** Cabreran dry whin heaths
Open, cushiony formations of *Calluna vulgaris*, *Erica umbellata*, *Genista sanabrensis*, *Halimium umbellatum*, *H. alyssoides* occupying dry, superficial soils.
- 31.2432** Cabreran mesophile whin heaths
Formations of *Calluna vulgaris*, *Genista carpetana*, *G. anglica*, *G. micrantha* and *Thymelaea coridifolia* (*T. dendryobryum*) of wetter stations.
- 31.244** Galicio-Leonese heaths
Erica aragonensis or *E. umbellata* heaths of the interior slopes of the Cordillera Cantabrica, of interior Galicia and of the Leonese mountains.
- 31.2441** Galicio-Leonese *Erica aragonensis* heaths
Supra-Mediterranean *Erica aragonensis* heaths with *Chamaespartium tridentatum*, *Calluna vulgaris*, *Halimium alyssoides* of the interior slopes of the Cantabrian Cordillera, eastern Galician ranges, Leon mountains and the Sierra de Cabrera.
- 31.2442** Galicio-Leonese *Erica umbellata* heaths
Lower altitude heaths on the confines of Galicia and Leon dominated by *Erica umbellata* accompanied by *Erica cinerea*, *Calluna vulgaris*, *Chamaespartium tridentatum*, *Halimium alyssoides*, *H. umbellatum* and Mediterranean elements such as *Lavendula stoechas* ssp. *pedunculata*.
- 31.2443** Galicio-Leonese *Erica cinerea* heaths
Erica cinerea-dominated variants of the Galician and Leonese heaths of 31.2442.
- 31.245** Oro-Castillan heaths
Erica aragonensis heaths of the Cordillera Central and the summits of the Montes de Toledo.
- 31.2451** Western Cordilleran *Erica aragonensis* heaths
E. aragonensis formations of the western Cordillera Central (Serra da Estrela, Sierra de Gata, Sierra de Pena de Francia) with *E. umbellata*, *Halimium alyssoides* and sometimes *Juniperus nana*.
- 31.2452** Ayllon *Erica aragonensis* heaths
E. aragonensis formations of the Sierra de Ayllon with *H. viscosum*, *H. ocymoides*, *Genista pilosa* and, sometimes, *Arctostaphylos uva-ursi*.
- 31.2453** Villuercan *Erica aragonensis* heaths
Isolated summital *Erica aragonensis* heaths of the Montes de Toledo (Villuercas).
- 31.246** Sorian heaths
Erica aragonensis and *Calluna vulgaris* heath communities of the northern Iberian Range, often with *Genista pilosa* or, on wetter soils, *G. anglica* and *G. micrantha*.
- 31.2461** Sorian summital heaths
Calluna heaths of high peaks, with *Viola montcaunica*.
- 31.2462** Sorian *Erica aragonensis* heaths
Beech-zone *E. aragonensis* heaths with *Arctostaphylos uva-ursi*.
- 31.2463** Sorian *Erica vagans* heaths
Formations of lower beech zone, with *Erica vagans*.
- 31.2464** Sorian collinar heaths
Erica arborea, *E. cinerea*, *Calluna vulgaris* formations of acidophilous oak zone.

- 31.247** **Cuencan heaths**
Erica aragonensis heaths of the southern Iberian Range (Valdemeca, Serrania de Cuenca) with *Thymelaea subrepens*.
- 31.248** **Luso-Extremaduran heaths**
Formations rich in *Erica umbellata* of the meso-Mediterranean and occasionally thermo-Mediterranean zones of the western parts of the Iberian peninsula, intermediate between heath and maquis.
- 31.249** ***Erica andevalensis* heaths**
Formations constituted by the local endemic *Erica andevalensis* on soils rich in heavy metals of the Rio Odiel basin in western Andalusia.
- 31.3** **MACARONESIAN HEATHS**
Heaths of the Canary Islands, Azores and Madeira.
(Delvosalle, 1964; Duvigneaud, 1977; Page, 1979; White, 1983; Bramwell and Bramwell, 1983; Wildpret de la Torre and del Arco Aguilar, 1987; Machado, *in litt.*)
- 31.31** **CANARIAN HEATHS**
Andryalo-Ericetalia p.
Low and medium-tall ericaceous formations of the cloud belt of the Canary Islands.
- 31.311** **Canarian *Erica scoparia* heaths**
Humid low heaths of high elevations of Tenerife (Anaga) and La Gomera (Incherada), with *E. scoparia* ssp. *platycodon*.
- 31.312** **Canarian *Erica arborea* heaths**
Low and medium-tall stages of the *Erica arborea*, *Myrica faya* and *Ilex canariensis* formations (tall forest-like formations are listed as 45.9).
- 31.32** **MADEIRAN CLOUD HEATHS**
Sometimes fairly tall, 2-3 metres high, *Erica arborea*, *Myrica faya*, *Erica scoparia*, *Laurus azorica*, *Cletura arborea* and *Pteridium aquilinum* heaths of the cloud zone of Madeira.
- 31.33** **MADEIRAN SUMMITAL HEATHS**
Erica cinerea var. *maderensis*-dominated heaths of the highest peaks of Madeira.
- 31.34** **AZOREAN LOWLAND HEATHS**
Erica azorica, *Myrica faya* and *Laurus azorica* heaths of the lower altitudes of the Azores.
- 31.35** **AZOREAN 'UPPER WOODS' HEATHS**
Heath facies of the *Erica azorica* and *Juniperus brevifolia* 'upper woods' of the Azores.
- 31.36** **AZOREAN SUMMITAL HEATHS**
Calluna vulgaris, *Daboecia azorica* and *Thymus caespititius* communities of the highest altitudes of the Azores (1 200-1 500 m).
- 31.4** **ALPINE AND BOREAL HEATHS**
Small, dwarf or prostrate shrub formations of the alpine and subalpine zones dominated by ericaceous species, *Dryas octopetala* or dwarf junipers; *Dryas* heaths of the British Isles.
- 31.41** **DWARF AZALEA AND VACCINIUM HEATHS**
Loiseleurio-Vaccinion
Trailing azalea, *Loiseleuria procumbens*, and lichen mats of high windswept localities in the Alps and Pyrenees, often with *Vaccinium*.
(Ellenberg, 1963; Gruber, 1978; Gimingham *et al.*, 1979; Polunin and Walters, 1985; Salomez, *in litt.* 1990)
- 31.411** ***Loiseleuria* heaths**
- 31.412** **Alpine *Vaccinium* heaths**

- 31.42** ALPENROSE HEATHS
Rhododendro-Vaccinietum
Rhododendron ferrugineum-dominated heaths of acid podzols in the Alps and Pyrenees, often with *Vaccinium*, sometimes with *Pinus mugo*. They often alternate in mosaic with 31.431 and 31.44.
 (Ellenberg, 1963; Gruber, 1978; Gimingham *et al.*, 1979; Polunin and Walters, 1985)
- 31.43** DWARF JUNIPER SCRUB
Juniperion nanae, *Pino-Juniperion sabiniae* p., *Pino-Cytision purgantis* p.
 Usually dense formations of prostrate junipers.
 (Ellenberg, 1963; Horvat *et al.*, 1974; Gruber, 1978; Guinochet and Vilmorin, 1978; Sfikas, 1978; Gimingham *et al.*, 1979; Strid, 1980; Pignatti, 1982; Polunin and Walters, 1985; Chiappini, 1985a; Noifalisse, 1987; Peinado Lorca and Rivas-Martinez, 1987)
- 31.431** *Juniperus nana* scrub
 Thermophile *Juniperus nana*-dominated heaths of the subalpine zone of the central and southern Alps, northern and central Apennines, Corsica, Sardinia, Forez, Pyrenees and of the upper levels of high Greek and Iberian mountains.
- 31.432** *Juniperus sabina* scrub
 Oro-Mediterranean *J. sabina* heaths of Iberia, inner Alpine valleys and rare Apennine stations.
- 31.433** *Juniperus hemisphaerica* scrub
J. hemisphaerica heaths of Iberia, the southern Apennines, Sicily (Madonie, Etna) and Greece.
- 31.43** *Juniperus oxycedrus* scrub
J. oxycedrus heaths of high Greek mountain slopes.
- 31.44** EMPETRUM-VACCINIUM HEATHS
Empetro-Vaccinietum
 Dwarf heaths dominated by *Empetrum hermaphroditum*, *Vaccinium uliginosum*, *Arctostaphylos alpina* and lycopodes (*Huperzia selago*, *Diphasiastrum alpinum*) of the Alps, Pyrenees, Central Massif, Jura, Northern Apennines.
 (Ellenberg, 1963; Gruber, 1978; Gimingham *et al.*, 1979; Polunin and Walters, 1985)
- 31.45** BOREO-ALPINE SCOTTISH HEATHS
 Alpine heaths of the highlands and islands of Scotland, with *Juniperus nana*, *Loiseleuria procumbens*, *Empetrum hermaphroditum*, *Arctostaphylos uva-ursi*, *A. alpina* and elements of Alpine flora.
 (Ratcliffe, 1977, 1980; Gillingham *et al.*, 1979; Noifalisse, 1987)
- 31.451** Scottish bearberry-azalea heaths
Arctostaphylos alpina-*Loiseleuria procumbens* facies of the boreo-alpine Scottish heaths characteristic of the northern Highlands.
- 31.452** Scottish crowberry-azalea heaths
Empetrum hermaphroditum-*Loiseleuria procumbens* facies of the boreo-alpine Scottish heaths characteristic of the Cairngorms.
- 31.453** Scottish dwarf juniper heaths
Juniperus nana facies of the boreo-alpine Scottish heaths.
- 31.46** BRUCKENTHALIA HEATHS
 Balkanic heaths with *Bruckenthalia spiculifolia*, *Vaccinium myrtillus*.
 (Horvat *et al.*, 1974; Polunin and Walters, 1985)
- 31.47** BEARBERRY HEATHS
Mugo-Rhodoretum hirsuti p., *Juniperion nanae* p., i.a.
 Alpine and subalpine mats of *Arctostaphylos uva-ursi* or *A. alpina*.
 (Ellenberg, 1963, 1988)

- 31.48** **HAIRY ALPENROSE HEATHS**
Mugo-Rhodoretum hirsuti p.
 Forest substitution heaths, treeline fringe formations and alpine heaths or mats dominated by *Rhododendron hirsutum* of calcareous soils in the Alps. *Erica herbacea* and *Rhodothamnus chamaecistus* may be constituents of the heaths.
 (Ellenberg, 1963, 1988)
- 31.49** **MOUNTAIN AVENS MATS**
Dryas octopetala may form woody mats in various calcicolous alpine grasslands (36) or rock vegetations (62). If sufficiently extensive they can be listed as heaths under this heading, together with the distinctive British and Irish formations.
 (Ellenberg, 1963, 1988; Ratcliffe, 1980; Noirfalise, 1987)
- 31.491** **High montane *Dryas* mats**
 Mats of *Dryas octopetala* of continental mountains, in calcicolous alpine grasslands and on high mountain rocks.
- 31.492** **Durness *Dryas* mats**
 Northern Scottish low altitude *Dryas* heaths associated with Durness limestone and shell sand.
- 31.493** **Hebridean *Dryas* mats**
 Hebridean mixed *Dryas-Arctostaphylos* heaths of Durness limestones.
- 31.494** **Burren *Dryas* mats**
Dryas-Arctostaphylos heaths of the Burren in western Ireland.
- 31.495** **Highland *Dryas* mats**
 High-altitude species-rich *Dryas* cliff-ledge communities of the mica-schist hills of the central Highlands of Scotland, with fragmentary outposts in Lakeland and Snowdonia.
- 31.4A** **APENNINE VACCINIUM HEATHS**
 Dwarf mats of *Vaccinium myrtillus*, *V. uliginosum* s.l. and, locally, *Empetrum nigrum* of the northern and central Apennines.
 (Pignatti, 1982; Noirfalise, 1987)
- 31.5** **DWARF MOUNTAIN PINE SCRUB**
Mugo-Rhodoretum hirsuti
Pinus mugo brushes of well-drained, often calcareous, soils in the Alps and Apennines, frequently accompanied by *Rhododendron hirsutum*, *Erica herbacea*, *Arctostaphylos uva-ursi*, *A. alpina*, *Rhodothamnus chamaecistus*.
 (Ellenberg, 1963, 1988; Pignatti, 1982; Richard and Pautou, 1983; Noirfalise, 1987; Maurin *in litt.*, 1989)
- 31.51** **INNER ALPINE DWARF MOUNTAIN PINE SCRUB**
 Formations of the dry inner Alps.
- 31.52** **OUTER ALPINE DWARF MOUNTAIN PINE SCRUB**
 Formations of the northern and south-eastern outer Alps.
- 31.53** **SOUTH-WESTERN ALPINE DWARF MOUNTAIN PINE SCRUB**
 Local formations of the south-western Alps (Haute Roya, Ligurian Alps).
- 31.54** **APENNINE DWARF MOUNTAIN PINE SCRUB**
 Rare and local Apennine formations of the Parmian Apennines, the Abruzzi and the Campanian Apennines.
- 31.6** **SUBALPINE BUSH AND TALL HERB COMMUNITIES**
Betulo-Adenostyletea p.
 Bushy facies of the tall herb communities (*Betulo-Adenostyletea*) of moist, rich soils mostly of the subalpine zone of higher mountain ranges (see 37.8).
 (Vanden Berghen, 1982)

- 31.61** GREEN ALDER BRUSH
Alnetum viridis, *Cymbalaria hepaticifoliae* p.
Dense thickets of green alders characteristic of the Alps and Corsica.
(Ellenberg, 1963, 1988; Gamisans, 1976, 1985; Gruber, 1978; Lambinon *et al.*, 1978; Guittonneau and Huon, 1983; Ozenda, 1985; Polunin and Walters, 1985)
- 31.611** Alpine green alder scrub
Alnetum viridis
Green alder (*Alnus viridis* ssp. *viridis*)-dominated formations, rich in tall herbs, of slopes with a good water-holding capacity, mostly on siliceous soils, in the subalpine and lower alpine belts of the Alps.
- 31.612** Corsican sweet alder brush
Cymbalaria hepaticifoliae, p.
One to three metre-tall brush of the Corsican endemic *A. viridis* ssp. *suaveolens*, sometimes accompanied by a few *Sorbus aucuparia*, *Acer pseudoplatanus* or *Rhamnus alpina*, limited to the moist, cool, north-facing slopes (ubacs) and, locally, to humid torrent galleries on the south-facing slopes (adrets) of the subalpine (1 600-2 100 m) belt of Corsica.
- 31.62** WILLOW BRUSH
Salicion arbusculae (*Salicion waldsteinianae*) i.a.
Willow-dominated facies of the subalpine tall herb communities of higher medio-European mountains and of the northern British Isles.
(Guinochet and Vilmorin, 1973; Ratcliffe, 1980; Polunin and Walters, 1985; Noirfalise, 1987; Vigo and Ninot, 1987; Ellenberg, 1988; Oberdorfer, 1990; Rodwell, 1991)
- 31.621** Pyreneo-Alpine willow brush
Continental mountain tall herb communities dominated by willow bushes.
- 31.6211** Alpine small willow brush
Brushes of *Salix hastata*, *S. glaucocinerea*, *S. helvetica* or other small willows, similar in appearance to, and often interspersed with, green alder brush.
- 31.6212** Alpine prostrate willow brush
Lower formations of prostrate or near-prostrate *Salix alpina*, *S. breviserrata*, *S. waldsteiniana*, *S. caesia*, *S. foetida*, *S. glabra*; formations of very small prostrate willows characteristic of snow patches (36.1) are excluded.
- 31.6213** Alpine tall willow brush
Taller *Salix pentandra*, *S. appendiculata* thickets.
- 31.6214** Pyrenean willow brush
Salix pyrenaica formations of the Pyrenees, often with *Dryas octopetala*.
- 31.622** Subarctic willow brush
Subarctic *Salix lapponum*, *S. lanata*, *S. arbuscula* or *S. myrsinites* formations of ungrazed cliff ledges in the central and northern Highlands of Scotland.
- 31.623** Northern willow brush
Mixed *S. aurita*, *S. atrocinerea*, *S. repens* and *S. caprea* scrub on ungrazed ledges, islands and gullies of the northern British Isles.
- 31.63** SUBALPINE TALL HERBS WITH BUSHES
Other bushy facies (*Vaccinium*, *Rubus*, *Sorbus*) of the subalpine tall herb communities (see 37.8). Tall bushy facies of other subalpine associations, such as *Amelanchier*, *Rhamnus*, *Sorbus* thickets associated with *Juniperus nana*-*Arctostaphylos uva-ursi* heaths can be included.
(Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Dupias, 1985)

- 31.64** **BRITISH ROSEROOT COMMUNITY**
Tall-herb dominated community with *Rhodiola rosea*, *Alchemilla glabra*, *Rubus saxatilis*, *Geum rivale*, *Geranium sylvaticum*, *Angelica sylvestris*, *Vaccinium myrtillus*, *Heracleum sphondylium*, *Saussurea alpina*, colonizing steep crags out of range of grazing, mostly characteristic of the Scottish Highlands with outposts in the Moffat Hills, Lakeland and North Wales.
(Ratcliffe, 1977, 1980; Polunin and Walters, 1985)
- 31.7** **HEDGEHOG-HEATHS**
Primary cushion heaths of the high, dry mountains of the Mediterranean region, with low, cushion-forming, often spiny shrubs, such as *Acantholimon*, *Astragalus*, *Erinacea*, *Vella*, *Bupleurum*, *Ptilotrichum*, *Genista*, *Echinopartum*, *Anthyllis* and various composites and labiates; secondary, zoogenic cushion heaths of the same regions, either downslope extensions of the oro-Mediterranean formations, and dominated by the same species, or specifically montane, often *Genista*-dominated.
(Rechinger, 1943, 1951; Tüxen and Oberdorfer, 1958; Rivas Goday and Rivas-Martinez, 1958; Delvosalle and Duvigneaud, 1962; Archiloque *et al.*, 1969; Polunin and Smythies, 1973; Horvat *et al.*, 1974; Ozenda, 1975, 1985; Girerd, 1978; Ozenda *et al.*, 1979; Izco, 1979; Molinier and Martin, 1980; Polunin, 1980; Reisigl and Danesch, 1980; Strid, 1980, 1989; Quézel, 1981; Nimis, 1981; Zaffran, 1982; Pignatti, 1982; White, 1983; Bramwell and Bramwell, 1983; Géhu, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Polunin and Walters, 1985; Dupias, 1985; Chiappini, 1985a; Noirfalise, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Camarda and Valsecchi, 1990; Gamisans, 1991)
- 31.71** **PYRENEAN HEDGEHOG-HEATHS**
Junipero-Genistetum horridae
Echinopartum horridum formations of dry slopes of the supra-Mediterranean zone of the southern Pyrenees; accompanying the dense, spiny cushions are *Juniperus hemisphaerica*, *Buxus sempervirens*, *Ononis fruticosa*, *Arctostaphylos uva-ursi* ssp. *crassifolia* and *Pinus sylvestris*.
- 31.72** **CORDILLERAN HEDGEHOG-HEATHS**
Cytiso oromediterranei-Echinopartum barnadesii, *Echinopartum pulviniformis-Cytisetum oromediterranei*, *Teucrii salviastris-Echinopartum pulviniformis*, *Genista hystrix-Echinopartum lusitanici*
Formations of the Cordillera Central and adjacent areas dominated by diverse forms of *Echinopartum*.
- 31.721** **Gredos hedgehog-heaths**
Oro-Mediterranean heaths of the Sierra de Gredos dominated by the endemic *Echinopartum lusitanicum* ssp. *barnadesii*.
- 31.722** **Bejar-Pena de Francia hedgehog-heaths**
Oro-Mediterranean heaths of the Sierra de Bejar and Pena de Francia dominated by *Echinopartum ibericum* ssp. *pulviniformis*.
- 31.723** **Estrela hedgehog-heaths**
Relict heaths of highly xeric upper supra-Mediterranean and oro-Mediterranean stations of the Serra da Estrela dominated by *Echinopartum ibericum* ssp. *pulviniformis*.
- 31.724** **Western Cordilleran secondary hedgehog-heaths**
Secondary *Echinopartum lusitanicum-Genista hystrix* hedgehog-heaths developed on skeletal soils of the supra-Mediterranean zone of the western Cordillera Central and surrounding areas.
- 31.73** **NEVADAN HEDGEHOG-HEATHS**
Erinacetalia p., *Lavandulo-Genistion boissieri p.*
Highly developed hedgehog formations of the Sierra Nevada with *Erinacea anthyllis*, *Vella spinosa*, *Astragalus sempervirens* ssp. *nevadensis*, *A. granatensis* ssp. *granatensis* (*A. boissieri*), *Ptilotrichum spinosum*, *Bupleurum spinosum*, *Genista baetica*. Associated dwarf suffrutescent formations of high slopes and crests.

- 31.731** **Lower Nevadan hedgehog-heaths**
Salvio-Lavanduletum lanatae p., *Astragalo-Velletum spinosae* p., *Santolino-Salvietum oxyodonti* p., *Thymo-Cistetum laurifolii* p.
 Supra-Mediterranean (lower xeroacanthic) hedgehog-heaths occupying mainly the 1 700-2 000 m altitudinal range, often rich in *Bupleurum spinosum*, with *Vella spinosa*, *Erinacea anthyllis* or *Echinopartum boissieri*.
- 31.732** **Middle Nevadan hedgehog-heaths**
Astragalo-Velletum spinosae p.
 Oro-Mediterranean (higher xeroacanthic) hedgehog-heaths occupying mainly the 2 000-2 300 m altitudinal range, with *Vella spinosa*, *Erinacea anthyllis*, *Ptilotrichum spinosum*, *Astragalus sempervirens* ssp. *nevadensis*, *A. granatensis* ssp. *granatensis*.
- 31.733** **Upper Nevadan hedgehog-heaths**
 Upper oro-Mediterranean hedgehog-heaths occupying mainly the 2 300-2 600 m altitudinal range, with *Erinacea anthyllis*, *Astragalus sempervirens* ssp. *nevadensis*, *A. granatensis* ssp. *granatensis*, *Juniperus nana* and *J. sabina* ssp. *humilis*.
- 31.734** **Nevadan dwarf cushion-heaths**
 Dwarf suffrutescent formations of windswept crests and slopes on very superficial soils.
- 31.7341** **Siliceous Nevadan dwarf cushion-heaths**
Arenario-Sideritetum glacialis
 Formations of base-rich siliceous soils at 2 600-2 900 m with *Sideritis glacialis*, *Arenaria pungens*, *Astragalus sempervirens* ssp. *nevadensis*.
- 31.7342** **Calcareous Nevadan dwarf cushion-heaths**
Andryalion agardhii: *Convolvulo-Andryaletum agardhii* = *Andryalo-Convolvuletum* p.
 Formations of white-tomentose dwarf cushions developed on calcareous soils (Trevenque, Dornajo, Dilar) with *Andryala agardhii*, *Erodium boissieri*, *Scabiosa pulsatilloides*, *Santolina elegans*, *Globularia spinosa*, *Pterocephalus spathulatus*, *Helianthemum pannosum*.
- 31.735** **Nevadan *Genista* hedgehog-heaths**
Genisto-Juniperetum nanae
Genista baetica-dominated hedgehog-heaths, often with *Juniperus nana* and *G. purgans*, of siliceous soils.
- 31.74** **FRANCO-IBERIAN HEDGEHOG-HEATHS**
 Oro-Mediterranean and montane hedgehog-heaths of other Iberian ranges and of southern France.
- 31.741** ***Erinacea* hedgehog-heaths**
Erinacetalia: *Xeroacantho-Erinaceion* p.
 Oro-Mediterranean *Erinacea*-dominated and related hedgehog-heaths.
- 31.7411** **Baetic *Erinacea-Vella* hedgehog-heaths**
Astragalo-Velletum spinosae p.
 Hedgehog-heaths of the Baetic and sub-Baetic ranges and of the southern Iberian Range, dominated by *Erinacea anthyllis* and/or by *Vella spinosa*, *Astragalus granatensis* ssp. *granatensis*, *A. sempervirens* ssp. *nevadensis*, *Bupleurum spinosum*, *Ptilotrichum spinosum*, developed in particular in the Sierras de Segura, de Cazorla, de Alcaraz, Tejada, Harana, Magina, de Baza, La Sagra, de Gador, Maria and on a few summits of the Sierra de Ronda.
- 31.7412** **Iberian Range *Erinacea* hedgehog-heaths**
Saturejo-Erinaceetum
Erinacea anthyllis-dominated hedgehog-heaths of the Iberian Range (Teruel, Cuenca, Guadalajara, Soria), often in altitudinal contact with *Genista pumila* formations.

- 31.7413** **Maestrazgo *Erinacea-Genista* hedgehog-heaths**
Genisto hispanicae-Erinaceetum, *Erodio-Erinaceetum*
Hedgehog-heaths with *Genista hispanica* ssp. *hispanica* and/or *Erinacea anthyllis* of the Maestrazgo, eastern spur of the Iberian Range under maritime influence.
- 31.7414** **South-eastern *Erinacea* hedgehog-heath**
Hedgehog-heaths with *Genista lobelii* ssp. *longipes*, *Erinacea anthyllis*, *Vella spinosa* of the sub-Baetic Aitana and Mariola ranges in the arid south-east.
- 31.7415** **South-eastern *Daphne* hedgehog-heaths**
Formations with *Daphne oleoides* ssp. *hispanica* of the mountains of the arid south-east.
- 31.742** **Peri-Nevadan dwarf cushion-heaths**
Andryalio agardhii p.
Oro-Mediterranean, and sometimes supra-Mediterranean, formations of dwarf white-tomentose, cushion-forming suffrutescents of the high sub-Baetic and Baetic ranges; characteristic are *Andryala agardhii*, *Convolvulus boissieri*, *Hippocrepis squamata* ssp. *eriocarpa*, *Pterocephalus spathulatus* and *Thymus granatensis*.
- 31.7421** **Cazorla dwarf cushion-heaths**
Formations of the Sierras de Cazorla, Segura, Alcaraz, Taibilla of the high Guadalquivir basin, with *Erodium cazorlanum*, *Scorzonera albicans*.
- 31.7422** **Baza-Tejeda-Ronda dwarf cushion-heaths**
Hippocrepidi-Pterocephalum spathulatae p. = *Andryalo-Convolvuletum* p.
Formations of the Sierras Tejeda, Almijara, la Torrecilla, Harana, Baza, la Sagra, Cazulas, Lapeza and of the Serrania de Ronda with *Anthyllis vulneraria* ssp. *argyrophylla*, *A. tejedensis*, *Helianthemum viscidulum*.
- 31.7423** **Magina dwarf cushion-heaths**
Helianthemo-Pterocephaletum
Formations of the Sierra de Magina with *Helianthemum pannosum* ssp. *frigidulum*, *Lithodora nitida* and *Viola cazorlensis*.
- 31.7424** **Maria-Maimon dwarf cushion-heaths**
Centaureo-Sideritetum stachydioidis
Formations of the Sierras María and Maimon with *Centaurea baetica*, *Sideritis stachydioides*, *Alyssum cadevallianum*.
- 31.743** ***Echinopartum boissieri* hedgehog-heaths**
Lavandulo-Genistion boissieri
Mostly supra-Mediterranean hedgehog-heaths colonizing superficial, eroded soils and wind-swept stations of calcareous Baetic and sub-Baetic ranges, comprising many cushion plants and generally physiognomically dominated by the large hemispherical shrubs of *Echinopartum boissieri*.
- 31.7431** **Alcaraz *Echinopartum* hedgehog-heaths**
Saturejo-Genistetum boissieri
Formations of the Sierra de Alcaraz, sometimes including *Erinacea anthyllis*.
- 31.7432** **Gador *Echinopartum* hedgehog-heaths**
Convolvulo-Lavanduletum lanatae
Formations of the 1 300-1 900 m altitudinal range in the Sierra de Gador, often with *Erinacea anthyllis* or *Ulex parviflorus*.
- 31.7433** **Baetic *Echinopartum* hedgehog-heaths**
Santolino-Salvietum oxyodonti
Formations developed in the 800-1 400 m altitudinal range of other Baetic and sub-Baetic ranges, often, in the higher mountains, immediately below *Erinacetalia* communities.

- 31.744** **Catalano-Valencian *Erinacea* hedgehog-heaths**
Genistion lobelii p.: *Erinaceo-Anthyllidetum montanae* i.a.
 Uncommon hedgehog-heaths with *Erinacea anthyllis* and *Anthyllis montana*, and related cushion plant formations, colonizing windswept stations with skeletal soil of the Mediterranean mountains of north-eastern Spain (Montsant, Llaveria, Cardo, Maestrazgo septentrional, Beceite; Montserrat; Bergueda, and Solsones).
- 31.745** ***Genista* cushion-heaths**
Genistion lobelii p., *Genistion occidentalis*
 Mostly supra-Mediterranean hedgehog garrigues and heaths physiognomically dominated by small, hemispherical *Genista*.
- 31.7451** **Pyreneo-Cantabrian cushion-heaths**
Genistion occidentalis: *Lithodoro diffusae-Genistetum legionensis*, *Lithodoro diffusae-Genistetum occidentalis*, *Arctostaphylo crassifoliae-Genistetum occidentalis*, *Teucrio pyrenaici-Genistetum occidentalis*
 Cushion-heaths dominated by *Genista hispanica* ssp. *occidentalis* or *Genista hystrix* ssp. *legionensis*, often with *Erica vagans*, *Arctostaphylos uva-ursi* ssp. *crassifolia* or *Lithodora diffusa*, characteristic of the Pyrenean-Cantabrian system, where they may occur from the collinar to the subalpine level.
- 31.7452** ***Genista sanabrensis* cushion-heaths**
 Heaths dominated by the cushions of *Genista sanabrensis*, with *Erica umbellata* and *Calluna vulgaris*, occupying crests of southern Galicio-Leonese mountains at about 1 800 m (see 31.2431).
- 31.7453** ***Genista pumila* cushion-heaths**
Aphyllantion: *Lino-Genistetum pumilae*
 Cushion heaths dominated by *Genista pumila* ssp. *pumila* of windswept plateaux and crests of the Meseta and of the northern and southern Iberian range.
- 31.7454** ***Genista scorpius* cushion-heaths**
Aphyllantion: *Armerio-Salvietum phlomoidis* p. i.a.
 Meseta hedgehog-heaths with *Genista scorpius*, rich in cushion-forming small shrubs.
- 31.7455** ***Genista pseudopilosa* cushion-heaths**
Aphyllantion: *Helianthemo-Genistetum pseudopilosae*
 Unarmed *Genista pseudopilosa*-dominated hedgehog-heaths with *Erinacea anthyllis* and other cushion plants of the Sierras de Alcaraz and Segura.
- 31.7456** ***Genista lobelii* and *G. pulchella* cushion-heaths**
Genistion lobelii p.
Genista lobelii and *G. pulchella* hedgehog-heaths of windswept hilltops of south-eastern France.
- 31.746** **Collinar *Astragalus* hedgehog-heaths**
Aphyllantion p.
 Local meso- and supra-Mediterranean *Astragalus* formations of the Spanish Meseta.
- 31.7461** **Dueran *Astragalus* hedgehog-heaths**
Santolino-Astragaletum boissieri
 Supra-Mediterranean *Astragalus granatensis* ssp. *granatensis* (*A. boissieri*) formations of pastoral runs of the left bank of the middle Duero (Soria, Segovia) and of the highlands of Atienza (Guadalajara).
- 31.7462** **Southern Mesetan *Astragalus* hedgehog-heaths**
Paronychio-Astragaletum tumidi
 Meso- and supra-Mediterranean hedgehog-heaths with *Astragalus clusii* (*A. tumidus*) of the southern Meseta, from La Mancha to the Baetic hills of eastern Andalusia (Orce, Sagra, Baza, Maria), with *Paronychia aretioides*, *Genista pumila* ssp. *mugronensis*, *G. scorpius*.

- 31.747** **Summital Balearic labiate hedgehog-heaths**
Hypericion balearici: *Teucrietum subspinosae*, *Pastinacetum lucidae* p.
 Cushion-forming communities with *Teucrium subspinosum*, *T. asiaticum*, *Pastinaca lucida*,
Thymelaea velutina and *Paeonia cambessedesii*.
- 31.7471** **Mallorcan hedgehog-heaths**
 Formations of high elevations of Mallorca, dominated by *Teucrium subspinosum*.
- 31.7472** **Menorcan hedgehog-heaths**
 Formations of Menorca with *Cistus creticus* and *Teucrium subspinosum* var.
spinescens.
- 31.75** **CYRNO-SARDIAN HEDGEHOG-HEATHS**
Carici-Genistetalia (Carlinetalia macrocephalae)
 Expanses of small, compact bushes with *Astragalus sirinicus* ssp. *genargenteus*, *Rosa*
seraphini, *Anthyllis hermanniae*, *Thymus herba-barona*, *Cerastium boissieri*, *Genista salz-*
mannii, *G. corsica*, *Berberis aetnensis*, *Prunus prostrata* and *Daphne oleoides*, of Sardinian
 and Corsican mountains.
- 31.751** ***Astragalus genargenteus* hedgehog-heaths**
Astragaletum genargentei
 Oro-Mediterranean *Astragalus sirinicus* ssp. *genargenteus* hedgehog-heaths of the Gennar-
 gentu and Monte Albo in Sardinia and of the high mountains of Corsica.
- 31.752** **Cyrno-Sardian *Euphorbia* hedgehog-heaths**
 Formations of wind-swept crests of Corsica and Sardinia dominated by the low spiny
 cushions of *Euphorbia spinosa*.
- 31.753** **Cyrno-Sardian *Thymus* cushion-heaths**
 Formations of the mountains of Corsica and Sardinia dominated by the hemispherical
 cushions of the endemic *Thymus herba-barona*.
- 31.754** **Cyrno-Sardian *Genista* hedgehog-heaths**
 Hedgehog-heaths of high mountains of Corsica and Sardinia and secondary heaths of the
 montane level dominated by *Genista salzmanii* (including var. *lobelioides*) or *G. corsica*.
- 31.755** **Cyrno-Sardian *Berberis* hedgehog-heaths**
 Formations of the mountains of Corsica and Sardinia dominated by *Berberis aetnensis*.
- 31.756** **Cyrno-Sardian *Anthyllis* hedgehog-heaths**
 Formations of the mountains of Corsica and Sardinia dominated by *Anthyllis herman-*
niae.
- 31.76** **MOUNT ETNA HEDGEHOG-HEATHS**
Astragaletum siculi
 Lava-colonizing formations with cushions of *Astragalus granatensis* ssp. *siculus*, *Berberis*
aetnensis, *Juniperus hemisphaerica*, *Genista aetnensis*, *Adenocarpus bivonae*, *Viola aeth-*
nensis.
- 31.77** **MADONIE AND APENNINE HEDGEHOG-HEATHS**
 Hedgehog-heaths formed by *Astragalus* spp. or *Genista* spp., of the mountains of the
 southern Italian peninsula and Sicily, except Etna.
- 31.771** **Madonie *Astragalus* hedgehog-heaths**
Astragaletum nebrodensis
 Oro-Mediterranean hedgehog-heaths of the Madonie with *Astragalus granatensis* ssp.
nebrodensis.
- 31.772** **Sila-Aspromonte *Astragalus* hedgehog-heaths**
Astragaletum calabri
 Oro-Mediterranean hedgehog-heaths of the Sila and Aspromonte with *Astragalus parnassi*
 ssp. *calabrus*.

- 31.773** **Apennine *Astragalus sirinicus* hedgehog-heaths**
Hedgehog-heaths with *Astragalus sirinicus* ssp. *sirinicus* of the central and southern Apennines, south to northern Calabria.
- 31.774** **Madonie *Genista cupanii* hedgehog-heaths**
Genistetum cupanii
Montane *Genista cupanii*-dominated hedgehog-heaths of the Madonie.
- 31.775** **Gargano *Genista* hedgehog-heaths**
Chamaecytiso-Genistetum michelii
Montane hedgehog-heaths of Monte Gargano with *Genista sylvestris* ssp. *dalmatica*.
- 31.78** **SUBALPINE PELOPONNESE HEDGEHOG-HEATHS**
Daphno-Festucea: Stipo-Morinion p.
Hedgehog-dominated facies of mostly secondary grassland-scrubland communities replacing *Abies cephalonica* forests in the 1 500-1 800 m altitudinal range of Peloponnese mountains, in particular, Taygetos, Parnon and Kyllini, composed of *Stipa pulcherrima* and *Morina persica*, with bushes and cushion-shaped perennials including *Astragalus angustifolius*, *Daphne oleoides*, *Juniperus haemisphaerica*, *Berberis cretica*, *Anthemis montana*, *Ribes uva-crispa*, *Prunus cocomilia*.
- 31.79** **LOWER ALPINE GREEK HEDGEHOG-HEATHS**
Daphno-Festucea: Eryngio-Bromion p.
Hedgehog-heaths developed on relatively humus-rich soils above treeline, in the 1 700-2 200 m altitudinal range of high Greek mountains; hedgehog facies of associated grasslands; similar, impoverished formations descending into the forest belts of the same mountains, with the exception of those of the Peloponnese, where they are replaced by distinctive formations, listed under 31.78.
- 31.791** **Greek tragacanth hedgehog-heaths**
Hedgehog-heaths of the Taygetos, Kyllini, Chelmos, Parnassus, Vardousia, Giona and calcareous central and northern Pindus, dominated by the large hemispherical tussocks of the tragacanth *Astragalus creticus* ssp. *rumelicus*, and/or *A. parnassi*, and with *Marrubium velutinum*, *M. cyllenaenum*, *Juniperus hemisphaerica*, *Daphne oleoides*, *Eryngium amethystinum*, *Sideritis clandestina*, *Cirsium cylleneum*.
- 31.7911** **Southern Peloponnese tragacanth hedgehog-heaths**
Astragalus creticus ssp. *rumelicus* heaths of the southern Peloponnese.
- 31.7912** **Kyllini-Chelmos tragacanth hedgehog-heaths**
Astragalus parnassi ssp. *cylleneus* and *A. creticus* ssp. *rumelicus* heaths of Kyllini and Chelmos.
- 31.7913** **Greek mainland tragacanth hedgehog-heaths**
Astragalus creticus ssp. *rumelicus* and/or *A. parnassi* ssp. *parnassi* heaths of the mainland.
- 31.792** **Greek *Astragalus angustifolius* hedgehog-heaths**
Astragalus angustifolius heaths, with *Marrubium thessalum* or *M. velutinum* ssp. *haussknechtii*.
- 31.7921** **Olympus *Astragalus angustifolius* hedgehog-heaths**
Formations of the Olympus system dominated by *A. angustifolius*.
- 31.7922** **Pindus *Astragalus angustifolius* hedgehog-heaths**
Formations of the Pindus dominated by *A. angustifolius* (or *A. sirinicus*).
- 31.793** **Greek cushion-heaths**
Cushion formations not dominated by thorny, tussock-forming species of *Astragalus*.
- 31.7931** ***Daphne oleoides* cushion-heaths**
Formations dominated by small bushes of *Daphne oleoides*, usually accompanied by stripped grassland components (36.437).

- 31.7932** *Buxus sempervirens* cushion-heaths
Formations dominated by low mats of *Buxus sempervirens*, characteristic of middle slopes of Greek mountains, in particular Olympus.
- 31.7A** UPPER ALPINE GREEK HEDGEHOG-HEATHS
Daphno-Festucetea: Astragalo-Seslerion
Shrubby formations colonizing the altitudinal range immediately above that occupied by the communities of 31.79, as well as stony slopes with shallow soil, loose scree and humus-deficient soils within the main 1 700-2 200 m range of these communities. Included are true spiny hedgehog-heaths, cushiony formations of dwarf suffrutescents and bush-dominated facies of stripped grasslands. *Astragalus angustifolius*, *Acantholimon androsaceum*, *Astragalus lacteus*, *Convolvulus cochlearis*, *Rindera graeca*, *Aster alpinus*, *Globularia stygia*, *Minuartia stellata*, *Erysimum pusillum*, *Thymus teucrioides*, *Alyssum kionae*, *Paronychia kapela*, *Thymus hirsutus*, *Anthyllis aurea*, *Achillea ageratifolia*, *Sideritis scardica*, *Linum flavum*, *Thymus boissieri*, *Sesleria caerulea* are characteristic.
- 31.7A1** Upper alpine *Astragalus* hedgehog-heaths
Formations dominated by the dense tussocks of *Astragalus angustifolius*.
- 31.7A2** *Minuartia* cushion-heaths
Communities dominated by the large, domed mats of *Minuartia stellata*.
- 31.7A3** Greek dwarf cushion-heaths
Formations of the high reaches of Greek mountains, rich in dwarf suffrutescents.
- 31.7A4** Upper alpine bushy grasslands
Bushy facies of the high altitude stripped grasslands (36.437).
- 31.7B** CRETAN HEDGEHOG-HEATHS
Saturejetea spinosae
Hedgehog-heaths of high mountains of Crete, in the 1 500-2 500 m altitudinal range, with *Astragalus creticus* ssp. *creticus*, *A. angustifolius*, *Acantholimon androsaceum*, *Atraphaxis billardieri*, *Berberis cretica*, *Chamaecytisus creticus*, *Daphne oleoides*, *Prunus prostrata*, *Euphorbia acanthothamnus*, *Verbascum spinosum*, *Sideritis syriaca*, *Satureja spinosa*, *Asperula idaea*, *Rhamnus prunifolius*, *Pimpinella tragioides*, *Acinos alpinus*.
- 31.7B1** Cretan tragacanth hedgehog-heaths
Astragalion creticum p.
Astragalus creticus ssp. *creticus*-dominated hedgehog-heaths of the Psiloriti and Dikti mountains of central and eastern Crete.
- 31.7B2** Cretan *Astragalus angustifolius* hedgehog-heaths
Verbascion spinosae p.; *Astragalion creticum* p.
Astragalus angustifolius-dominated hedgehog-heaths of the Lefka Ori, Psiloriti and Dikti mountains of Crete.
- 31.7B3** Cretan *Chamaecytisus* hedgehog-heaths
Chamaecytisus creticus-dominated hedgehog-heaths of Crete.
- 31.7B4** Other Cretan hedgehog-heaths
- 31.7C** AEGEAN SUMMITAL HEDGEHOG-HEATHS
Isolated, endemic-rich, mostly summital hedgehog-heaths of calcareous mountains of Aegean islands and Mount Athos.
- 31.7C1** Aegean tragacanth hedgehog-heaths
Hedgehog-heaths of mountain summits of Aegean islands, characterized by large tragacanth.
- 31.7C11** Kerki tragacanth hedgehog-heath
Mount Kerki summit community of Samos with *Astragalus creticus* var. *samius*, *A. angustifolius*, *Acantholimon androsaceum*, *Atraphaxis billardieri*, *Centaurea spinosa* var. *tragacanthoides*, *C. xylobasis*, *Genista fasselata* var. *subsericans*, *Prunus prostrata*, *Silene urvillei*, *Lithospermum hispidulum*, *Thymus squarrosus*.

- 31.7C12** **Ambelos tragacanth hedgehog-heath**
Mount Ambelos summit community of Samos with *Astragalus ptilodes*, *Acantholimon androsaceum*, *Prunus prostrata*, *Silene urvillei*.
- 31.7C13** **Chios tragacanth hedgehog-heath**
Formations with *Astragalus trojanus* var. *chius* of the highlands of Chios.
- 31.7C14** **Lesbos tragacanth hedgehog-heath**
Mount Petrovuni summit community of Lesbos with *Astragalus parnassi* (*A. lesbiacus*).
- 31.7C15** **Samothrace tragacanth hedgehog-heath**
Mount Phanga summit community of Samothrace with *Astragalus parnassi* var. *samothracious* and *Genista fasselata* var. *subsericans*.
- 31.7C16** **Athos tragacanth hedgehog-heath**
Mount Athos communities with *Astragalus monachorum* and *A. angustifolius* ssp. *pungens*.
- 31.7C17** **Euboa tragacanth hedgehog-heath**
Mount Delphi community of Euboa with *Astragalus creticus* var. *euboicus*, *Daphne oleoides*, *Prunus prostrata*.
- 31.7C2** **Aegean *Astragalus angustifolius* hedgehog-heaths**
Communities characterized by the dense tussocks of *Astragalus angustifolius*.
- 31.7C21** **Lesbos Olympus hedgehog-heath**
Mount Olympus summit community of Lesbos with *Astragalus angustifolius* and *Silene urvillei*.
- 31.7C22** **Thasos hedgehog-heath**
Mount Agia Illias summit community of Thasos.
- 31.7D** **MONTANE *GENISTA ACANTHOCLADA* HEDGEHOG-HEATHS**
Formations dominated by hemispherical shrubs of *Genista acanthoclada* of the middle levels (about 800-1 200 m) of mountains and plateaux of the Peloponnese.
- 31.7E** ***ASTRAGALUS SEMPERVIRENS* HEDGEHOG-HEATHS**
Astragalus sempervirens ssp. *sempervirens*, ssp. *muticus*, ssp. *cephalonicus* formations of the southern Alps, the eastern Pyrenees, Iberia, the Apennines and Greece, transitional between the alpine and subalpine heaths of 31.4 and the true Mediterranean hedgehog-heaths of 31.7.
- 31.7F** **CANARIAN CUSHION-HEATHS**
Spartocytisium nubigeni
Open formations dominated by broom-like plants of the montane zone (above 1 900 m) of the Canary Islands, with many endemic species.
- 31.7F1** **Tenerife cushion-heaths**
Spartocytisetum nubigeni
Formations of Tenerife with *Spartocytisium supranubius*, *Adenocarpus viscosus* var. *viscosus*, *Descurainia bourgaena*, *Pterocephalus lasiospermus*, *Erysimum scöparium*, *Scrophularia glabrata*, *Nepeta teydea*, *Echium wildpretii*, *E. auberianum*, *Cheirolophus teydis*, *Plantago webbii*, *Sideritis cretica*, *Argyranthemum teneriffae*, *Pimpinella cumbrae*, *Arrhenatherum calderae*.
- 31.7F2** **La Palma cushion-heaths**
Telino benehoavensi-Adenocarpetum spartioidis
Formations of La Palma with *Adenocarpus viscosus* var. *spartioides*, the very rare *Genista benehoavensis* and *Descurainia gilba*, *Pterocephalus porphyranthus*, *Viola palmensis*, *Echium wildpretii*, *E. gentianoides*, *Micromeria lasiophylla* ssp. *palmensis*.

31.8

THICKETS*Prunetalia, Cytisetalia scopario-striati, Epilobietea angustifolii*

Pre- and post-forest formations, mostly deciduous, of Atlantic or medio-European affinities, characteristic of the deciduous forest zone, but also colonizing cool, moist or disturbed stations of the Mediterranean evergreen forest zone.

31.81

MEDIO-EUROPEAN RICH-SOIL THICKETS*Prunetalia: Pruno-Rubion fruticosi p., Berberidion*

Thickets of *Prunus spinosa*, *P. mahaleb*, *Rosa spp.*, *Cornus mas*, *C. sanguinea*, *Sorbus aria*, *Crataegus spp.*, *Lonicera xylosteum*, *Rhamnus catharticus*, *R. alpinus*, *Clematis vitalba*, *Ligustrum vulgare*, *Viburnum lantana*, *V. opulus*, *Rubus spp.*, *Amelanchier ovalis*, *Cotoneaster integerrimus*, *C. nebrodensis*, *Pyrus pyraeaster*, *Malus sylvestris*, *Euonymus europaeus*, *Corylus avellana*, *Ulmus minor*, *Acer campestre*, *A. monspessulanum*, *Carpinus betulus* characteristic of forest edges, hedges and (mostly *Carpinion* or *Quercion pubescenti-petraeae*) woodland recolonization, developed on soils relatively rich in nutrients, neutral or calcareous.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Bournérias, 1979; Noifalisse *et al.*, 1980; Vanden Berghen, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Diaz Gonzalez and Fernando Prieto, 1987; Navarro Andrés and Valle Gutiérrez, 1987; Peinado Lorca and Martínez Parras, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990; Jonglet *in litt.*, 1990; Salomez *in litt.*, 1990; Rodwell, 1991)

31.811

Blackthorn-bramble scrub*Pruno-Rubion fruticosi p.: Pruno-Rubenion fruticosi ('Prunion spinosae')*

Mesophile, often luxuriant, communities characteristic of *Carpinion* forest edges and substitution formations with, among others, *Prunus spinosa*, *Carpinus betulus*, *Crataegus spp.*, *Sambucus nigra*, *Rosa spp.*, *Viburnum opulus*, *Rubus spp.* Included are species-poor *Prunus spinosa* thickets, such as British *Prunus spinosa-Rubus fruticosus* scrub and corresponding mainland formations with *Rubus fruticosus*, *R. elegantispinosus*, *R. bifrons*, *R. armenicus*.

31.8111

Sub-Atlantic blackthorn-bramble scrub

Prunus spinosa, *Carpinus betulus*, *Crataegus spp.*, *Rosa spp.*, *Rubus spp.* communities of the European mainland, under sub-Atlantic or subcontinental climates.

31.8112

Atlantic blackthorn-bramble scrub

Prunus spinosa, *Rubus spp.* communities of the British Isles and other areas of strongly Atlantic climate. *Ulex europaeus*, *Hedera helix*, *Lonicera periclymenum*, *Pteridium aquilinum* are often present.

31.812

Blackthorn-privet scrub*Berberidion*

Communities of more calcareous, drier soils and warmer exposure characteristic of the *Quercion pubescenti-petraeae* and of xeric, calciphilous forms of the *Carpinion*, with, among others, *Prunus spinosa*, *Ligustrum vulgare*, *Viburnum lantana*, *Cornus mas*, *Rhamnus catharticus*.

31.8121

Atlantic and medio-European blackthorn-privet scrub

Communities occupying the domain of the *Carpinion* and northern irradiations of *Quercion pubescenti-petraeae* communities.

31.81211

Medio-European blackthorn-privet scrubs

Prunus spinosa, *Ligustrum vulgare*, *Viburnum lantana*, *Cornus mas*, *Rhamnus catharticus*, *Crataegus spp.*, *Carpinus betulus* communities of the European mainland, under sub-Atlantic or subcontinental climates.

31.81212

Atlantic hawthorn-ivy scrubs

Communities of the British Isles and areas of strongly Atlantic climates differing from 31.81211 in particular in the scarcity of *Carpinus betulus*.

- 31.812121** Atlantic calcicline scrub
Widespread neutrophilous to calcareous species-rich thorny scrub and semi-natural hedge communities of the British Isles, with *Crataegus monogyna*, *Hedera helix*, *Rubus* spp., *Prunus spinosa*, *Fraxinus excelsior*. Included are the *Hedera helix-Urtica dioica*, *Mercurialis perennis* and *Brachypodium sylvaticum* subcommunities of the *Crataegus monogyna-Hedera helix* scrub.
- 31.812122** Wayfaring tree chalk scrub
Species-rich communities, mostly of southeastern England, characterized by the abundance of *Viburnum lantana*, *Ligustrum vulgare*, *Cornus sanguinea*, *Tamus communis* and *Clematis vitalba*, and the frequency of *Taxus baccata* saplings and *Juniperus communis*.
- 31.8122** Sub-Mediterranean blackthorn-privet scrub
Prunetum mahaleb, i.a.
Communities with *Prunus mahaleb*, *Acer monspessulanum* and other xero-thermophile species, occupying the southern part of the west European range of the unit as well as a few highly xero-thermic central European sites.
- 31.8123** Rock pear scrub
Berberidion: Cotoneastro-Amelanchieretum
Possibly primary scrub formations with *Cotoneaster integerrimus*, *C. nebrodensis* and *Amelanchier ovalis* developed on very shallow soils between *Xerobromion* grasslands and open xerothermic oak woods.
- 31.8124** Sea buckthorn scrub
Berberidion: Salici-Hippophaetum rhamnoidis
Formations characterized by the physiognomically distinctive presence of *Hippophae rhamnoides*, ssp. *fluviatilis* or ssp. *carpatica*.
- 31.8125** Inner Alpine barberry scrub
Thorny heaths of inner Alpine valleys with *Berberis vulgaris*.
- 31.81251** Marmot plum scrub
Berberido-Prunetum brigantiacae
Inner Alpine formations with *Prunus brigantina*.
- 31.81252** Other inner Alpine barberry scrubs
- 31.8126** Iberian barberry scrub
Berberidion: Pruno spinosae - Berberidetum cantabricae
North-western Iberian montane communities with *Berberis vulgaris* ssp. *cantabrica*, *Prunus spinosa*, *Corylus avellana*, *Sorbus aria*, *Taxus baccata*, *Crataegus monogyna*, *Ribes alpinum*, *R. petraeum*, *Rhamnus alpinus*.
- 31.82** BOX THICKETS
Berberidion p.
Box-dominated formations of 31.81, 31.89, 31.8A or 31.8B.
(Tüxen and Oberdorfer, 1958; Lopez, 1976; Noirfalise *et al.*, 1980; Vigo and Ninot, 1987)
- 31.83** ATLANTIC POOR SOIL THICKETS
Prunetalia p.: Pruno-Rubion fruticosi p.: Frangulo-Rubion (Rubion subatlanticum; Franguletalia)
Thickets of *Rubus* spp., *Frangula alnus*, *Sorbus aucuparia*, *Corylus avellana*, *Lonicera periclymenum*, *Cytisus scoparius*, characteristic of forest edges, hedges and (mostly *Quercion*) woodland recolonization developed on soils relatively poor in nutrients, usually acid, mostly under climates with strong Atlantic influence.
(Vanden Berghen, 1982; Ellenberg, 1988; Rameau *et al.*, 1989; Oberdorfer, 1990; Rodwell, 1991)
- 31.831** Bramble thickets
Formations dominated by *Rubus* spp., including British *Rubus fruticosus-Holcus lanatus* underscrub.

- 31.832** Alder buckthorn, rowan, honeysuckle thickets
Other formations (except broom fields, gorse thickets, hazel thickets and bracken fields, separately coded below).
- 31.84** BROOM FIELDS
Cytisetalia scopario-striati
Formations with an upper stratum dominated by tall brooms.
(Tüxen and Oberdorfer, 1958; Lopez, 1976; Gruber, 1978; Noirfalise *et al.*, 1980; Lopez Gonzalez, 1982; Pignatti, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Vigo and Ninot, 1987; Machado, *in litt.* 1989)
- 31.841** Medio-European *Cytisus scoparius* fields
Sarothamnion scoparii (*Pruno-Rubion fruticosi*; *Sarothamnetion*)
Expanses of broom (*Cytisus scoparius*), a common recolonization stage of the *Quercion* in the plains and hills of northern and middle Europe, reaching the montane zone in the higher mountains.
- 31.8411** Lowland and hill broom fields
Cytisus scoparius fields of the lowlands, hills and low mountains of northern, western and central Europe.
- 31.8412** Alpine broom fields
Montane *Cytisus scoparius* fields of the Alpine system.
- 31.8413** Central Massif *Cytisus scoparius* fields
Montane beech-level formations of *Cytisus scoparius* of the Central Massif.
- 31.8414** Pyrenean *Cytisus scoparius* fields
Prunello pyrenaicae-Sarothamnetum scoparii
Montane formations of *Cytisus scoparius* of the Pyrenees.
- 31.842** *Cytisus purgans* fields
Pino-Cytision purgantis p., *Genistion polygaliphyllae p.*
Cytisus purgans-dominated formations of higher levels (upper montane, subalpine, oro-Mediterranean) of south-western European mountains, often associated with dwarf juniper scrubs (31.43) or hedgehog-heaths (31.7), and physiognomically reminiscent of the latter.
- 31.8421** Cévennes *Cytisus purgans* fields
Localized formations of the upper levels of the Cévennes.
- 31.8422** Pyrenean *Cytisus purgans* fields
Pino-Cytision purgantis: *Senecio-Genistetum purgantis i.a.*
Upper montane Pyrenean formations appearing on the edge of, or as substitution of, acidophilous pine woods.
- 31.8423** Galicio-Cantabrian *Cytisus purgans* fields
Genistion polygaliphyllae: *Cytisetum scopario-purgantis p.*, *Cytiso cantabrici-Genistetum obtusirameae p.*
Galician and oro-Cantabrian upper montane formations.
- 31.8424** Upper Cordilleran *Cytisus purgans* fields
Pino-Juniperetea: *Pino-Cytision purgantis*: *Junipero nanae-Cytisetum oromediterranei p.*, *Cytiso oromediterranei-Echinopartetum barnadesii p.*, *Cytiso oromediterranei-Echinopartetum pulviniformis p.*
Alti-Mediterranean and oro-Mediterranean formations of the Cordillera Central.
- 31.8425** Lower Cordilleran *Cytisus purgans* fields
Cytiso oromediterranei-Genistetum cinerascens p.
Upper supra-Mediterranean formations of the Cordillera Central.
- 31.8426** Galicio-Leonese *Cytisus purgans* fields
Genisto sanabrensis-Juniperetum nanae
Oro-Mediterranean formations of the high southern Galicio-Leonese sierras.

- 31.8427** Nevadan *Cytisus purgans* fields
Genisto-Juniperetum nanae cytisetosum
 Oro-Mediterranean formations of the Sierra Nevada.
- 31.843** **Piornales**
Genistion floridae, *Genistion polygaliphyllae*
Cytisus multiflorus, *C. striatus*, *C. scoparius*, *C. grandiflorus*, *C. cantabricus*, *Genista florida* and other tall broom fields of the Iberian peninsula, mostly characteristic of the transition between the Atlantic and Mediterranean domains.
- 31.8431** **White-flowered broom fields**
Genistion polygaliphyllae: *Cytisenion multiflorae*, *Genistion polygaliphyllae p.*;
Genistion floridae p.
 Formations rich in white-flowered *Cytisus multiflorus* of the western Meseta, the (mostly western) Cordillera Central, the sierras of southern Galicia and Leon and the western Cantabrian mountains, in which *C. multiflorus* is either the only tall broom or is an important component of broom fields also containing yellow-flowered *Genista florida* ssp. *polygaliphylla*, *G. florida* ssp. *florida*, *G. cinerea* ssp. *cinerascens*, *Cytisus scoparius* and others.
- 31.8432** **North-western Iberian *Genista florida* fields**
Genistion polygaliphyllae: *Genistion polygaliphyllae*, *Cytisenion striati p.*
 Formations rich in *Genista florida* ssp. *polygaliphylla* of the oro-Cantabrian region, the sierras of southern Galicia and Leon, the Serra da Estrela, the northern Iberian range, with *Cytisus cantabricus*, *C. scoparius*, *C. striatus*, *Genista obtusiramea*, *Adenocarpus complicatus*.
- 31.8433** **North-western Iberian *Cytisus* fields**
Genistion polygaliphyllae: *Cytisenion striati*
 Formations rich in *Cytisus striatus* or *C. ingramii* of the western Cordillera Central and of Galician hills and plateaux, with *Genista florida* ssp. *polygaliphylla*, *Cytisus scoparius*, *C. multiflorus* or *Ulex europaeus*.
- 31.8434** **Central Iberian *Genista florida* fields**
Genistion floridae: *Genistion floridae*
 Formations rich in *Genista florida* ssp. *florida* of the Cordillera Central and the southern Iberian range, with *Cytisus scoparius*, *C. multiflorus*, *C. striatus*, *Genista cinerea* ssp. *cinerascens*, *Adenocarpus hispanicus*.
- 31.8435** **Upper Cordilleran *Genista cinerea* fields**
 Formations dominated by *Genista cinerea* ssp. *cinerascens* of higher elevations of the Cordillera Central.
- 31.8436** **Central Iberian *Cytisus* fields**
Genistion floridae p.
 Formations rich in *Cytisus striatus* or *C. scoparius* of the Cordillera Central and the Montes de Toledo with *Genista florida* ssp. *florida* or *Chamaespartium tridentatum*.
- 31.8437** **Andalusian broom fields**
Genistion floridae: *Adenocarpion decorticantis*
 Formations of *Cytisus reverchonii*, *C. grandiflorus*, *Adenocarpus decorticans* of the supra-Mediterranean zone of Andalusian mountains.
- 31.844** **Tyrrhenian broom fields**
 Broom fields of peninsular Italy and of the large Tyrrhenian islands.
- 31.8441** **Peninsular Italian broom fields**
 Supra-Mediterranean and montane peninsular formations with *Cytisus scoparius*, *C. sessilifolius* or *Adenocarpus complicatus*.
- 31.8442** **Insular Tyrrhenian broom fields**
 Supra-Mediterranean and montane formations of Corsica, Sardinia and Sicily with *Cytisus scoparius*.

- 31.845** *Genista aetnensis* stands
Formations of the very large *Genista aetnensis*, endemic to the western Mediterranean and of considerable biogeographical interest, with a distribution limited to Sicily and Sardinia.
- 31.8451** Etna *Genista aetnensis* stands
Formations of *Genista aetnensis* colonizing the lava fields of the eastern flank of Mount Etna.
- 31.8452** Sardinian *Genista aetnensis* stands
Very rare and localized *Genista aetnensis* formations of Sardinia (east and Iglesiente).
- 31.846** Canary Island broom fields
Micromerio-Telinion teneriffae
Canary Island formations with *Teline* spp., *Micromeria* spp., *Adenocarpus foliolosus* developed in particular in the humid montane zone where they replace heaths on sunnier exposures.
- 31.85** GORSE THICKETS
Ulex europaeus thickets of the Atlantic domain (including British *Ulex europaeus-Rubus fruticosus* scrub p.)
(Bournérias, 1984; Ellenberg, 1988; Rodwell, 1991)
- 31.86** BRACKEN FIELDS
Extensive, often closed communities of the large fern *Pteridium aquilinum*.
- 31.861** Sub-Atlantic bracken fields
Pteridium aquilinum fields appearing as a recolonization stage of the *Quercion* of the Atlantic and sub-Atlantic areas of continental Europe, including the British Isles and the Iberian peninsula.
- 31.862** Macaronesian bracken fields
Pteridium facies of the heaths of the Atlantic Islands.
- 31.863** Supra-Mediterranean bracken fields
Pteridium aquilinum fields of the *Quercetalia pubescenti-petraeae* zone.
- 31.87** WOODLAND CLEARINGS
Epilobietea angustifolii
Communities colonizing medio-European and sub-Mediterranean deciduous or coniferous woodland clearings, clear-felled or burnt areas.
(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Noirfalise *et al.*, 1980; Vanden Berghen, 1982; Oberdorfer, 1990)
- 31.871** Herbaceous clearings
Epilobion angustifolii, *Atropion*
Short-lived herbaceous communities colonizing recent clearings.
- 31.8711** Willowherb and foxglove clearings
Epilobion angustifolii
Communities of acid soils with raw humus, composed of *Epilobium angustifolium*, *Digitalis purpurea*, *D. grandiflora*, *Senecio sylvaticus*, *Calamagrostis epigeios*, *Carex pilulifera*.
- 31.8712** Burdock and deadly nightshade clearings
Atropion
Formations of mull soils, with *Arctium nemorosum*, *Atropa bella-donna*, *Bromus ramosus*, *Hypericum hirsutum*, *Fragaria vesca*, *Stachys alpina*, *D. lutea*.
- 31.872** Shrubby clearings
Sambuco-Salicion capreae
Formations of *Salix caprea*, *Sambucus nigra*, *S. racemosa*, *Sorbus aucuparia*, *Rubus* spp. succeeding the herbaceous formations in the regrowth of clearings.

- 31.88** COMMON JUNIPER SCRUB
Middle European lowland and montane communities dominated by *Juniperus communis*. (Bournérias, 1984; Ellenberg, 1988; Oberdorfer, 1990; Rodwell, 1991)
- 31.881** Juniper downs
Juniperus communis colonization of medio-European calcareous grasslands.
- 31.882** Juniper heaths
J. communis colonization of heaths and related communities.
- 31.883** Juniper-wood sorrel woodland
Upland formation of the central highlands of Scotland and of northern England, in which *Juniperus communis* is the most abundant small tree or large shrub, accompanied by ericoids, ferns, grasses, bryophytes and a fairly rich flora of herbaceous dicots.
- 31.89** SOUTH-WESTERN SUB-MEDITERRANEAN DECIDUOUS THICKETS
Pruno-Rubion ulmifolii, *Lonicero-Berberidion hispanicae*
Mostly deciduous shrubs and hedges, usually tall and luxuriant, often very rich in lianas, of Mediterranean France, of sub-Mediterranean areas of the Iberian peninsula and of moist stations in the Mediterranean zone of the Iberian peninsula. (Tüxen and Oberdorfer, 1958; de Bolos *et al.*, 1970; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Rivas-Martinez, 1975c, 1980; Lopez, 1976; Rivas-Martinez, Diaz *et al.*, 1984; Peinado Lorca *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987)
- 31.891** Franco-Iberian sub-Mediterranean deciduous thickets
Rubo-Coriaretum i.a.
Formations mostly of moist stations within the Mediterranean zone of France, Catalonia, the Balearics and Valencia, with *Rosa sempervirens*, *Rubus ulmifolius*, *Tamus communis*, *Prunus spinosa*, *Cornus sanguinea*, *Crataegus monogyna* and, locally, *Coriaria myrtifolia*.
- 31.892** Western Iberian sub-Mediterranean deciduous thickets
Rubo ulmifolii-Tametum communis, *Lonicero hispanicae-Rubetum ulmifolii*, *Rhamno catharticae-Crataegetum laevigatae*, *Lonicero etruscae-Rosetum agrestis i.a.*
Formations of the western, particularly north-western, part of the Iberian peninsula, with *Crataegus monogyna*, *Prunus spinosa*, *Cornus sanguinea*, *Ligustrum vulgare*, *Sambucus nigra*, *Euonymus europaeus*, brambles, particularly the Mediterranean *Rubus ulmifolius*, various roses, notably *Rosa sempervirens* and *Rosa canina* agg., and particularly rich in lianas, *Tamus communis*, *Smilax aspera*, *Clematis vitalba*, *Lonicera periclymenum*, *L. etrusca*, *Rubia peregrina*, *Bryonia cretica*, *Vitis vinifera*, *Humulus lupulus*.
- 31.893** Central Iberian sub-Mediterranean deciduous thickets
Sabino-Berberitum hispanicae, *Pruno malahebo-Berberitum hispanicae*, *Rosetum micrantho-agrestis i.a.*
More continental formations of central Iberia, developed mostly on deep, moist soils in the supra-Mediterranean zone of the Meseta, the Ebro basin, the Cordillera Central, the southern Iberian range, the Montes de Toledo, the Sierra Morena and the western Baetic or sub-Baetic mountains, with *Berberis hispanica*, *Prunus spinosa*, *P. mahaleb*, *Crataegus monogyna*, *Ribes uva-crispa*, *Rubus ulmifolius*, *Lonicera xylostium*, *L. etrusca*, *Amelanchier ovalis*, *Rhamnus saxatilis*, numerous roses of the *Rosa agrestis* and *R. canina* aggregates (e.g. *Rosa micrantha*, *R. pouzinii*, *R. corymbifera*, *R. sicula*) and, locally, *Hippophae rhamnoides*.
- 31.894** Oro-Baetic sub-Mediterranean deciduous thickets
Lonicero-Berberidion hispanicae: Crataego-Loniceretum arborea
Supra- and oro-Mediterranean formations of eastern sub-Baetic and Baetic mountains (Sierras de Cazorla, Segura, Baza, Magina, Alcaraz and the Sierra Nevada), with *Lonicera arborea*, *L. splendida*, *Prunus ramburii*, *Cotoneaster granatensis*, *Berberis hispanica*, *Crataegus monogyna*, *Rosa spp.*
- 31.8A** TYRRHENIAN SUB-MEDITERRANEAN DECIDUOUS THICKETS
Formations of peninsular Italy, Sicily, Sardinia and Corsica. (Pignatti, 1982; Chiappini, 1985a, b; Gamisans, 1985, 1991)

- 31.8A1** **Cyrno-Sardian sub-Mediterranean deciduous thickets**
Formations of Corsica and Sardinia with *Rubus ulmifolius*, *Rosa agrestis*, *R. canina*, *R. serafini*, *Prunus spinosa*, *Crataegus monogyna*, *Clematis vitalba*, *Pyrus amygdaliformis*, *Rhamnus persicifolius*.
- 31.8A2** **Italo-Sicilian sub-Mediterranean deciduous thickets**
Formations of the Italian peninsula and Sicily with *Rubus ulmifolius*, *Rosa sempervirens*, *R. arvensis*, *Pyrus amygdaliformis*, *P. communis*, *Malus sylvestris*, *Amelanchier ovalis*, *Cotoneaster integerrimus*, *C. nebrodensis*, *Pyracantha coccinea*, *Crataegus monogyna*, *C. laciniata*, *Prunus spinosa*, *P. cocomilia*, *P. mahaleb*, *Coriaria myrtifolia*, *Cotinus coggygria*, *Pistacia terebinthus*, *Euonymus europaeus*, *Paliurus spina-christi*, *Rhamnus catharticus*, *Lonicera xylosteum*, *L. etrusca*.
- 31.8B** **SOUTH-EASTERN SUB-MEDITERRANEAN DECIDUOUS THICKETS (SCHIBLJAK)**
Prunion fruticosae
Deciduous pre- and post-forest formations, forest edges, hedges and woodland recolonization of the *Quercion frainetto* and *Ostryo-Carpinion* zones of the Balkan peninsula, with very local irradiations in central Europe, extreme north-eastern Italy and the Aegean. (Rechinger, 1951; Ellenberg, 1988; Horvat *et al.*, 1974; Polunin and Walters, 1985; Oberdorfer, 1990)
- 31.8B1** **Central European sub-Mediterranean deciduous thickets**
Prunetum fruticosae
Prunus fruticosa formations of dry, continental Central European areas, notably east of the Harz mountains.
- 31.8B2** **Illyrian sub-Mediterranean deciduous thickets**
Prunus fruticosa formations of north-eastern Italy.
- 31.8B3** **Greek sub-Mediterranean deciduous thickets**
Varied, often species-rich formations of temperate and sub-Mediterranean areas of continental Greece and the northern Aegean with *Prunus spinosa*, *P. fruticosa*, *P. mahaleb*, *P. cerasifera*, *P. cocomilia*, *Pyrus amygdaliformis*, *Pyracantha coccinea*, *Crataegus monogyna*, *C. laciniata*, *Sorbus domestica*, *Rosa sempervirens*, *R. canina* agg., *R. rubiginosa* agg., *Rubus ulmifolius*, *Euonymus* spp., *Cornus mas*, *Cornus sanguinea*, *Ligustrum vulgare*, *Rhamnus saxatilis*, *Berberis vulgaris*, *Clematis vitalba*, *Paliurus spina-christi*, *Cotinus coggygria*, *Rhus coriaria*, *Coriaria myrtifolia*, *Syringa vulgaris*, *Cercis siliquastrum*, *Coronilla emerus*, *Colutea arborescens*, *Juniperus oxycedrus*, *J. communis*, *Buxus sempervirens*, *Corylus* spp., *Acer* spp., *Fraxinus ornus*, *Ulmus minor*, *Carpinus* spp., *Ostrya carpinifolia*, *Quercus* spp..
- 31.8B4** **Aegean sub-Mediterranean deciduous thickets**
Southern and eastern Aegean formations with *Crataegus monogyna*, *C. azarolus*, *Prunus cocomilia*, *P. webbii*, *P. prostrata*, *P. discolor*, *Pyrus amygdaliformis*, *Rubus ulmifolius*, *Rosa sempervirens*, *Berberis cretica*, *Rhododendron flavum*, *Acer sempervirens*, *Quercus brachyphylla*, *Q. infectoria*.
- 31.8C** **HAZEL THICKETS**
Thickets or brush, often very extensive, composed exclusively or predominantly of *Corylus* spp., a frequent facies of 31.81, 31.83, 31.89, 31.8A, and 31.8B. (Dupias, 1985; Ellenberg, 1988)
- 31.8D** **DECIDUOUS SCRUB WOODLAND**
Early stages of deciduous tall forest regrowth or colonization composed predominantly of young individuals of tall forest species. The type of scrub woodland can be specified by placing at the third, fourth and fifth decimal places of 31.8D the first three digits after the decimal point of 41 that characterize the corresponding tall forest type.
- 31.8E** **COPPICE**
Regrowth stages of woodland treated in coppice without standards. The type of coppice can be specified by placing at the third, fourth and fifth decimal places of 31.8E the first three digits after the decimal point of 41 that characterize the corresponding tall forest type.

31.8F**MIXED SCRUB WOODLAND**

Early stages of mixed tall forest regrowth or colonization composed predominantly of young individuals of tall forest species. The type of scrub woodland can be specified by placing at the third, fourth and fifth decimal places of 31.8F the first three digits after the decimal point of 41 that characterize the corresponding tall forest type.

31.8G**CONIFEROUS SCRUB WOODLAND**

Early stages of conifer forest regrowth or colonization composed predominantly of young individuals of tall forest species. The type of scrub woodland can be specified by placing at the third, fourth and fifth decimal places of 31.8G the first three digits after the decimal point of 42 that characterize the corresponding tall forest type.

32 Sclerophyllous scrub

Mediterranean and sub-Mediterranean evergreen sclerophyllous bush and scrub (maquis, garrigue, matorral, phrygana *sensu lato*), recolonization and degradation stages of broad-leaved evergreen forests, supra-Mediterranean garrigues, pseudo-maquis, Macaronesian xerophytic communities.

32.1

ARBORESCENT MATORRAL

Quercetalia ilicis, Pistacio-Rhamnetalia alaterni i.a.

Pre- or post-forest formations with a more or less dense arborescent cover and with a usually thick, high evergreen shrub stratum. They are mostly degradation or reconstitution stages of the broad-leaved evergreen forests (45) or their substitution, intermediate between them and maquis (32.2 to 32.5); some are substitution stages of thermophilous deciduous (41) or conifer (42) forests.

(Rivas-Martinez, 1974; Quézel, 1981; Tomaselli, 1981a)

32.11

EVERGREEN OAK MATORRAL

Meso-Mediterranean arborescent matorral organized around evergreen oaks. Dense, low, coppice-like woods of evergreen oaks.

(Horvat *et al.*, 1974; Rivas-Martinez, 1974; Quézel, 1981; Tomaselli, 1981a; Chiappini, 1985a)

32.111

Quercus suber matorral

Arborescent matorral mostly of *Quercus suber*. Detailed habitats can be coded by placing at the fourth and fifth decimal places of 32.111 the second and third digits after the decimal point of 45.2 that characterize the corresponding cork oak forest.

32.112

Acidiphile *Quercus ilex* and *Q. rotundifolia* matorral

Arborescent matorral mostly of *Q. ilex* or *Q. rotundifolia*, usually with *Erica arborea* and *Arbutus unedo*, on siliceous substrates of the western Mediterranean. Detailed habitats can be coded by placing at the fourth, fifth and sixth decimal places of 32.112 the second, third and fourth digits after the decimal point of 45.3 that characterize the corresponding evergreen oak forest.

32.113

Calciphile *Quercus ilex*, *Q. rotundifolia*, *Q. coccifera* matorral

Arborescent matorral mostly of *Q. ilex*, *Q. rotundifolia* or *Q. coccifera* on calcareous substrates of the western Mediterranean. For *Q. ilex* or *Q. rotundifolia* matorrals, detailed habitats can be coded by placing at the fourth, fifth and sixth decimal places of 32.113 the second, third and fourth digits after the decimal point of 45.3 that characterize the corresponding evergreen oak forest. For Italian *Q. coccifera* formations, use 32.1135.

32.114

Eastern Mediterranean *Quercus ilex*, *Q. coccifera* matorral

Arborescent matorral mostly of *Q. ilex* or *Q. coccifera* (*Q. calliprinos*) on both siliceous and calcareous substrates of the eastern Mediterranean.

32.1141

Greek *Q. ilex* arborescent matorral

Formations derived from 45.31C.

32.1142

Cretan *Q. ilex* arborescent matorral

Formations derived from 45.31D.

32.1143

Greek *Q. coccifera* arborescent matorral

Formations derived from 45.41.

32.115

Mixed oak arborescent matorral

Arborescent matorral organized around mixed evergreen (*Q. suber*, *Q. ilex*, *Q. rotundifolia*) and deciduous (*Q. pyrenaica*, *Q. faginea*) oaks of Iberia.

- 32.116** Evergreen oak low woods
Dense, low, coppice-like formations of evergreen oaks.
- 32.1161** *Q. ilex*, *Q. rotundifolia* low woods
Q. ilex, *Q. rotundifolia* formations. Detailed habitats can be coded by placing at the fifth, sixth and seventh decimal places of 32.1161 the second, third and fourth digits after the decimal point of 45.3 that characterize the corresponding evergreen oak forest.
- 32.1162** *Q. coccifera* low woods
Q. coccifera (*Q. calliprinos*) formations. Detailed habitats can be coded by placing at the fifth decimal place of 32.1162 the second digit after the decimal point of 45.4 that characterizes the corresponding kermes oak forest.
- 32.12** OLIVE AND LENTISC MATORRAL
Thermo-Mediterranean or thermo-Canarian arborescent matorral with *Olea europaea* ssp. *sylvestris*, *O. europaea* ssp. *cerasiformis*, *Ceratonia siliqua*, *Pistacia lentiscus*, *P. atlantica* or *Myrtus communis* (see 45.1).
(Bolos *et al.*, 1970; Horvat *et al.*, 1974; Rivas-Martinez, 1974; Quézel, 1981; Tomaselli, 1981a; Chiappini, 1985a, b; Veri and Pacioni, 1985; Gamisans, 1985; Rivas-Martinez and Costa, 1987; Serrada *et al.*, 1988)
- 32.121** Olive arborescent matorral
Olea europaea ssp. *sylvestris*-dominated formations (see 45.11).
- 32.122** Carob arborescent matorral
Ceratonia siliqua-dominated formations (see 45.12).
- 32.123** Lentisc arborescent matorral
Tall *Pistacia lentiscus*-dominated formations.
- 32.124** Myrtle arborescent matorral
Tall *Myrtus communis*-dominated formations (e.g. Balearic *murtedas*, *Clematidi-Myrtetum*).
- 32.125** Canarian olive-lentisc arborescent matorral
Canary Island *Olea europaea* ssp. *cerasiformis* or *Pistacia atlantica*-dominated formations (see 45.13).
- 32.13** JUNIPER MATORRAL
Mediterranean and sub-Mediterranean evergreen sclerophyllous bush and scrub organized around arborescent junipers. Mixed dominance can be indicated by combination of codes: (Rechinger, 1951; Bolos and Molinier, 1960; Bolos *et al.*, 1970; Horvat *et al.*, 1974; Rivas-Martinez, 1974; Quézel, 1981; Ozenda, 1981, 1985; Tomaselli, 1981b; Chiappini, 1985a, b; Gamisans, 1985; Peinado Lorca and Rivas-Martinez, 1987)
- 32.131** *Juniperus oxycedrus* arborescent matorral
Arborescent matorral dominated by *Juniperus oxycedrus* s.l.
- 32.1311** Inland *Juniperus oxycedrus* arborescent matorral
Juniperus oxycedrus ssp. *oxycedrus*-dominated formations of dry, rocky slopes and deforested areas.
- 32.1312** *Juniperus macrocarpa* arborescent matorral
Juniperus oxycedrus ssp. *macrocarpa* formations of coastal sands and abrupt shores; many are dunal and can be coded under 16.27.
- 32.1313** *Juniperus transtagana* arborescent matorral
Juniperus oxycedrus ssp. *transtagana* formations of maritime sands of south-western Portugal; they should usually be listed under 16.27.
- 32.132** *Juniperus phoenicea* arborescent matorral
Arborescent matorral dominated by *Juniperus phoenicea* s.l.

- 32.1321** **Inland *Juniperus phoenicea* arborescent matorral**
Juniperus phoenicea ssp. *phoenicea*-dominated formations occupying steep rocky slopes of the meso-Mediterranean and, locally, thermo-Mediterranean or lower supra-Mediterranean zones, particularly developed on crests and spurs of the mountains bordering the Ebro depression, in calcareous mountains of Valencia, in the south-western Alps and Provence, in Sardinia, in Sicily, in Puglia and in southern Greece. Remarkable, generally uncommon, stands of old, tall trees may take on an almost woodland appearance.
- 32.1322** ***Juniperus lycia* arborescent matorral**
Juniperus phoenicea ssp. *lycia*-dominated formations of coastal sands, alluvions and abrupt shores. Many are dunal and can be coded under 16.27.
- 32.133** ***Juniperus excelsa* and *J. foetidissima* arborescent matorrals**
 Arborescent matorrals of Greece dominated by *Juniperus excelsa* or *J. foetidissima*.
- 32.1331** ***Juniperus excelsa* arborescent matorral**
 Formations derived from 42.A3.
- 32.1332** ***Juniperus foetidissima* arborescent matorral**
 Formations derived from 42.A4.
- 32.134** ***Juniperus communis* arborescent matorral**
 Mediterranean formations dominated by *Juniperus communis*.
- 32.135** ***Juniperus drupacea* arborescent matorral**
 Formations derived from 42.A5, limited to the Peloponnese.
- 32.136** ***Juniperus thurifera* arborescent matorral**
 Formations derived from 42.A2.
- 32.14** **PINE MATORRAL**
 Mediterranean and sub-Mediterranean sclerophyllous brush and scrub dotted by pines. Mixed dominance can be indicated by combination of codes.
 (Horvat *et al.*, 1974; Rivas-Martinez, 1974; Quézel, 1981; Tomaselli, 1981a; Polunin and Walters, 1985)
- 32.141** **Mesogean pine arborescent matorral**
 Formations dominated by *Pinus pinaster* ssp. *pinaster*.
- 32.142** **Stone pine arborescent matorral**
 Formations dominated by *Pinus pinea*.
- 32.143** **Aleppo pine arborescent matorral**
 Formations dominated by *Pinus halepensis*.
- 32.144** **Aegean pine arborescent matorral**
 Formations dominated by *Pinus brutia*.
- 32.145** **Black pine and scots pine arborescent matorral**
 Formations dominated by black pines (*Pinus pallasiana*, *P. salzmannii*) or occasionally by scots pines (*P. sylvestris*).
- 32.15** **ARBOR-VITAE MATORRAL**
Arisaro vulgare-Tetraclinidatum articulatae
 Relict *Tetraclinis articulata* forest remnants of the Sierras de Cartagena in the arid Iberian South-east, with a low, open vegetation of *Arisarum vulgare*, *Periploca laevigata*, *Chamaerops humilis*, *Rhamnus lycioides*, *Asparagus stipularis*, *A. albus*, *Lithodora fruticosa*, *Brachypodium retusum*, *Lavandula dentata*, *Thymus glandulosus*, *Teucrium carthaginense* and an admixture of *Tetraclinis* of varied age, from seedlings to old trees; *Pinus halepensis* (a man-encouraged competitor), *Olea europaea* ssp. *sylvestris* and *Quercus ilex* may be part of the arborescent layer. This formation is of exceptional bio-geographical and historical importance.

(Rivas-Martinez, 1974; Templado, 1974; Quézel, 1981; Tomaselli, 1981b; Alcaraz Ariza and Peinado Lorca, 1987)

32.16

DECIDUOUS OAK MATORRAL

Formations dominated by semi-deciduous or deciduous oaks.

32.161

Eastern deciduous oak matorral

Mediterranean or sub-Mediterranean evergreen sclerophyllous bush and scrub organized around eastern Mediterranean deciduous or semi-evergreen oaks (*Quercus macrolepis*, *Q. trojana*, *Q. anatolica*, i.a.).
(Quézel, 1981)

32.162

Western deciduous oak matorral

Mediterranean or sub-Mediterranean evergreen sclerophyllous bush and scrub organized around western thermo-Mediterranean, meso-Mediterranean and sometimes supra-Mediterranean deciduous or semi-evergreen oaks (*Q. canariensis*, *Q. faginea*, *Q. pyrenaica*, *Q. pubescens*, i.a.).
(Rivas-Martinez, 1974)

32.17

ARID ZONE MATORRAL

Ziziphium loti p.

Pre-desert brush of *Periploca laevigata*, *Lycium intricatum*, *Asparagus stipularis*, *A. albus*, *Withania frutescens* (32.25) with tall *Ziziphus lotus*, confined to the arid Iberian South-east.

(Freitag, 1971; Rivas-Martinez, 1974; Quézel, 1981; Alcaraz Ariza and Peinado Lorca, 1987)

32.18

LAUREL MATORRAL

Humid arborescent matorral with tall laurel (*Laurus nobilis*) developed locally in Sardinia, Sicily and Campania, in particular.

(Fenaroli, 1970; Chiappini, 1985a, b; Veri and Pacioni, 1985)

32.19

CYPRESS MATORRAL

Maquis dominated by native (in the Aegean; see 42.A1) or planted cypress (*Cupressus*).
(Quézel, 1981)

32.1A

ZELKOVA MATORRAL

Zelkovo-Aceretum sempervirentis, *Vincetoxico-Zelkovetum abeliceae*

Formations of the mountains of Crete, for the most part hedgehog-heaths, dominated by sparse to moderately closed stands of *Zelkova abelicea*, a rare, declining Tertiary relict of Pontic affinities, often associated with *Acer sempervirens*.

(Zaffron, 1982)

32.2

THERMO-MEDITERRANEAN SHRUB FORMATIONS

Pistacio-Rhamnietalia alaterni: *Oleo-Ceratonion*, *Asparago-Rhamnion oleoidis*, *Periplocion angustifoliae*, *Rhamno-Quercion cocciferae* p., *Juniperion lyciae* p., *Ceratonio-Rhamnion*; *Phlomidetalia purpureae*; *Anthyllidetalia terniflorae*; *Calluno-Ulicetalia*: *Stauracanthion boivinii*, *Ericanion umbellatae* p.; *Lavanduletalia stoechidis*: *Stauracantho genistoidis-Halimion halimifolii*, *Ulici argentei-Cistion ladaniferi* p.

Shrub formations characteristic of the thermo-Mediterranean zone. Included here are those formations, for the most part indifferent to the siliceous or calcareous nature of the substrate, that reach their greatest extension or optimal development in the thermo-Mediterranean zone. Also included are the numerous, strongly characterized, thermophile formations endemic to the south of the Iberian peninsula, mostly thermo-Mediterranean but sometimes meso-Mediterranean; in their great local diversity they are a western counterpart of, and sometimes approach in appearance, the mostly eastern Mediterranean phryganas, which, however, on account of their strong structural singularity, are listed separately under 33.

(Rechinger, 1951; Rivas-Goday and Rivas-Martinez, 1968; Fenaroli, 1970; Lapraz, 1970, 1973a, 1974, 1977; Freitag, 1971; Horvat *et al.*, 1974; Rivas-Martinez, 1974, 1979; Ozenda *et al.*, 1979; Tomaselli, 1981 a, b; Quézel, 1981; Chiappini 1985 a, b; Veri and Pacioni, 1985; Bueno *et al.*, 1985; Noirfalise, 1986; Camarda and Valsecchi, 1990)

- 32.21** THERMO-MEDITERRANEAN BRUSHES, THICKETS AND HEATH-GARRIGUES
Oleo-Ceratonion, Asparago-Rhamnion, Ceratonio-Rhamnion, Juniperion lyciae p., Rhamno-Quercion cocciferae p.
 Lentisc-dominated or lentisc-rich brushes and related formations with *Olea europaea* ssp. *sylvestris*, *Pistacia lentiscus*, *Rhamnus alaternus*, *R. lycioides* ssp. *lycioides*, *oleoides*, *velutinus*, *graecus*, *Myrtus communis*, *Rubia peregrina*, *R. tenuifolia*, *Thymus capitatus*, *Prasium majus*, *Asparagus stipularis*, *A. acutifolius*, *A. albus*, *A. aphyllus*, *Cneorum tricoccon*, *Daphne gnidium*, *Phillyrea angustifolia*, *P. latifolia*, *Osyris quadripartita*, *O. alba*, *Bupleurum fruticosum*, *B. gibraltarium*, *Ephedra fragilis*, *Chamaerops humilis*, various oaks (*Quercus ilex*, *Q. rotundifolia*, *Q. suber*, *Q. coccifera*; *Q. fruticosa*), *Sarcopoterium spinosum*, *Calicotome villosa*, *C. spinosa*, widespread in the thermo-Mediterranean zone of the Iberian peninsula (except the arid Iberian South-east: 32.25), of the Balearics, Corsica, Sardinia and Sicily, of continental France and Italy, of peninsular and archipelagic Greece. A few extremely distinctive habitats formed by facies of these formations, distributed throughout large portions of their range, are separated under 32.22, 32.23 and 32.24. Other characteristic habitats are listed below as subdivisions of 32.21. (Rechinger, 1951; Rivas Goday and Rivas-Martinez, 1968; Bolos *et al.*, 1970; Freitag, 1971; Horvat *et al.*, 1974; Rivas-Martinez, 1974, 1979; Brullo *et al.*, 1977; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Gamisans, 1985; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987)
- 32.211** Oleo-lentisc brush
 Usually pluri-specific brushes in which *Olea europaea* ssp. *sylvestris* accompanied by *Pistacia lentiscus* plays a determinant physiognomic role. Almost entirely restricted to the thermo-Mediterranean zone, they are represented by particularly well-developed, extensive stands in southern Iberia, the Balearics, Sardinia, Sicily, southern Greece and the Aegean. When the characteristic species increase in height they grade into arborescent matorral (32.12).
- 32.212** Thermo-Mediterranean heath-garrigues
 Formations dominated by the thermophile, often calciphile, heathers *Erica multiflora* and *E. manipuliflora*, best developed in the thermo-Mediterranean zones of southern and eastern Spain, the Balearics, Sardinia, Sicily, Pantelleria, southern Italy, southern Greece and the Aegean. Western meso-Mediterranean formations are listed under 32.4B.
- 32.2121** Western *Erica multiflora* heath-garrigues
 Usually calciphile *Erica multiflora* formations of the Iberian and Italian peninsulas and the large western Mediterranean islands.
- 32.2122** Western *Erica manipuliflora* heath-garrigues
 Rare, calciphile *Erica manipuliflora* formations of Puglia and Sicily.
- 32.2123** Eastern *Erica manipuliflora* heath-garrigues
Erica manipuliflora formations of Greece and its archipelagoes.
- 32.213** Thorny burnet brush
 Non-cushion formations dominated by *Sarcopoterium spinosum* of the eastern Mediterranean.
- 32.214** Lentisc brush
Pistacia lentiscus-dominated or -rich formations, widespread and abundant in thermo-Mediterranean and coastal meso-Mediterranean zones of the entire Mediterranean basin; locally, similar formations may appear in warm inland meso-Mediterranean areas. Often low and sometimes very open, the lentisc brush can, in favourable situations, reach a height of several metres, grading into arborescent matorral (32.123).
- 32.215** *Calicotome* brush
 Thermo-Mediterranean formations physiognomically dominated by the brilliantly flowering *Calicotome villosa* or *C. spinosa*.
- 32.216** Laurel thickets
Laurus nobilis thickets of humid or fresh stations, lower facies of 32.18.

- 32.217** Coastal *Helichrysum garrigues*
 Low formations of *Helichrysum* (*H. italicum* ssp. *microphyllum*, *H. italicum* ssp. *italicum*) with spurges (*Euphorbia pithyusa*, i.a.), *Pistacia lentiscus*, *Camphorosma monspeliaca*, *Artemisia densiflora*, *Thymelaea passerina*, *T. hirsuta*, *T. tartonraira* of the immediate vicinity of sea cliffs, forming the transition between cliff vegetations or cliff-top phryganas and thermo-Mediterranean brushes; they are particularly characteristic of the large Mediterranean islands.
- 32.218** Myrtle thickets
Myrtus communis-dominated brush. Particularly noteworthy formations occur in the Balearics (*Clematidi-Myrtetum*), in southern Iberia, in Sardinia, in the Aegean. Myrtle thickets can in favourable situations reach a height of a few metres, grading into arboreal matorral (32.124).
- 32.219** Thermo-Mediterranean kermes oak brushes
Quercus coccifera thickets rich in thermo-Mediterranean elements, in particular, *Pistacia lentiscus*, *Chamaerops humilis*, *Rhamnus lycioides*, *Asparagus albus*, *A. acutifolius*, *Bupleurum gibraltariensis*.
- 32.2191** Iberian thermo-Mediterranean kermes oak brush
Melico-Cocciferetum, *Rhamno lycioidis-Quercetum cocciferae*, *Bupleuro gibraltari-Pistacietum lentisci*, *Quercus cocciferae-Pistacietum lentisci*, *Asparago albi-Rhamnetum oleoides*, *Chamaeropo-Rhamnetum lycioides*, *Rhamno lycioidis-Quercetum cocciferae*
 Formations of *Quercus coccifera* of southern Portugal, southern and eastern Spain and the Ebro basin.
- 32.2192** Tyrrhenian thermo-Mediterranean kermes oak brush
 Rare *Quercus coccifera* formations of Liguria, Corsica, Sardinia and Sicily.
- 32.2193** Greek thermo-Mediterranean kermes oak brush
 Formations of *Quercus coccifera* of the thermo-Mediterranean zone of Greece and its archipelagoes.
- 32.21A** *Phillyrea* thickets
Phillyrea angustifolia or *P. media*-dominated formations; they constitute facies, in particular of the southern Iberian *Asparago-Rhamnion* and of the Aegean *Ceratonio-Rhamnion*, notably on Samothrace and Rhodes; they constitute also remarkable coastal formations on Minorca, based on the endemic *P. media* var. *rodriguezii*, and in Valencia.
- 32.21A1** Minorcan *lentiscareae*
Aro picti-Phillyreetum rodriguezii
 Thickets of *Phillyrea media* var. *rodriguezii* restricted to Minorca.
- 32.21A2** Valencian *mata*
Phillyreo-Rhamnetum angustifoliae
 Thickets of *Phillyrea angustifolia*, *Pistacia lentiscus*, *Quercus coccifera*, *Rhamnus lycioides* ssp. *angustifolia*, *R. alaternus* of fixed dunes of Valencia. They are almost extinct, surviving only in the Dehesa de la Albufera. The code should be used in conjunction with 16.28.
- 32.21A3** Western *Phillyrea* thickets
Phillyrea angustifolia or *P. media*-dominated formations of the western Mediterranean.
- 32.21A4** Eastern *Phillyrea* thickets
Phillyrea angustifolia or *P. media*-dominated formations of the eastern Mediterranean.
- 32.21B** Buckthorn-asparagus brushes
 Thermo-Mediterranean formations in which *Asparagus* spp. and/or *Rhamnus lycioides* predominate.

- 32.21C** *Osyris* brushes
Formations dominated by *Osyris alba* or *O. tripartita*.
- 32.21D** *Storax* thickets
Styrax officinalis-dominated formations of thermo- and meso-Mediterranean areas of the eastern Mediterranean.
- 32.21E** *Buxus balearica* box thickets
Cneoro-Buxetum balearicae; *Aceri-Buxetum*
Buxus balearica formations of coastal regions of Andalusia, bordering the Sea of Alboran, and of the Balearics.
- 32.21F** Dwarf oak scrub
Formations of the semi-evergreen shrub *Quercus fruticosa* of southern Portugal and western Andalusia.
- 32.21G** Tall spiny broom brush
Brushes dominated by tall, spiny species of *Genista*.
- 32.21G1** Karpathos and Kasos tall spiny broom brush
Genista fasselata formations of Karpathos and Kasos.
- 32.21G2** Pantelleria tall spiny broom brush
Genista aspalathoides formations of Pantelleria.
- 32.21H** *Corema* brush
Corema album-dominated formations of the south-western coasts of the Iberian peninsula. Most of them are dunal and can be listed under 16.28, completed by this code.
- 32.21I** Thermo-Mediterranean juniper brushes
Formations rich in thermo-Mediterranean elements dominated by prostrate or low shrubby *Juniperus oxycedrus* or *J. phoenicea*. Many of them are dunal and can be listed under 16.28, completed by this code. See also 32.2B2.
- 32.22** TREE-SPURGE FORMATIONS
Stands of *Euphorbia dendroides*, remarkable tertiary relict of Macaronesian origin; they occur as a facies of the thermo-Mediterranean brushes of the Balearics, Corsica, Sardinia, Sicily, Islas Eolie, Egadi, Pelagi, Pantelleria, Crete, and, very locally, of those of the coasts of northern Catalonia, south-eastern France, peninsular Italy and its islands, central Greece, notably on slopes facing the gulf of Corinth, the Peloponnese and the Aegean archipelagoes. Particularly extensive and robust stands occur in Sicily, Sardinia and Crete where they may extend to relatively high altitudes.
(Rechinger, 1951; Bolos *et al.*, 1970; Pignatti, 1972; Horvat *et al.*, 1974; Brullo *et al.*, 1977; Rivas-Martinez *et al.*, 1980; Ozenda, 1981; Becker *et al.*, 1982; Lopez Gonzalez, 1982; Gamisans, 1985; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987)
- 32.23** DISS-DOMINATED GARRIGUES
Garrigues invaded and dominated by the high tussocks of *Ampelodesmos mauritanica*; typically thermo-Mediterranean, they also occur extensively in the meso-Mediterranean zone. They are most prevalent on the Tyrrhenian coast of central and southern Italy and in Sicily.
(Pignatti *et al.*, 1962; Reisigl and Danesch, 1980; Pignatti, 1982)
- 32.24** PALMETTO BRUSH
Chamaerops humilis-dominated formations; other thermo-Mediterranean brushes or garrigues rich in the physiognomically important palmetto can be identified by a combination of this code and that of the other appropriate subdivision of 32.2. Palmetto brushes are best represented in the coastal areas of south-western, southern and eastern Iberia, the Balearics, Sicily and its satellite islands, with more sporadic occurrences in the Guadalquivir basin, Sardinia, and the Tyrrhenian coasts and islands of peninsular Italy.
(Fenaroli, 1970; Ozenda *et al.*, 1979; Reisigl and Danesch, 1980; Tomaselli 1981a, b; Chiappini, 1985b; Noifalise, 1986)

32.25

PRE-DESERT SCRUB

Periplocion angustifoliae, Anthyllidetalia terniflorae

Shrub formations constituting, with the halo-nitrophilous scrubs (15.724) and the localized gypsum scrubs (15.93), much of the natural and semi-natural vegetation of the arid zone of south-eastern Spain (Almeria, Murcia, Alicante), a highly distinctive region of unique climatological, biological and landscape character within Europe, extremely rich in African and endemic species. Several of the most remarkable formations remain in only a few undisturbed localities and are gravely at risk. Outposts of these communities exist in Sicily, the Egadi islands and Pantelleria.

(Delvosalle and Duvigneaud, 1962; Rivas Goday and Rivas-Martinez, 1968; Brullo *et al.*, 1970; Freitag, 1971; Rivas-Martinez, 1974; Ozenda *et al.*, 1979; Pignatti, 1982; Ferre Bueno *et al.*, 1985; Noirfalise, 1986; Alcaraz Ariza and Peinado Lorca, 1987)

32.251

Iberian jujube brush

Ziziphetum loti

Communities dominated by hummocks of the lotus tree *Ziziphus lotus*, usually with *Lycium intricatum*, *Withania frutescens*, *Asparagus albus*, *A. stipularis*, *Rhamnus lycioides*, of the arid Iberian South-east. Very tall stands can be coded as 32.17.

32.252

Sicilian jujube brush

Ziziphus lotus formations of western Sicily.

32.253

Maytenus brushes*Rhamno angustifoliae-Maytenetum europaei*

More or less dense, spiny brushes limited to very restricted areas of the Almerian and Carthaginian coasts of the arid Iberian South-east, dominated by the shrub of African affinities *Maytenus senegalensis* var. *europaeus* with *Rhamnus lycioides* ssp. *angustifolia* and ssp. *velutinus*, *Asparagus albus*, *A. stipularis*, *A. horridus*, *Chamaerops humilis* and occasionally *Buxus balearica*.

32.254

Iberian *Periploca* scrubs*Gymnosporio europaeae-Periplocetum angustifoliae*

Open, sometimes sparse brush dominated by *Periploca laevigata* ssp. *angustifolia* with *Osyris quadripartita*, *Chamaerops humilis*, *Pistacia lentiscus*, *Rhamnus lycioides* and locally *Calicotome infesta* ssp. *intermedia*, *Tetraclinis articulata*, *Maytenus senegalensis* or *Lycium intricatum*, limited to very arid coastal areas of Murcia and Almeria.

32.255

Pantellerian *Periploca* scrubs*Periploco-Euphorbietum dendroidis*

Summer deciduous shrub formations of *Periploca laevigata* ssp. *angustifolia*, *Lycium intricatum*, *Euphorbia dendroides* with *Prasium majus*, *Pistacia lentiscus*, *Asparagus acutifolius*, *Phillyrea angustifolia*, *Calicotome villosa* of the south-western coast of Pantelleria and of the Egadi islands.

32.256

Tall arid brushes

Anthyllidetalia terniflorae: Genisto-Phlomidion almeriensis

Communities essentially endemic to the province of Almeria, constituted by *Phlomis purpurea* ssp. *almeriensis*, *P. caballeroi*, *Genista spartioides* ssp. *retamoides*, *G. umbellata*, *G. ramosissima*, *G. cinerea* ssp. *valentina*, *Launaea arborescens*, *L. lanifera*, *Lavatera oblongifolia*, *Linum suffruticosum*, *Salsola webbii*, *Salvia candelabrum*, *Sideritis foetens*, *Thymelaea tartonraira*, *Ulex parviflorus* ssp. *canescens*, *Frankenia webbii*, *Anthyllis terniflora*. Formations belonging to this alliance dominated by large, non-spiny brooms are listed separately under 32.26.

32.2561

Salsola webbii brush*Frankenio-Salsoletum webbii*

Tall brush communities of arid slopes at the base of coastal mountains with *Salsola webbii*, *Launaea arborescens*, *Anthyllis terniflora*, *Frankenia webbii*, *Echium pycnanthum*.

32.2562

Sideritis brush*Salvio-Sideritetum foetens*

Montane brush of sunny calcareous slopes of the Sierra de Gador and the Sierra de Alhamilla, rich in endemics among which the shrubs *Sideritis foetens* and *Lavandula lariata* and the woody perennials *Salvia candelabrum*, *Lavatera oblongifolia* and *Ptilostemon hispanicus*.

32.2563

Gorse-phlomis scrub*Phlomidi-Ulicetum canescentis*

Formation endemic to the base-rich volcanic rocks of the mountains of Cabo de Gata, dominated by the gorse *Ulex argenteus* ssp. *erinaceus*, of extraordinarily limited range, accompanied by *Phlomis purpurea* ssp. *almeriensis*, *P. caballeroi* and numerous elements of thermo-Mediterranean brushes, *Asparagus* spp., *Pistacia lentiscus*, *Quercus coccifera*, *Chamaerops humilis*.

32.2564

Genista umbellata garrigues*Corydothymo-Phlomidetum almeriensis*

Open scrub rich in dwarf shrubs and dominated by the large cushions of ssp. *umbellata* of the remarkable, taxonomically widely isolated, southern and south-eastern Spanish endemic *Genista umbellata*, in association with the also cushion-forming *Thymus capitatus*, *Genista spartioides* ssp. *retamoides*, another southern Spanish endemic, and *Phlomis purpurea* ssp. *almeriensis*. This formation, which presents physiognomic similarities with phryganas (33), constitutes a transition between the arid brushes and the thermo-Mediterranean garrigues of section 32.27, in particular those formed by the only other population of *G. umbellata* (ssp. *equisetiformis*). Many of the accompanying dwarf shrubs, such as *Thymus glandulosus*, *Satureja obovata*, *Teucrium eriocephalum*, however, are Iberian South-east endemics or preferentials.

32.257

Arid garrigues*Anthyllidetalia terniflorae: Thymo-Siderition leucanthae, Anthyllido-Salsolion papillosae.*

Low, open garrigues, often of steppic character, occupying mostly skeletal soils of the arid Iberian South-east.

32.2571

Murcio-Alicantian arid garrigues*Thymeo-Siderition leucanthae*

Diverse formations of the northern part of the arid Iberian South-east characterized by various combinations of the dwarf shrubs *Helianthemum caput-felis*, *H. cinereum* ssp. *cinereum*, *H. pilosum* ssp. *violaceum*, *Hypericum ericoides*, *Launaea pumila* and the endemic *Astragalus hispanicus*, *Sideritis leucantha* ssp. *tragoriganum*, *Teucrium pumilum* ssp. *carolipau*, *Thymus longiflorus* ssp. *moroderi*.

32.2572

Almerian arid garrigues*Anthyllido-Salsolion papillosae*

Very open formations limited to the areas of the Iberian South-east with the most extreme arid conditions, characterized by *Anabasis articulata*, *Frankenia webbii*, *Haloxylon articulatum*, *Launaea lanata*, *Limonium album*, *Teucrium gnaphalodes*, *Sideritis pusilla* ssp. *flavovirens*, and an exceptional number of endemics, including *Coris hispanica*, *Euzomodendron bourgaeum*, *Herniaria fontanesii* ssp. *almeriana*, *Limonium insignis*, *Salsola papillosa*, *Santolina viscosa*, *Sideritis pusilla* ssp. *pusilla*, *S. pusilla* ssp. *osteoxyla*, *Teucrium eriocephalum*, *T. almeriense*.

32.25721

Limonium-Anabasis arid garrigues*Limonio-Anabasetum articulatae p.*

Formations rich in succulent plants of argillous and stony soils of Murcia and Almeria, with *Anabasis articulata* and *Limonium insignis*.

32.25722

Cabo de Gata arid garrigue*Limonio-Anabasetum articulatae charidemetosum*

Formations of Cabo de Gata (*Charidemum Promontorium*) with *Teucrium charidemi*, *Caralluma europaea* var. *confusa*, *Lapiedra martinezii*, *Anthirrhinum charidemi*, *Dianthus charidemii*, *Sideritis pusilla* ssp. *osteoxyla*, taxa for the most part endemic to the promontory.

32.25723

Tabernas arid garrigues*Anabaso-Euzomodendretum*Species-rich formations of the arid depression between the Sierras de Gador, Filabres and Alhamilla, with *Euzomodendron bourgaeum*, *Coris hispanica*, *Koelpinia linearis*.

32.25724

Coastal Almerian arid garrigues*Teucrio-Sideritetum pusillae*Coastal Murcio-Almerian formations with *Teucrium gnaphalodes*, *T. baltasari*, *Sideritis pusilla* ssp. *pusilla* and ssp. *flavovirens*, *Launaea nudicaulis*.

32.26

THERMO-MEDITERRANEAN BROOM FIELDS (RETAMARES)Formations dominated by retamas (*Lygos* spp.) or by large, non-spiny thermo-Mediterranean brooms of genera *Cytisus* and *Genista*.(Delvosalle and Duvigneaud, 1962; Brullo *et al.*, 1977; Lopez Gonzalez, 1982; Pignatti, 1982; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987)

32.261

Iberian retama brush*Genisto scorpii-Retametum*, *Cytiso multiflorae-Retametum*, *Cytiso scoparii-Retametum*, *Retamo-Adenocarpetum decorticantis*Thermo-, meso- and, locally, lower supra-Mediterranean *Lygos sphaerocarpa* formations of the Ebro basin, the Meseta, the Iberian Range, the Central Cordillera, Extremadura and eastern Portugal, the Baetic and sub-Baetic mountains, in which the retama either forms pure, often very open, stands or associates with various brooms such as *Cytisus multiflorus*, *C. scoparius* or *Adenocarpus decorticans*.

32.262

Lusitanian retama brush*Lygos monosperma* formations of coastal south-western Andalusia and southern Portugal.

32.263

Genista speciosa* broom fieldsPhlomidetalia purpureae: Ulici-Genistetum speciosae*Tall, open formations dominated by, or rich in, the endemic *Genista cinerea* spp. *speciosa*, with *Phlomis purpurea* ssp. *purpurea*, *Ulex parviflorus* ssp. *willkommii*, *Cronanthus biflorus*, *Ptilostemon hispanicus*, and, sometimes, *Lavandula lanata*, *Catananche coerulea*, *Teucrium polium*, *Salvia candelabrum* or *Satureja graeca*, of the lower meso-Mediterranean slopes of hills facing the Guadalquivir depression of eastern Andalusia.

32.264

Genista valentina* broom fieldsGenisto-Phlomidion almeriensis: Genisto valentinae-Calicotometum intermediae, Retamo sphaerocarphae-Genistetum valentinae*Formations of the arid Iberian South-east dominated by the endemic *Genista valentina*, accompanied by *Lygos sphaerocarpa* or, in the Sierra de Cartagena area, *Calicotome infesta* spp. *intermedia*.

32.265

Genista retamoides* broom fieldsGenisto-Phlomidion almeriensis p.; Phlomidetalia purpureae: Lavandulo dentatae-Genistetum retamoidis*Formations of the coast of the Sea of Alboran and of the arid Iberian South-east dominated by the endemic *Genista spartioides* ssp. *retamoides*.

32.266

Genista haenseleri* broom fieldsPhlomidetalia purpureae: Corodothymo capitati-Genistetum haenseleri*Open formations of abrupt, hot, sunny slopes of the Sierras de Ojen, Mijas (Unidad Blanca), southern Andalusia characterized by the presence of the striking, tall endemic broom *Genista haenseleri*, associated with *Phlomis purpurea* ssp. *purpurea*, *Ulex parviflorus* ssp. *willkommii*, *Genista umbellata* ssp. *equisetiformis*, *Thymus capitatus*, *Teucrium fruticans*.

- 32.267** *Genista ramosissima* broom fields
Genisto-Phlomidion almeriensis: *Thymelaeo-Genistetum ramosissimae*
 Formations characterized by the presence of the usually dominant, non-spiny broom *Genista ramosissima* of south-eastern Spain and North Africa, limited to the hills of the Rio Aguas basin and the Macizo de Bedar; *Thymelaea tartonraira*, *Phlomis purpurea* ssp. *almeriensis* may be very abundant.
- 32.268** Sicilian retama brush
 Retama fields formed on maritime sands of southern Sicily by *Lygos raetam* ssp. *gussonei*, European and Sicilian endemic related to *Lygos raetam* of the southern Palaearctic sub-desert belt.
- 32.269** Eolian broom fields
 Thermo-Mediterranean formations of volcanic rocks and sands of Stromboli and Vulcano dominated by the very tall Eolian endemic broom *Cytisus aeolicus*, with the Tyrrhenian insular endemic *Centaurea aeolica*.
- 32.26A** *Genista ephedroides* broom fields
 Formations dominated by the Tyrrhenian endemic *Genista ephedroides*, restricted to a few localities on western and northern Sardinian headlands, the north coast of Sicily, the Eolian and Ponsian islands and the Cilento coast (Campania).
- 32.26B** Ibiza broom fields
Cytiso fontanesii-Genistetum dorycnifoliae
 Formations characterized by the remarkable, tall Ibiza endemic *Genista dorycnifolia*, accompanied by the eastern Iberian *Chronanthus biflorus* (*Cytisus fontanesii*).
- 32.27** MEDITERRANEAN GORSE-HEATHS
Ulici argentei-Cistion ladaniferi p. i.a.
 Western Mediterranean formations, for the most part limited to the lower meso-Mediterranean and thermo-Mediterranean zones of the western Iberian peninsula, dominated by gorse (*Ulex* spp., *Stauracanthus* spp.) of thermo-Mediterranean affinities, or by the spiny, globular broom *Genista hirsuta*, accompanied by a cortège of plants characteristic of the meso- and thermo-Mediterranean cistus maquis (32.331), thermo-Mediterranean brushes (32.21) or, occasionally, meso-Mediterranean garrigues (32.4). Other thermo-Mediterranean gorse formations will be found among the more specialized extreme southern Iberian endemic communities listed under 32.25, 32.28, 32.29, 32.2A, 32.2B and 32.2C (Braun-Blanquet, Pinto da Silva and Rozeira, 1956, 1964; Rivas Goday and Rivas-Martinez, 1968; Rivas-Martinez, 1979)
- 32.271** Monchique *Ulex argenteus* gorse-heaths
Cisto ladaniferae-Ulicetum argentei
Ulex argenteus ssp. *argenteus*-dominated or -rich formations of low slopes of the Sierra da Monchique and neighbouring areas of Algarve and south-west Alentejo, usually with *Cistus ladanifer*. The gorse is endemic to the area; the communities inhabited by its two equally restricted relatives, *U. argenteus* ssp. *subsericeus* and *U. argenteus* ssp. *erinaceus* are listed under 32.2A3, 32.2B4 and 32.2563.
- 32.272** Lusitanian *Ulex densus* gorse-heaths
 Cushion-heaths of *Ulex densus* formed in substitution stages of the *Melico-Cocciferetum* on dry, calcareous coastal hills of the Tejo and Estremadura regions of central-western Portugal; the gorse is endemic to the area.
- 32.273** Morena *Ulex eriocladius* gorse heaths
Ulici eriocladi-Cistetum ladaniferae p., *Ulici eriocladi-Ericetum umbellatae* p., *Helianthemo-Saturejetum micranthae* p.
 Formations of the western Sierra Morena (Sierra de Aracena, Badajoz region, south-eastern Portugal) dominated by *Ulex eriocladius*, developed mostly in the meso-Mediterranean zone and locally in contact with *Erica umbellata* heaths; the gorse is endemic to the area.

- 32.274** **Franco-Iberian *Ulex parviflorus* gorse-heaths**
Ulex parviflorus ssp. *parviflorus*-dominated formations of central-western Portugal, southern and eastern Spain and southern France, locally distributed on calcareous or siliceous substrates of the thermo-Mediterranean and lower meso-Mediterranean zones, occasionally ascending to higher elevations. Communities including the related *Ulex parviflorus* ssp. *willkommii*, *U. baeticus* and *U. australis* are listed under 32.28, 32.2A and 32.2C, clearly meso-Mediterranean formations under 32.4H.
- 32.275** **Alentejo *Stauracanthus* gorse-heaths**
Stauracanthus genistoides ssp. *spectabilis*-dominated formations of the coast of Alentejo; the gorse has a very restricted distribution: outside of its Alentejo stations it occurs only in Morocco.
- 32.276** **Luso-Extremaduran *Genista hirsuta* gorse-heaths**
Genista hirsuti-Cistetum ladaniferae
Genista hirsuta-dominated formations of thermo- and meso-Mediterranean Luso-Extremaduran regions, widespread and physiognomically striking by the hemispherical port of the shrub, similar to that of many gorses and of phrygana species.
- 32.28** **IBERIAN THERMO-MEDITERRANEAN GARRIGUES**
Phlomidetalia purpureae
 Mostly calcicolous, open garrigues of the extreme south of the Iberian peninsula characterized by the abundance of *Phlomis purpurea* ssp. *purpurea*, *Ulex parviflorus* ssp. *willkommii*, *Genista umbellata* ssp. *equisetiformis*, *Thymus eryanthus*, *Thymus capitatus*, *Micromeria graeca*, *Teucrium polium*, *Calicotome villosa*, *Asperula hirsuta*.
- 32.281** **Baetic garrigues**
Saturejo-Coridothymion p.
 Varied calcicolous formations of Baetic hills; they may be dominated by any of a number of characteristic species of the class, and in particular by *Thymus capitatus*, *Teucrium polium*, *Helianthemum hirtum*, *Phlomis purpurea* ssp. *purpurea* or *Ulex parviflorus* ssp. *willkommii*; they occur locally throughout the entire Baetic area. A few communities, remarkable for the dominance of less widespread, often endemic, usually striking species, and, in many cases, for their adaptation to non-calcareous soils or to outlying areas, have been listed separately.
- 32.282** **Ronda *Ononis speciosa* garrigues**
Saturejo-Coridothymion p.: Bupleuro-Ononidetum speciosae
 Spectacular formations dominated by the endemic shrub *Ononis speciosa* with *Bupleurum gibraltarium*, *Thymus capitatus*, *Micromeria graeca*, *Phlomis purpurea* ssp. *purpurea*, *Ulex parviflorus* ssp. *willkommii*, *Genista umbellata* ssp. *equisetiformis*, *Calicotome villosa*, *Satureja obovata*, *Ptilostemon hispanicus*, locally distributed in calcareous areas of the Serrania de Ronda and satellite ranges.
- 32.283** **Guadalquivir *Genista equisetiformis* garrigues**
Saturejo-Coridothymion p.: Genisto-Cytisetum fontanesii
 Sub-Baetic formations of calcareous hills lining the Guadalquivir depression of Andalusia with the large cushion-forming *Genista umbellata* ssp. *equisetiformis* and *Chronanthus biflorus* accompanied by *Thymus capitatus*, *T. eryanthus* and *Ulex parviflorus* ssp. *willkommii*.
- 32.284** **Alboran *Genista equisetiformis* garrigues**
Saturejo-Coridothymion p.: Lavandulo stoechidi-Genistetum equisetiformis
 Acidophilous formations limited to rare enclaves of the slopes above the Sea of Alboran, with *Genista umbellata* ssp. *equisetiformis*, *Ulex parviflorus* ssp. *willkommii*, *Calicotome villosa*, *Lavandula stoechas* ssp. *stoechas*, *Adenocarpus grandiflorus*.
- 32.285** **Andalusian magnesium garrigues**
Stachelino-Ulicion baetici
Ulex baeticus-dominated or -rich formations of ultrabasic dolomites, serpentines and peridotites of the Serrania de Ronda and its peripheral ranges.

32.2851

Ronda dolomite garrigues*Ulici-Halimietum viscosi* = *Cisto clusii-Ulicetum baetici*

Dolomitic formations with *Ulex baeticus*, *Phlomis purpurea* ssp. *purpurea*, *Cistus clusii*, *Halimium viscosum*, *Euphorbia baetica*, *Linaria clementei* and, sometimes, *Genista haenseleri* of the Serrania de Ronda, Sierra Blanquilla, de Ojen and surrounding areas.

32.2852

Ronda serpentine and peridotite garrigues*Asperulo-Staehelinetum baeticae*

Formations of serpentines and peridotites of the Sierra de Carratraca and a few nearby stations of the Serrania de Ronda with *Ulex baeticus* (or sometimes *Genista umbellata* ssp. *equisetiformis*), *Galium boissierianum*, *Staehelina baetica*, *Centaurea carratracensis*.

32.2853

Bermeja *Ulex* garrigues*Halimio atriplicifolii-Digitalietum laciniatae* p.

Formations of the Sierra Bermeja dominated by *Ulex baeticus*.

32.286

Bermeja *Halimium* garrigues*Halimio atriplicifolii-Digitalietum laciniatae* p.

Tall *Halimium atriplicifolium* formations of the peridotites of the Sierra Bermeja with *Phlomis purpurea* ssp. *purpurea*, *Genista lanuginosa*, *G. hirsuta*, *Lavandula stoechas*.

32.29

GIBRALTAR *STAURACANTHUS* GORSE-HEATHS*Stauracanthion boivinii*

Highly distinctive formations, dominated by the endemic gorse *Stauracanthus boivinii*, limited to a few locations with siliceous, oligotrophic soils and high precipitation of the thermo- and lower meso-Mediterranean zone of the vicinity of the Straits of Gibraltar.

(Braun-Blanquet, Pinto da Silva and Rozeira, 1964; Rivas-Martinez, 1979; Asensi Marfil and Diez Garretas, 1987)

32.291

Aljibe *Stauracanthus* gorse-heaths

Formations of the Sierras del Aljibe, Blanquilla, del Niño and de Ojen with the Gibraltar endemics *Genista tridens* and *Bupleurum foliosum*.

32.292

Algarve *Stauracanthus* gorse-heaths

Very local formation of the coast of the Algarve, with *Genista triacanthos*, *Erica umbellata*, *Calluna vulgaris* and *Tuberaria major*.

32.2A

SOUTH-WESTERN IBERIAN XERO-PSAMMITIC BRUSHES*Stauracantho genistoidis-Halimion halimifolii*

Open brushes formed by *Stauracanthus genistoides* ssp. *genistoides*, *Halimium halimifolium*, *H. commutatum* and *Cistus bourgaeanus*, highly adapted to the extreme aridity and oligotrophy of fossil dunes and other deep, fixed sands with very low water table of the coastal areas of the south-western Iberian peninsula.

(Braun-Blanquet, Pinto da Silva and Rozeira, 1964; Rivas-Martinez, 1979; Rivas-Martinez et al., 1980; Asensi Marfil and Diez Garretas, 1987)

32.2A1

Southern Andalusian *monte blanco**Halimio halimifolii-Stauracanthetum genistoidis*

Formations of the coasts of the Gulf of Cadiz, between the estuaries of the Rios Guadalete, Guadalquivir and Tinto, particularly characteristic of the Coto Doñana (*monte blanco*), in which the characteristic shrubs listed above are accompanied by, in particular, *Lavandula stoechas* ssp. *lusitanica*, *Armeria velutina* and *Thymus tomentosus* and, in the wide transition zone with the *monte negro*, by *Ulex australis* and *Erica scoparia*.

32.2A2

Guadalquivir xero-psammitic brushes*Halimio commutati-Cistetum bourgaeani*

Somewhat transitional formations of inland sands of the Guadalquivir valley with *Halimium viscosum*, *Genista hirsuta*, *Cistus crispus* and elements of thermo-Mediterranean brushes.

- 32.2A3** **Algarve xero-psammitic brushes**
Ulici subsericei-Cistetum bourgaeani
 Very local formation of the Algarve coast with *Lavandula stoechas* ssp. *lusitanica*, *Armeria macrophylla* and the extremely narrow endemic *Ulex argenteus* ssp. *subsericeus*.
- 32.2A4** **Lusitanian xero-psammitic brushes**
Helichryso angustifolii-Stauracanthetum genistoides
 Formations of sands of the Atlantic coast of Portugal with *Helichrysum italicum* and *Corema album*.
- 32.2B** **CABO DE SÃO VICENTE BRUSHES**
Junipero-Cistetum palhinhae, *Asparago-Rhamnetum oleoidis juniperetosum lyciae* i.a.
 Low brush and garrigue formations of the dolomitic tableland, karsts, sands and terra-rosas of the vicinity of Cabo de São Vicente, with dwarf *Juniperus phoenicea* ssp. *lycia*, *Cistus palhinhae*, *Ulex argenteus* ssp. *erinaceus*, rich in endemics.
 (Braun-Blanquet, Pinto da Silva and Rozeira, 1964; Polunin and Smythies, 1973; Rivas-Martinez, 1974)
- 32.2B1** **Cabo de São Vicente *Teucrium-Armeria* garrigue**
 Very low, open garrigue of *Teucrium polium* ssp. *vincentinum*, *Armeria pungens*, *Helichrysum italicum*, *Asteriscus maritimus* of the windswept, karstic tableland of Cabo de São Vicente.
- 32.2B2** **Cabo de São Vicente juniper brush**
 Dwarf, prostrate *Juniperus phoenicea* ssp. *lycia* brush with *Cistus palhinhae*, *Biscutella vincentina*, *Teucrium polium* ssp. *vincentinum*, *Antirrhinum majus* ssp. *cirrhigerum*, *Armeria pungens*, *Iberis procumbens*, *Cerinthe major* ssp. *gymnandra*.
- 32.2B3** **Cabo de São Vicente *Cistus palhinhae* fields**
Cistus fields formed by the spectacular, large-flowered, lustrous-leaved, low *Cistus palhinhae*, endemic to these communities.
- 32.2B4** **Cabo de São Vicente *Ulex* garrigue**
 Formations of *Ulex argenteus* ssp. *erinaceus*, restricted endemic found only in this community and that of Cabo de Gata (32.2563), with *Cistus crispus*, *C. palhinhae*, *C. salvifolius*, *Armeria pungens*, *Teucrium polium* ssp. *vincentinum*, *Thymus camphoratus*.
- 32.2B5** **Cabo de São Vicente *Genista-Thymus* garrigue**
 Phrygana-like formations of *Genista hirsuta* and *Thymus*, with *Cistus salvifolia*, *Phlomis purpurea*, *Ophrys ciliata*, *Serapias strictiflora*.
- 32.2C** **THERMO-MEDITERRANEAN HEATHS**
Ericion umbellatae: Erico scopariae-Ulicetum australis; Genistion micrantho-anglicae: Erico ciliaris-Ulicetum lusitanici
 Closed formations of heather, gorse and halimium constituting the extensive *monte negro* of the Coto Doñana; alternating with the xerophile *monte blanco* (32.2A1), they occupy deep, sandy, oligotrophic soils with a water table close to the surface; their composition includes an admixture of thermo-Mediterranean and Atlantic heath species together with local endemics. Particularly characteristic in the Guadalquivir area, they are locally represented north to the Sado-Tago river area of coastal Portugal.
 (Rivas-Martinez, 1979; Rivas-Martinez *et al.*, 1980; Asensi Marfil and Diez Garretas, 1987)
- 32.2C1** **Dry Andalusian *monte negro***
Erico scopariae-Ulicetum australis
 Formations of higher ground with the endemic gorse *Ulex australis*, *Erica scoparia*, *Calluna vulgaris*, *Genista triacanthos*, *Erica umbellata*, *Halimium halimifolium*, *Cistus salvifolius*.
- 32.2C2** **Humid Andalusian *monte negro***
Erico ciliaris-Ulicetum lusitanici
 Formations of semi-peaty edges of fresh-water lagoons and depressions where the winter and spring water table reaches the surface, with *Ulex minor* var. *lusitanicus*, *Erica ciliaris*, *E. scoparia*, *Calluna vulgaris*, *Genista anglica*, *Molinia caerulea*, *Pteridium aquilinum*, *Cistus salvifolius*.

- 32.3** **MESO-MEDITERRANEAN SILICICOLOUS MAQUIS**
Cisto-Lavanduletea, Pistacio-Rhamnetalia alaterni; Ericenion arboreae
 Shrubby formations, often tall, on mostly siliceous soils of the meso-Mediterranean zone of the Iberian peninsula, France, Italy and the large western Mediterranean islands, degradation stages of evergreen oak forests. Very similar formations of the thermo-Mediterranean zone and of the eastern Mediterranean are included.
 (Duvigneaud, 1953; Rivas-Martinez, 1974, 1979; Quézel, 1981)
- 32.31** **HIGH MAQUIS**
 Highest formations, with a tall stratum of *Erica arborea*, *Arbutus unedo* and *Quercus spp.* but few or no emergent oaks, in contrast to 32.1.
 (Rechinger, 1951; Braun-Blanquet, Pinto da Silva and Rozeira, 1964; Fenaroli, 1970; Horvat *et al.*, 1974; Quézel, 1981; Gamisans, 1985; Polunin and Walters, 1985; Chiappini, 1985a, b; Veri and Pacioni, 1985; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987)
- 32.311** **Western Mediterranean high maquis**
Ericenion arboreae; Phillyreo angustifoliae-Arbutetum unedi, Phillyreo rodriguezii-Arbutetum unedi, Erico arboreae-Arbutetum unedi i.a.
 Formations with *Erica arborea*, *Arbutus unedo*, *Quercus ilex*, *Phillyrea angustifolia*, *P. media*, *Viburnum tinus*, *Rhamnus alaternus*, *Juniperus oxycedrus*, *Fraxinus ornus*.
- 32.312** **Luso-Extremaduran high maquis**
Ericenion umbellatae; Cisto psilosepali-Ericetum lusitanicae i.a.
 Formations with *Erica lusitanica*, *E. arborea*, *E. scoparia*, *Cistus psilosepalus*, *C. populifolius* developed in particular in the vicinity of lauriphyllus formations of ravines and water-course edges of the Montes de Toledo.
- 32.313** **Eastern Mediterranean high maquis**
Orno-Quercetum ilicis p.; Andrachno-Quercetum ilicis p.
 Formations of Greece and the Balkan peninsula, with *Erica arborea*, *Arbutus unedo*, *A. andrachne*, *Pistacia terebinthus*, *Phillyrea latifolia*, *Juniperus oxycedrus*, *Quercus coccifera*, *Q. ilex*.
- 32.32** **LOW ERICACEOUS MAQUIS**
Erico scopariae-Lavandulo stoechidis, Ampelodesmo-Ericetum scopariae, Erico scopariae-Cistetum populifolii i.a.
 Lower (usually less than one metre) maquis rich in *Calluna vulgaris*, *Erica scoparia*, *E. cinerea* or sometimes low *E. arborea*, often accompanied by *Cistus spp.*, *Lavandula stoechas* and various brooms.
 (Braun-Blanquet, Pinto da Silva and Rozeira, 1964; Braun-Blanquet, 1974; Lavagne and Moutte, 1977; Rivas-Martinez, 1979; Quézel, 1981; Gamisans, 1985; Polunin and Walters, 1985; Peinado Lorca and Rivas-Martinez, 1987)
- 32.33** **TALL CISTUS MAQUIS**
 Meso-, thermo- and occasionally supra-Mediterranean formations of Iberia and southern France, in which the tall, large-flowered *Cistus ladanifer* is prominent. Included are more or less dense, homogeneous fields of *C. ladanifer*, which can be identified by addition of digit 1 in the fourth decimal place of any of the subdivisions below, and more varied formations dominated by tall clumps of *C. ladanifer*, which can be identified by addition of digit 2 in the fourth decimal place of these subdivisions.
 (Loisel, 1971; Rivas-Martinez, 1979; Quézel, 1981; Peinado Lorca and Rivas-Martinez, 1987)
- 32.331** **South-western Iberian tall cistus maquis**
Ulici argentei-Cistion ladaniferi p.
 Abundant formations rich in gorses, spiny brooms or, occasionally, heathers, developed on usually shallow soils in the thermo- and meso-Mediterranean zones of the south-west of the Iberian peninsula.

- 32.332** **Central Iberian tall cistus maquis**
Cistion laurifolii p.
 Formations with brooms, heathers and lavenders of siliceous soils, generally rather eroded and oligotrophic of the meso- and, locally, supra-Mediterranean zones of the Meseta, the Iberian Range and its satellites, the eastern Cordillera Central and southern Galicia and Leon.
- 32.333** **Baetic tall cistus maquis**
Phlomidetalia purpureae p. i.a.
 Formations of southern Andalusia, developed in siliceous or peridotite ranges in association with local Baetic floras.
- 32.334** **Tyrrhenian tall cistus maquis**
Calicotomo-Cistion ladaniferi p.
 Localized meso- and thermo-Mediterranean formations of siliceous or decalcified soils and subhumid climates of the Tyrrhenian hinterland (crystalline Provence, Valencia), often with heath elements.
- 32.34** **LOW CISTUS MAQUIS**
 Western Mediterranean formations of small or medium *Cistus* spp., most characteristic of the siliceous soils of the meso-Mediterranean zone, but also widely occurring in the thermo-Mediterranean zone and in the siliceous supra-Mediterranean zone. Formations of mostly calciphile *Cistus* species (e.g. *C. albidus*, *C. clusii*) and of indifferent species accompanied by strongly calciphile floras are listed under 32.4; formations of entirely thermo-Mediterranean species (e.g. *Cistus bourgaeanus*, *C. palhinhae*, *C. heterophyllus*) and of widespread species associated with co-dominant thermo-Mediterranean species have been listed under 32.2. Included here are all other formations; homogeneous, more or less dense cistus fields can be identified by addition of digit 1 in the fourth decimal place of the subdivisions below, more varied maquis of which the relevant cistus species is an essential element, by addition of digit 2 in the fourth decimal place of these subdivisions. (Loisel, 1971; Braun-Blanquet, 1974; Girerd, 1978; Rivas-Martinez, 1979; Quézel, 1981; Lopez Gonzalez, 1982; Gamisans, 1985; Polunin and Walters, 1985; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987)
- 32.341** ***Cistus monspeliensis* maquis**
 Formations dominated by *Cistus monspeliensis*, widespread in the Mediterranean region; homogeneous fields form in particular after fires.
- 32.342** ***Cistus salvifolius* maquis**
 Formations dominated by *Cistus salvifolius*, equally widespread, though less often dominant, in the entire Mediterranean region.
- 32.343** ***Cistus populifolius* maquis**
 Formations dominated by *Cistus populifolius*, often taller, mainly of cooler, moister, shadier, siliceous or serpentine stations of the meso-Mediterranean zone of the southern half of the Iberian peninsula, in particular of Portugal, Extremadura, the Sierra Morena, the Montes de Toledo, the Iberian Range system, the mountains of Andalusia Occidental, entering in several areas into the supra- or thermo-Mediterranean zones and extending north locally to northern Iberia and Languedoc.
- 32.344** ***Cistus laurifolius* maquis**
Cistion laurifolii p. i.a.
 Formations dominated by *Cistus laurifolius*, often also of medium height, widespread on siliceous or decalcified soils in meso- and supra-Mediterranean Iberia, particularly in the *Quercus pyrenaica* realm, extending to the montane zone of the Pyrenees, and locally to sub-Mediterranean areas of the southern Central Massif and the south-western Alps.
- 32.345** ***Cistus psilosepalus* maquis**
Ericenion umbellatae: Halimio ocymoidis-Cistetum psilosepali p.
 Formations dominated by *Cistus psilosepalus* of moist, lime-free soils of the western half of the Iberian peninsula, usually associated with southern heath elements, within the Atlantic influence, frequently located in depressions and gullies.

- 32.346** *Cistus crispus* maquis
Formations of southern and eastern Iberia, southern France and western Sicily dominated by *Cistus crispus*.
- 32.347** *Cistus incanus* maquis
Cistus incanus (including ssp. *corsicus* and ssp. *creticus*) formations of the Balearics, Corsica, Sardinia, Sicily and peninsular Italy.
- 32.348** *Cistus albidus* maquis
Silicolous formations with *Cistus albidus*. Most *C. albidus* formations have a pronounced garrigue character and should be listed under 32.4; however, some may be accompanied by a cortège so typical of silicolous maquis that they are better retained here.
- 32.35** **LOW CISTUS-LAVANDULA STOECHAS MAQUIS**
Usually varied west-Mediterranean maquis rich in *Lavandula stoechas*, accompanied by *Cistus* spp., *Erica* spp., brooms (*Genista* spp., *Cytisus* spp. i.a.). The subspecies of *L. stoechas* can be used to characterize regional groups of communities otherwise differing by the assembly of accompanying species. In all cases, pure or almost pure *Lavandula* formations can be identified by addition of digit 1 in the fourth decimal place, digit 2 denoting the varied formations.
(Loisel, 1971; Rivas-Martinez, 1979; Gamisans, 1985; Chiappini, 1985a, b)
- 32.351** **Central Mediterranean lavender maquis**
Calicotomo-Cistion ladaniferi p.
Formations with *Lavandula stoechas* ssp. *stoechas* of north-eastern Iberia, France, Italy and the western Mediterranean islands.
- 32.352** **Central Iberian lavender maquis**
Cistion laurifolii p.
Formations of central Iberia with *Lavandula stoechas* ssp. *pedemontana*.
- 32.353** **Western Iberian lavender maquis**
Ulici argentei-Cistion ladaniferi p.
Formations of western Iberia with *Lavandula stoechas* ssp. *luisieri* or *L. stoechas* ssp. *sampaiana*.
- 32.36** **LOW SPARSE MAQUIS**
Sparse, low silicolous formations of *Helichrysum* spp., *Cistus* spp., *Erica* spp. physiognomically similar to calcicolous garrigues.
- 32.37** **BROOM-DOMINATED MAQUIS**
Low, west-Mediterranean maquis dominated by leguminous shrubs (*Cytisus*, *Teline*, *Genista*, *Adenocarpus*, *Calicotome spinosa*).
(Lavagne and Moutte, 1977; Rivas-Martinez, 1979; Lopez Gonzalez, 1982)
- 32.371** *Genista hystrix* maquis
Formations, widespread in north-western areas of the Iberian peninsula, with *Genista hystrix*.
- 32.372** **Mixed brooms maquis**
Leguminous formations, other than those dominated by *Genista hystrix*, with numerous local variants.
- 32.4** **WESTERN MESO-MEDITERRANEAN CALCICOLOUS GARRIGUES**
Rosmarinetalia: Rosmarino-Ericion, Aphyllanthion p.
Shrubby formations, often low, on mostly calcareous soils of the meso-Mediterranean zone of the Iberian peninsula, France, Italy and the large western Mediterranean islands. Included here are those formations that reach their optimal development within the meso-Mediterranean zone although they often enter the thermo- or supra-Mediterranean levels. The subdivisions proposed are based on the physiognomically most significant dominants; co-dominance can be indicated by use of multiple codes.

(Hübl *et al.*, 1958; Barkman, 1958; Lausi and Poldini, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969, 1970; Fenaroli, 1970; Lapraz, 1970, 1973a, b, 1976, 1984; Costa, 1974; Lavagne and Moutte, 1977; Ozenda *et al.*, 1979; Izco, 1979; Reissigl *et al.*, 1980; Quézel, 1981; Ozenda, 1981; Pignatti, 1982; Devaux *et al.*, 1983; Ozenda, 1985; Polunin and Walters, 1985; Dominicus *et al.*, 1985; Chiappini, 1985 a, b; Veri and Pacioni, 1985; Gamisans, 1985; Fenaroli, 1985; Fernandez Gonzalez *et al.*, 1986; Peinado Lorca and Rivas-Martinez, 1987; Camarda and Valsecchi, 1990)

- 32.41** KERMES OAK GARRIGUES
Formations, usually relatively closed and tall, dominated by *Quercus coccifera* with little or no *Pistacia lentiscus* or other thermo-Mediterranean shrubs, very widespread in the meso-Mediterranean zone of the Iberian peninsula and southern France.
- 32.42** ROSEMARY GARRIGUES
Formations, usually relatively tall, dominated by *Rosmarinus officinalis*.
- 32.43** CISTUS GARRIGUES
Formations, mostly meso-Mediterranean, but often also thermo- or supra-Mediterranean, dominated by the low, calciphilous *Cistus albidus* or *C. clusii*, or occasionally by indifferent species, usually accompanied by a more varied flora than that of the silicicolous cistus maquis, though sometimes capable of forming dense cistus fields. These can be identified by use of digit 1 in the fourth decimal place, digit 2 being reserved for more varied formations.
- 32.431** *Cistus albidus* garrigues
Formations dominated by *Cistus albidus*, widespread in Iberia, France, the Balearics and Liguria, with local stations in other parts of northern Italy, and in Corsica and Sardinia.
- 32.432** *Cistus clusii* garrigues
Formations of *Cistus clusii*, mostly widespread in rather warm, dry areas of the southern and eastern parts of the Iberian peninsula and in the Balearics, with a very limited representation on Monte Gargano, in Calabria, and in Sicily.
- 32.433** *C. monspeliensis*, *C. salvifolius*, *C. incanus* garrigues
Garrigues with *Cistus monspeliensis*, *C. salvifolius* or *C. incanus*. Many formations of these species are maquis or maquis-like communities, best listed under 32.3. Some, however, with a pronounced calciphile character and a garrigue structure, can be listed here.
- 32.44** SPURGE GARRIGUES
Formations dominated by bushy or robust perennial *Euphorbia* species.
- 32.441** Spiny spurge garrigues
Euphorbia spinosa cushion garrigues of very dry soils of the meso- or thermo-Mediterranean zones of southern France, Corsica, Sardinia, Sicily and peninsular Italy.
- 32.442** Unarmed spurge garrigues
Formations with other, often woody-stocked, clump-forming *Euphorbia* species (e.g. *E. fragifera*, *E. characias*).
- 32.45** PROSTRATE JUNIPER GARRIGUES
Meso-Mediterranean garrigues dominated by *Juniperus oxycedrus* or other low, shrubby junipers.
- 32.46** LAVENDER GARRIGUES
Meso-, or sometimes thermo-, Mediterranean garrigues rich in calciphile *Lavandula latifolia* or, occasionally, *L. angustifolia*; almost pure fields of *L. latifolia* may form, in particular, as a facies of calcareous grasslands.
- 32.461** Lavender stands
Homogeneous, or almost homogeneous, *L. latifolia* stands invading grasslands.
- 32.462** Lavender mixed garrigues
Other, more varied, lavender formations.

- 32.47** **THYME, SAGE, GERMANDER AND OTHER LABIATE GARRIGUES**
 Characteristically very low, open garrigues of which the main components are labiate shrubs of *Thymus* (e.g. *T. piperella*, *T. funkii*, *T. zygis*, *T. vulgaris*, *T. capitatus*, *T. mastigophorus*), *Salvia* (e.g. *S. lavandulifolia*, *S. officinalis*), *Teucrium* (e.g. *T. polium*, *T. marum*, *T. subspinosum*, *T. aragonense*, *T. gnaphalodes*, *T. chamaedrys*, *T. montanum*), *Sideritis* (e.g. *S. scordioides*, *S. incana*), *Micromeria* (e.g. *M. fruticosa*, *M. graeca*, *M. juliana*), *Satureja* (e.g. *S. montana*), *Stachys* (e.g. *S. glutinosa*), *Nepeta* (e.g. *N. foliosa*) or other genera (except *Lavandula* and *Rosmarinus*).
- 32.48** **GENISTA GARRIGUES**
 Formations characterized by the abundance of small, spiny brooms such as *Genista scorpius*, *G. hispanica*, *G. corsica*, *G. lucida*.
- 32.481** *Genista scorpius*, *G. hispanica* garrigues
 Formations of southern France and Spain; some Meseta formations are listed under 31.7 (hedgehog-heaths) or 32.6.
- 32.482** *Genista corsica* garrigues
 Formations of Corsica and Sardinia; many formations are hedgehog-heaths (32.7).
- 32.483** *Genista lucida* garrigues
 Formations of Mallorca.
- 32.49** **CALICOTOME GARRIGUES**
 Meso-Mediterranean formations dominated by *Calicotome spinosa*.
- 32.4A** **COMPOSITE GARRIGUES**
 Meso-Mediterranean garrigue formations dominated by members of various genera of the family Asteraceae.
- 32.4A1** *Helichrysum*, *Santolina*, *Phagnalon* garrigues
 Usually low, open garrigues formed by dwarf, shrubby composites, often with small grey or whitish leaves and showy yellow bloom, of genera *Helichrysum*, *Stachelina* (*S. dubia*), *Phagnalon* (*P. rupestre*), *Santolina*, *Scorzonera*.
- 32.4A2** *Artemisia* garrigues
 Formations dominated by the usually small-leaved and inconspicuously flowering species of genus *Artemisia*.
- 32.4A3** **Aromatic inula garrigues**
 Formations dominated by the invasive *Inula viscosa*.
- 32.4A4** **Medium-tall composite garrigues**
 Formations dominated by other large composites.
- 32.4B** **ERICA GARRIGUES**
 Meso-Mediterranean formations dominated by the calciphile heathers *Erica multiflora* or *E. manipuliflora*.
- 32.4C** **GLOBULARIA GARRIGUES**
 Formations dominated by *Globularia alypum*.
- 32.4D** **HELIANTHEMUM AND FUMANA GARRIGUES**
 Formations dominated by small or dwarf shrubs of the genera *Helianthemum* (e.g. *H. asperum*, *H. pilosum*, *H. oelandicum*, *H. marifolium*, *H. cinereum*, *H. lavandulifolium*, *H. nummularium*, *H. caput-felis*) or *Fumana* (e.g. *F. ericoides*, *F. laevipes*, *F. thymifolia*).
- 32.4E** **GROMWELL GARRIGUES**
 Formations dominated by *Lithodora* (*Lithospermum*) *fruticosa* of Spain and southern France.
- 32.4F** **THYMELAEA GARRIGUES**
 Meso-Mediterranean formations rich in shrubs of genus *Thymelaea* (e.g. *T. tinctoria*, *T. nitida*, *T. pubescens*).

- 32.4G** *BUPLEURUM* GARRIGUES
Often tall, sometimes very tall, dense formations dominated by *Bupleurum fruticosum*.
- 32.4H** GORSE GARRIGUES
Meso-Mediterranean formations dominated by *Ulex parviflorus*.
- 32.4I** RESTHARROW GARRIGUES
Formations dominated by *Ononis fruticosa* of Iberia.
- 32.4J** *ANTHYLLIS* GARRIGUES
Formations of *Anthyllis cytisoides*.
- 32.4K** *DICTAMNUS* GARRIGUES
Formations of *Dictamnus albus* (*D. hispanicus*) of stony terrains of eastern Spain.
- 32.5** **EASTERN GARRIGUES**
Micromerietea p.
Shrubby formations, often low, of the meso-, thermo- and occasionally supra-Mediterranean zones of Greece. Included here are all sclerophyllous formations, regardless of substrate, except those with conspicuous cushion structure (phryganas s.s., listed in 33, and hedgehog-heaths, listed in 31.7), those with abundant *Pistacia lentiscus*, *Myrtus communis* or other thermo-Mediterranean brush elements (*Phillyrea* spp., *Erica manipuliflora*, *Styrax officinalis*, *Genista fasselata*, *Euphorbia dendroides*, *Calicotome villosa*, *Sarcopoterium spinosum*) listed in 32.2 and high maquis with *Erica arborea* and *Arbutus* spp., listed in 32.3. The subdivisions proposed are based on the physiognomically most significant dominants; co-dominance can be indicated by use of multiple codes.
(Rechinger, 1951; Horvat *et al.*, 1974; Huxley and Taylor, 1977; Ozenda *et al.*, 1979; Reisigl *et al.*, 1980; Polunin, 1980; Quézel, 1981; Polunin and Walters, 1985)
- 32.51** EASTERN KERMES OAK GARRIGUES
Formations, usually relatively closed and tall, dominated by *Quercus coccifera* with little or no *Pistacia lentiscus* or other thermo-Mediterranean shrubs; kermes oak garrigues are by far the most widespread xerophyllous shrub formations in the eastern meso-Mediterranean zone. They are also well represented in the supra-Mediterranean and thermo-Mediterranean zones. Formations pertaining to the latter, when rich in other, more restrictively thermophile shrubs, have been listed as 32.2193.
- 32.52** EASTERN ROSEMARY GARRIGUES
Formations, usually relatively tall, dominated by *Rosmarinus officinalis*.
- 32.53** EASTERN *CISTUS* GARRIGUES
Formations dominated by, or rich in, *Cistus* species. Dense cistus fields can be identified by use of digit 1 in the fourth decimal place, digit 2 being reserved for more varied formations.
- 32.531** Eastern *Cistus incanus* garrigues
Low to medium-tall, large-flowered, pink *Cistus incanus* ssp. *incanus* or *C. incanus* ssp. *creticus* formations.
- 32.532** Eastern *Cistus parviflorus* garrigues
Usually low, small-flowered, deep pink *Cistus parviflorus* formations.
- 32.533** Eastern *Cistus salvifolius* garrigues
Low to medium-tall, white-flowered *Cistus salvifolius* formations.
- 32.534** Eastern *Cistus monspeliensis* garrigues
Usually medium-tall, white-flowered *Cistus monspeliensis* formations.
- 32.54** EASTERN SPURGE GARRIGUES
Formations dominated by bushy or robust perennial *Euphorbia* species.
- 32.541** Eastern spiny spurge garrigues
Formations rich in the spiny, cushion-forming *Euphorbia acanthothamos*.

- 32.542** Eastern unarmed spurge garrigues
Formations with other, often woody-stocked, clump-forming *Euphorbia* species (e.g. *E. characias* ssp. *wulfenii*, *E. rigida*).
- 32.55** EASTERN PROSTRATE JUNIPER GARRIGUES
Garrigues dominated by low, shrubby *Juniperus oxycedrus*, *J. communis* or *J. phoenicea*.
- 32.56** EASTERN LAVENDER GARRIGUES
Garrigues rich in *Lavandula stoechas* or, occasionally, *L. angustifolia*.
- 32.57** EASTERN SAGE AND OTHER LABIATES GARRIGUES
Garrigues of which the main components are labiate shrubs or robust perennials (except *Lavandula* and *Rosmarinus*).
- 32.571** Tree germander garrigues
Tall or very tall *Teucrium fruticans* formations.
- 32.572** Jerusalem sage garrigues
Fairly tall formations dominated by *Phlomis fruticosa*. Very degraded habitats occupied by almost monospecific fields of this species can be listed under 32.9.
- 32.573** Eastern *Salvia* and *Stachys* garrigues
Fairly tall formations dominated by shrubs or woody perennials of genera *Salvia* (e.g. *S. triloba*, *S. argentea*, *S. eichlerana*, *S. pomifera*), *Stachys* (e.g. *S. cretica*) or others.
- 32.574** Eastern dwarf labiate garrigues
Low, open garrigues formed by dwarf shrubs or perennials of genera *Thymus* (e.g. *T. capitatus*, *T. teucrioides*, *T. atticus*, *T. sibthorpii*, *T. striatus*, *T. comptus*), *Teucrium* (e.g. *T. polium*), *Sideritis* (e.g. *S. syriaca*, *S. clandestina*), *Micromeria* (e.g. *M. juliana*, *M. graeca*), *Phlomis* (e.g. *P. cretica*, *P. floccosa*, *P. lanata*) or others.
- 32.58** CHRIST'S THORN GARRIGUES
Garrigues dominated by *Paliurus spina-christi*.
- 32.59** EASTERN BROOM GARRIGUES
Formations characterized by the abundance of broom-like shrubs of genera *Genista*, *Chamaecytisus*, *Teline* or others.
- 32.5A** EBENUS BRUSHES
Formations of Crete dominated by *Ebenus cretica*.
- 32.5B** EASTERN *HELICHRYSUM* AND OTHER COMPOSITE GARRIGUES
Usually low, open garrigues formed by dwarf, shrubby composites of genera *Helichrysum*, *Phagnalon* (*P. graecum*), *Scorzonera*.
- 32.5C** EASTERN *ERICA* GARRIGUES
Meso-Mediterranean formations dominated by the heather *Erica manipuliiflora*.
- 32.5D** ANDRACHNE GARRIGUES
Garrigues characterized by richness in low bushes of *Arbutus andrachne*.
- 32.5E** EASTERN *GLOBULARIA* GARRIGUES
Formations dominated by *Globularia alypum*.
- 32.5F** EASTERN *HELIANTHEMUM* AND *FUMANA* GARRIGUES
Formations dominated by small or dwarf shrubs of the genera *Helianthemum* or *Fumana*.
- 32.5G** EASTERN *THYMELAEA* GARRIGUES
Formations rich in shrubs of genus *Thymelaea* (e.g. *T. tartonraira*).
- 32.5H** EASTERN *BUPLEURUM* GARRIGUES
Often tall, sometimes very tall, dense formations dominated by *Bupleurum fruticosum*.

- 32.6 SUPRA-MEDITERRANEAN GARRIGUES**
Ononidion striatae p., *Aphyllanthion* p., *Lavandulo-Genistion boissieri*
 Low shrub formations with pronounced Mediterranean affinities formed as a degradation stage of thermophile deciduous forests (*Quercion pubescentis*, *Ostryo-Carpinion*) or sometimes of *Quercus rotundifolia* forests in the supra-Mediterranean belt. Included here are only those formations that are characteristic of the supra-Mediterranean level; formations, particularly of the lower supra-Mediterranean, that are closely related to meso-Mediterranean communities have been included under 32.4 and 32.5.
 (Duvigneaud, 1953; Delvosalle and Duvigneaud, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969; Braun-Blanquet, 1971; Bonin, 1971; Guinochet and Vilmorin, 1973; Ozenda, 1975, 1981, 1985; Molinier and Martin, 1980; Becker *et al.*, 1982; Pignatti, 1982; Lopez Gonzalez, 1982; Dupias, 1985; Gamisans, 1985; Fernandez Gonzalez, 1986)
- 32.61 TRUE-LAVENDER GARRIGUES**
Lavandulo-Astragaletum
 Montane formations dominated by *Lavandula angustifolia* ('*L. vera*') with *Genista cinerea* ssp. *cinerea*, *Buxus sempervirens* (both sometimes co-dominant), *Astragalus purpureus*, *Onobrychis supina*, *Satureja montana*, *Catananche caerulea*, *Aphyllanthes monspeliensis*, *Thymus vulgaris* characteristic of great surfaces of the supra-Mediterranean level of southern France.
- 32.62 GENISTA CINEREA GARRIGUES**
 Supra-Mediterranean garrigues or grasslands of the south-western Alps, Haute Provence, the southern Central Massif, the Corbières and the eastern Pyrenees dominated by *Genista cinerea* ssp. *cinerea*, including the broom-rich facies of the French lavender garrigues and the White Quercy broom-fields.
- 32.63 MONTANE THYME GARRIGUES**
Aphyllanthion p., *Lavandulo-Genistion boissieri* p.
 Low formations of the supra-Mediterranean levels of the Iberian Meseta and its surrounding mountains and of northern Spain and southern France, rich in small labiate shrubs of genera *Thymus* (e.g. *T. serpolifolium*, *T. vulgaris*, *T. loscosii*), *Teucrium* (e.g. *T. aureum*, *T. aragonense*, *T. gnaphalodes*, *T. polium*), *Salvia* (e.g. *S. lavandulifolia*, *S. phlomoides*), *Satureja* (e.g. *S. montana*), *Sideritis* (e.g. *S. incana*), *Lavandula* (*L. angustifolia*, *L. lanata*, *L. latifolia*), accompanied by leguminous shrubs (e.g. *Genista scorpius*, *G. pilosa*, *G. pseudopilosa*, *G. cinerea* ssp. *speciosa*, *Coronilla minima*) and various grasses (e.g. *Stipa* spp., *Brachypodium* spp.). In the north they often have an important, sometimes predominant, grass element and their impoverished shrub component is sometimes reduced to an almost monospecific *Thymus* formation; southwards, they become progressively more dominated by a richer constellation of shrub species.
- 32.64 SUPRA-MEDITERRANEAN BOX SCRUB**
 Box thickets of the supra-Mediterranean zone, occurring as facies within several formations of southern France such as French lavender garrigues and supra-Mediterranean steppic grassland complexes, in north-eastern Spanish ranges and in isolated stations of the Apennines.
- 32.65 ITALIAN SUPRA-MEDITERRANEAN GARRIGUES**
 In the supra-Mediterranean level of Italy and the large central Mediterranean islands, the substitution stages of the thermophile deciduous forests are mostly grasslands or shrubby grasslands, hedgehog-heaths, deciduous shrubs, semi-maquis or occasionally embryonic garrigues that differ little from those of the meso-Mediterranean level. A few formations, in particular with labiates of genera *Thymus*, *Teucrium*, *Salvia*, *Lavandula* and others, with *Helichrysum* spp. or with *Euphorbia* spp. may warrant separate listing under this heading.
- 32.7 PSEUDOMAQUIS**
 Shrub formations intermediate between Mediterranean maquis and schibljak, resulting from the degradation of the *Ostryo-Carpinion* of Greece, the Balkans and Italy, with a mixture of evergreen and deciduous bushes including *Quercus coccifera*, *Juniperus oxycedrus*, *Quercus trojana*, *Carpinus orientalis*, *Ostrya carpinifolia*, *Pistacia terebinthus*, *Buxus sempervirens*. Similar Iberian formations with *Amelanchier ovalis*, *Prunus lusitanica*, *Ilex aquifolium*. French and Italian formations with *Quercus pubescens* and *Quercus ilex*.
 (Horvat *et al.*, 1974; Tomaselli, 1981a; Polunin and Walters, 1985)

- 32.8** **MACARONESIAN XEROPHYTIC COMMUNITIES**
Kleinio-Euphorbieta canariensis
 Xerophytic scrub formations of the lower slopes of the Canary Islands, Madeira and the Salvagen Islands, rich in succulents, in particular cactiform or dendroid spurges *Euphorbia* spp., rosette-forming *Aeonium* spp. and composites.
 (Delvolsalle, 1964; Duvigneaud, 1977; White, 1983; Bramwell and Bramwell, 1983; Hampshire, 1984; Wildpret de la Torre and del Arco Aguilar, 1987; Machado *in litt.* 1989)
- 32.81** **WESTERN CANARIAN SPURGE COMMUNITIES**
 Open, varied formations of arid, stony slopes of the lower, 0-700 m, level of the western and central Canarian islands, characterized by the abundance of fleshy-stemmed, aphyllous, or small-leaved species, in particular *Euphorbia* spp., *Senecio kleinia*, *Periploca laevigata*, *Cneorum pulverulentum*, *Messerschmidia fruticosa*, *Echium giganteum*, *Convolvulus floridus*, *Allagopappus dichotomus*, *Rhamnus crenulata*, *Rubia fruticosa*, *Argyranthemum* spp., *Artemisia canariensis*, *Sonchus leptocephalus*, *Asparagus arborescens*, *Rumex lunaria*, *Micromeria* spp., *Paronychia canariensis*.
- 32.811** **Cardonales**
 Formations dominated by the cactiform spurge *Euphorbia canariensis*.
- 32.812** **Tabaibales**
 Formations dominated by the tree-like spurges *Euphorbia aphylla*, *E. obtusifolia*, *E. balsamifera*, *E. atropurpurea*, *E. bravoana*, *E. regis-jubae*, *E. bourgaeana*.
- 32.813** **Kleinia tabaibales**
Senecio kleinia (*Kleinia neriifolia*), *Sonchus* spp. or other composite-dominated formations.
- 32.814** **Dragon tree communities**
 Formations in which the forest relict *Dracaena draco* is present.
- 32.815** ***Cneorum* cushion communities**
Cneorum pulverulentum formations.
- 32.816** ***Plocama* communities**
 Formations with *Plocama pendula*.
- 32.82** **WESTERN CANARIAN SAXICOLOUS FORMATIONS**
 Formations colonizing hard rock faces, lava flows and ravine walls within the xerophytic zone of the western and central Canary Islands.
- 32.821** **Western Canarian saxicolous labiate communities**
 Formations of small ligneous plants colonizing hard, dry rocks with *Micromeria* spp., *Lavandula canariensis*, *L. pinnata*, and the fern *Notholaena vellea*.
- 32.822** **Cardoncillo communities**
 Formations colonizing lava flows, with the succulent asclepiad cardoncillos *Ceropegia dichotoma* and *C. fusca*, *Phagnalon purpurascens* and *Sonchus leptocephalus*.
- 32.823** **Western Canarian crassulid communities**
 Formations of dry, less sunny rocks dominated by succulent crassulids (*Aeonium* spp., *Greenovia* spp.) with *Sonchus gummifer*, *S. radiatus*, *Picridium ligulatum*, *Lavandula abrotanoides*, *Asparagus scoparius*, *Hypericum reflexum*, *Lavatera acerifolia*, *L. phoenicea*, *Vieraea laevigata* and many lichens.
- 32.83** **EASTERN CANARIAN XEROPHYTIC COMMUNITIES**
 Open formations of semi-desertic Fuerteventura and Lanzarote, with high endemism; characteristic of various groupings are *Euphorbia obtusifolia*, *Senecio kleinia*, *Asparagus pastorianus*, *Echium bonnetii*, *Caralluma burchardii*, the cactiform spurge *Euphorbia handiense*, *Pulicaria burchardii*, *P. canariensis*, *Argyranthemum winteri*, *Echium handiense*, *Bupleurum handiense*, *Sideritis massoniana*, *Asteriscus sericeus*, *A. schultzei*, *Minuartia platiphylla*, *Reichardia famarae*, *Aichryson tortuosum*, *Aeonium lancerottense*, *Aeonium balsamiferum*, *Limonium bourgaei*, *Echium decaisnei* ssp. *purpuricense*, *Argyranthemum ochroleucum*, *Helichrysum gossypium*, *H. monogynum*, *Ferula lancerottensis*,

Sedum lancerottense, *Thymus origanoides*, *Lavandula pinnata*, *Echium pitardii*, *Limonium puberulum*.

- 32.84 CANARIAN *LAUNAEA* SCRUB
Steppic grasslands of the Canary Islands invaded and dominated by *Launaea arborescens*.
- 32.85 MADEIRAN SPURGE FORMATIONS
Aeonio-Lytanthion p.
Shrubby formations of the low slopes (0-350 m) of Madeira with *Euphorbia piscatoria*, *Globularia salicina*, *Phyllis nobla*, *Myrtus communis*, *Chamaemeles coriacea*, *Rubus ulmifolius*, *Olea europea ssp. maderensis*, *Bencomia codata*, *Echium nervosum*.
- 32.86 MADEIRAN SAXICOLOUS FORMATIONS
Formations colonizing rocks and volcanic ash deposits in the xerophytic zone of Madeira, with *Aeonium glutinosum*, *Plantago arborescens ssp. maderensis*, *Helichrysum spp.*, *Sonchus ustulatus*, *Phagnalon spp.* *Tolpis fruticosa*, *Sedum brissemoretii*, *Davallia canariensis* or *Musschia aurea* and *Aeonium glandulosum*.
- 32.87 DESERTAS DRY SCRUB
Formation with Madeiran endemics *Artemisia argentea*, *Calandula maderensis*, *Andryala glandulosa*, *Jasminum odoratissimum* and introduced plants.
- 32.9 FIELDS OF ASPHODEL, *PHLOMIS*, THISTLE, *FERULA*
Over-browsed and over-grazed garrigues physiognomically transformed into fields of asphodel, *Phlomis*, thistle or *Ferula*.
- 32.A SPANISH-BROOM FIELDS
Formations of Spanish broom, *Spartium junceum*, in Mediterranean and sub-Mediterranean areas.

33 Phrygana

Cushion-forming thermo-Mediterranean sclerophyllous formations, often thorny and summer deciduous. They are best developed in the eastern Mediterranean, where they may occupy considerable surfaces in coastal areas and occasionally inland. They also include a few rare, relict associations of the west Mediterranean, mostly characteristic of the edge of seashores and of maritime cliffs, where they constitute an often narrow belt between the cliff communities and thermo-Mediterranean brushes, incorporating, in addition to characteristic, often endemic or very rare, hemispherical cushion-forming species, an admixture of species belonging to these two vegetation complexes.

(Rechinger, 1951; Molinier and Molinier, 1957; Bolos and Molinier, 1960; Laurentiades, 1969; Bolos *et al.*, 1970; Horvat *et al.*, 1974; Caniglia *et al.*, 1974-1975; Molinier *et al.*, 1976; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Reisigl *et al.*, 1980; Nimis, 1981; Quézel, 1981; Pignatti, 1982; Gamisans, 1982; Gêhu *et al.*, 1984; Chiappini, 1985 a, b.; Kassioumis, 1988; Camarda and Valsecchi, 1990)

33.1

WEST MEDITERRANEAN CLIFFTOP PHRYGANAS

Astragalo-Plantaginetum subulatae, *Anthyllido-Thymelaeetum hirsutae*, *Thymelaeo-Helichrysetum*, *Armerietum ruscinonensis*

Rare, extremely local and isolated associations of clifftops and adjacent areas dispersed along the coasts of Provence, Cap Corse, the Straits of Bonifacio, Catalonia (Cabo de Creus) and extreme south-western Portugal, characterized by the presence of *Astragalus massiliensis* or *Anthyllis hermanniae*, variously accompanied by *Thymelaea hirsuta*, *Helichrysum italicum*, *Plantago subulatum*, *Armeria ruscinonensis*.

33.11

CALCAREOUS PROVENCE PHRYGANA

Very rare formations of the Marseilles coast of Provence (les Goudes), with *Astragalus massiliensis*, *Thymelaea tartonraira* and *Plantago subulata*.

33.12

CRYSTALLINE PROVENCE PHRYGANA

Formations of the maritime façade of the Maures and the Estérel, with *Anthyllis barba-jovis* and *Thymelaea hirsuta*.

33.13

CAP CORSE PHRYGANA

Formations of Cap Corse, with *Anthyllis hermanniae*.

33.14

STRAITS OF BONIFACIO PHRYGANA

Formations of the southern tip of Corsica and the extreme northern coast of Sardinia, with *Astragalus massiliensis*.

33.15

CABO DE CREUS PHRYGANA

Isolated formation of the Cabo de Creus promontory in Catalonia, with *Astragalus massiliensis*, *Pistacia lentiscus*, *Cistus albidus*, *C. salvifolius*, *Phillyrea angustifolia*, *Juniperus oxycedrus*.

33.16

CABO DE SÃO VICENTE PHRYGANA

Very isolated formations of the Cabo de São Vicente and the Ponta de Sagres, with *Astragalus massiliensis* and *Crithmum maritimum*.

- 33.2** **SARDINIAN *CENTAUREA HORRIDA* PHRYGANAS**
Centaureetum horridae
 Highly threatened formations of the promontories of northern Sardinia, limited to the peninsulas of Stintino and Capo Caccia and the islands of Asinara and Tavolara, dominated by the large, silvery-blue, hemispherical cushions of the endemic tertiary relict *Centaurea horrida*, associated with many other endemic or restricted relict species including *Astragalus massiliensis*, *Erodium corsicum*, *Limonium acutifolium*, *Nananthea perpusilla*, *Evax rotundata*, *Armeria pungens*.
- 33.3** **AEGEAN PHRYGANAS**
Cisto-Micromerietea, *Sarcopoterietalia spinosi*
 Low, thorny formations of hemispherical shrubs of the coastal thermo-Mediterranean zone of Greece and its islands with *Sarcopoterium spinosum*, *Centaurea spinosa*, *Satureja thymbra*, *Thymus capitatus*, *Genista acanthoclada*, *Anthyllis hermanniae*, *Euphorbia acanthothamnus*, *Stachys spinosa*, *Ballota pseudodictamnus*, *B. acetabulosa*, *Erica manipuliflora*, *Rhamnus oleoides*, *Lithospermum hispidulum*, *Fumana arabica*, *F. thymifolia*, *Cistus creticus*, *C. parviflorus*, *C. salvifolius*, *Pistacia lentiscus*, *Teucrium brevifolium*, *T. divaricatum*, *T. polium*, *Calicotome villosa*, *Micromeria graeca*, *M. juliana*, *M. nervosa*, *Salvia triloba*, *Ononis spinosa*, *Helichrysum italicum* ssp. *microphyllum* and ssp. *italicum*, *Phagnalon graecum*, much more widespread and diverse than the western Mediterranean formations. The subdivisions proposed are based on physiognomically significant dominants; co-dominance can be indicated by use of multiple codes.
- 33.31** **SARCOPOTERIUM PHRYGANAS**
Sarcopoterium spinosum-dominated formations, by far the commonest phrygana facies, widespread in the Aegean archipelagoes and Crete, with local outposts in peninsular Greece and the Ionian islands.
- 33.32** **MARITIME *CENTAUREA SPINOSA* PHRYGANAS**
 Rare, relict formations on coastal sands and gravels of Egina, Attica, Euboea, Skyros, Samos, Lesbos, Lemnos, Samothrace and Crete, dominated by the large, silvery hemispherical cushions of *Centaurea spinosa* ssp. *spinosa*, sometimes accompanied by *Sarcopoterium spinosum* or *Euphorbia acanthoclada*.
- 33.33** **LESBIAN *CENTAUREA SPINOSA* PHRYGANAS**
 Phryganas often rich in *Centaurea spinosa* ssp. *spinosa*, mixed with *Sarcopoterium spinosum*, *Satureja timbra*, *Ballota acetabulosa* of Lesbos, extending from the coast to the highest hills in the arid western part of the island; covering a relatively vast expanse, they harbour a highly distinctive flora and fauna as well as remnants of fossil forest.
- 33.331** **Lesbian *Centaurea-Sarcopoterium* phryganas**
Sarcopoterium phrygana rich in *Centaurea spinosa*.
- 33.332** **Lesbian *Sarcopoterium* phryganas**
Sarcopoterium phrygana with little or no *Centaurea spinosa*.
- 33.333** **Lesbian steppe-phrygana**
 Open, almost pure, stands of *Centaurea spinosa* on steppe hills.
- 33.34** **CYCLADIAN *CENTAUREA* PHRYGANAS**
 Formations of the Cyclades, rich in *Centaurea spinosa* ssp. *cycladum*, extending from coastal areas to the highest elevations.
- 33.35** **HEATHER PHRYGANAS**
 Phryganas in which *Erica manipuliflora* plays an important role, often associated with *Sarcopoterium spinosum*, *Genista acanthoclada*, *Pistacia lentiscus*, *Ballota acetabulosa*, *Cistus creticus*, *C. parviflorus*, *C. salvifolius*, a facies of the *Sarcopoterium* phrygana developing locally notably in eastern Crete and the Cyclades.
- 33.36** **THYME PHRYGANAS**
 Phryganas dominated or formed by *Thymus capitatus*.
- 33.37** **GENISTA PHRYGANAS**
Genista acanthoclada formations of the thermo-Mediterranean zone.

33

- 33.38 **SAVORY PHRYGANAS**
Facies of the phryganas in which *Satureja thymbra* becomes locally dominant.
- 33.39 **SPINY SPURGE PHRYGANAS**
Euphorbia acanthothamnos-dominated formations.
- 33.3A **GROMWELL PHRYGANAS**
Lithospermum hispidulum-dominated phryganas, limited to south-eastern Aegean islands.
- 33.3B **ANTHYLLIS PHRYGANAS**
Anthyllis hermanniae-dominated or -rich phryganas, widespread, in particular in the northern Aegean.
- 33.4 **MID-ELEVATION PHRYGANAS OF CRETE**
Euphorbio-Verbascion, i.a.
Varied formations of supra- and oro-Mediterranean levels of Crete resulting from the broad contact between phryganas and hedgehog-heaths (32.7), with *Euphorbia acanthothamnos*, *Verbascum spinosum*, *Berberis cretica*, *Phlomis cretica*, *Satureja biroi*, *Sideritis syriaca*, *Hypericum empetrifolia*, *Origanum microphyllum*, *Micromeria juliana*, *Helichrysum italicum* ssp. *microphyllum*, *Genista acanthoclada*.
- 33.5 **HYPERICUM PHRYGANAS**
Extremely rare, local colonies of hemispherical shrubs of *Hypericum aegyptiacum* forming open phryganas on calcareous rocks by the sea in the Ionian islands, western Crete, Sardinia and Lampedusa.
- 33.6 **ITALIAN SARCOPOTERIUM SPINOSUM PHRYGANAS**
Very local, impoverished *Sarcopoterium spinosum* formations of Capo St. Elia (southern Sardinian coast) and of the Gulf of Taranto (Puglia, Calabria).
- 33.7 **SARDINIAN GENISTA ACANTHOCLADA PHRYGANA**
Very local *Genista acanthoclada* ssp. *sardoa*-dominated communities of north-western Sardinia.
- 33.8 **BALEARIC CLIFFTOP PHRYGANAS**
Launaeetum cervicornis
Formations of the coasts of Mallorca and Minorca dominated by the cushion-forming Balearic endemics *Launaea cervicornis*, *Astragalus balearicus*, *Centaurea balearica*, *Anthyllis fulgurans*, *A. hermanniae* ssp. *hystrix*, *Teucrium subspinosum*.
- 33.9 **CYRNO-SARDIAN GENISTA PHRYGANAS**
Thermo-Mediterranean formations of headlands and peninsulas of Corsica and Sardinia dominated by cushion-forming spiny *Genista corsica* or *G. morisii*. These endemic species participate in the constitution of hedgehog-heaths (31.75) as well as in that of the coastal formations listed here, which assume an evident phrygana appearance; they may also enter in the composition of mid-elevation formations of less distinctive appearance which can be listed under 32.482.
- 33.A **PANTELLERIA PHRYGANA**
Matthiolo-Helichrysetum errerae
Coastal formation of hemispherical shrubs with the Pantelleria endemics *Helichrysum saxatile* ssp. *errerae* and *Matthiola pulchella*, vicariant of the west Mediterranean, Balearic and Sardinian clifftop phryganas.

34 Dry calcareous grasslands and steppes

Dry thermophilous grasslands of the lowlands, hills and montane zone, on mostly calcareous soils, sands, decomposed rock surfaces; steppes; thermophile forest fringe formations

34

34.1

MIDDLE EUROPEAN PIONEER SWARDS

Sedo-Scleranthetea p.

Open, thermophile formations of sandy or rocky ground in non-Mediterranean lowland to montane areas.

34.11

MIDDLE EUROPEAN ROCK DEBRIS SWARDS

Alyso-Sedion albi, *Sedo albi-Veronicion dillenii*, *Sedo-Scleranthion p.*, *Sedion pyrenaici p.*

Open lowland and hill formations of sub-oceanic climates, formed mostly by annuals and succulents or semi-succulents on decomposed rock surfaces of edges, ledges or knolls, with calcareous or siliceous soils frequently disturbed by erosion or rabbits. They comprise a great variety of distinct and often very local, isolated communities harbouring many characteristic species, among which numerous rare forms including both relict and evolutionarily recent taxa.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Royer, 1977; Rivas-Martinez, 1977a; Schumacher, 1977; Guinochet and Vilmorin, 1983; Duvigneaud, ms, 1985; Parent, 1986; Duvigneaud and Saintenoy-Simon, 1988; Oberdorfer, 1990)

34.111

Stonecrop swards

Formations dominated by, or rich in, *Sedum album* or other *Sedum* species, commonest facies of most communities.

34.112

Houseleek communities

Formations harbouring often rare and local lowland forms of *Sempervivum spp.* or *Jovibarba spp.*

34.1121

Sempervivum tectorum communities

Formations with *Sempervivum tectorum*, of the Jura, the Lake Constance area, the Moselle Valley, Hesse.

34.1122

Jovibarba sobolifera communities

Formations with *Jovibarba sobolifera*, of Franconia, Rhine, southern Saxony and Brandenburg.

34.1123

Amblève houseleek community

The unique, and therefore highly vulnerable, formation of *Sempervivum funkii* var. *aqualiense* known from only one site on the cliffs of the Amblève Valley, northern Ardennes.

34.113

Grassy rock debris communities

Formations in which perennial grasses such as *Poa badensis*, *Melica ciliata* and *Festuca spp.* play an important physiognomic role.

34.114

Middle European rock debris therophyte communities

Formations in which small annuals predominate over sparser crassulids or perennial grasses.

34.12

CALCAREOUS SAND SWARDS

Koelerion glaucae, *Sileno conicae-Cerastion semidecandri* (*Sedo-Cerastion*) *p.*

Open grasslands of strongly to slightly calcareous inland sands with *Helichrysum arenarium*, *Silene otites*, *S. chlorantha*, *Dianthus deltoides*, *Astragalus arenarius*, *Onosma arenarium*, *Jurinea cyanoides*, *Koeleria glauca*, *Festuca psammophila*, *F. polesica*, *F. duvallii* and the Brandenburg endemic *Stipa borysthena* ssp. *germanica*, sometimes interspersed with annual formations with *Cerastium semidecandrum*, *Vicia lathyroides*, *Silene conica*, *Phleum arenarium*, *Petrorhagia prolifera*. Dunal formations can be characterized by conjunction of this code with those of 64.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Duvigneaud, ms, 1985; Parent, 1986; Oberdorfer, 1990)

34.2

LOWLAND HEAVY METAL GRASSLANDS

Dry, short grasslands, often rich in lichens and mosses, colonizing western and central European soils with a high content in heavy metals such as zinc and lead, and comprising uniquely adapted species, ecotypes or populations mostly related to, or derived from, otherwise montane, boreo-montane or steppic species.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Lambinon and Auquier, 1964; Auquier, 1964; Maquinoy *et al.*, 1972; Westhoff and den Held, 1975; Richards and Swan, 1976; Schumacher, 1977; Noirfalise *et al.*, 1980; Sipkes, 1980; Duvigneaud, 1982d; Noirfalise and Dethioux, 1982; Drachenfels *et al.*, 1984; Duvigneaud, ms, 1985; Bradshaw, 1985; Oberdorfer, 1990)

34.21

BRITISH HEAVY METAL GRASSLANDS

Formations, in particular of Wales and the Pennines, developed in the vicinity of former mining operations or on river gravels, with *Minuartia verna*, *Thlaspi caerulescens*, *Armeria maritima*, *Viola lutea*, *Festuca ovina* s.l., *F. rubra* s.l., *Agrostis tenuis*.

34.22

CALAMINARIAN GRASSLANDS

Thlaspi calaminariae: *Violetum calaminariae*, *Violetum guestphalicae*

Open formations colonizing heavy metal soils, either natural or resulting from past mining operations, in rapid regression and limited to a few stations in eastern Belgium, western Rhineland, Westphalia and Lower Saxony, and to one station in the southern Netherlands, comprised of a highly specialized flora with the endemics *Viola calaminaria*, *V. guestphalica*, *Thlaspi caerulescens* (= *T. alpestre*) ssp. *calaminaria* and *Festuca aquisgranensis* (*F. ophioliticola* ssp. *calaminaria*), with *Minuartia verna* var. *hercynica*, *Silene vulgaris* ssp. *humilis* and *Armeria halleri*, limited to this formation and the next, and with the steppic, central European *Festuca valesiaca*.

34.221

Viola calaminaria grasslands

Formations of eastern Belgium, the extreme southern Netherlands and the Aachen area, with the yellow-flowered *Viola calaminaria*.

34.222

Viola guestphalica grasslands

Formations of northern Westphalia and of southern Lower Saxony, with the purple-flowered *Viola guestphalica*.

34.223

Eifel *Armeria halleri* grasslands

Communities of the Eifel with *Armeria halleri* and without violets.

34.23

CENTRAL EUROPEAN HEAVY METAL GRASSLANDS

Armerion halleri: *Armerietum halleri*, *Armerietum bottendorfensis*, *Armerietum hornburgensis*

Formations of Saxony and of the Harz with the endemic or near endemic *Armeria halleri*, *A. bottendorfensis*, *A. hornburgensis* and with *Minuartia verna* var. *hercynica*, *Silene vulgaris* ssp. *humilis*.

34.3

DENSE PERENNIAL GRASSLANDS AND MIDDLE EUROPEAN STEPPES

Festuco-Brometea

Dry closed thermophilous grasslands of middle European or Mediterranean lowlands and hills, up to the montane zone, dominated by perennial grasses; steppic grasslands of continental middle European affinities.

34.31

SUB-CONTINENTAL STEPPIC GRASSLANDS

Festucetalia valesiaca

Open grasslands of sub-continental climates with *Festuca valesiaca*, *F. rupicola*, *F. pseudovina*, *F. duvalii*, *F. trachyphylla*, *Stipa capillata*, *S. joannis*, *S. pulcherrima*, *S. tirsia* (= *S. stenophylla*), *S. dasyphylla*, *Chrysopogon gryllus*, *Danthonia alpina*, *Koeleria macrantha*, *Agrostis capillaris*, *Poa bulbosa*, *P. molinerii* (= *P. badensis* var. *xerophila*), *P. perconcinna* (= *P. carniolica*), *Melica ciliata*, *Brachypodium pinnatum*, *Carex supina*, *C. stenophylla*, *C. humilis* and herbs such as *Adonis vernalis*, *Pulsatilla montana*, *P. pratensis*, *P. grandis*, *P. patens*, *P. pusilla*, *Veronica spicata*, *Allium flavum*, *A. sphaerocephalon*, *Silene otites*, *Artemisia campestris*, *Achillea collina*, *A. nobilis*, *A. setacea*, *Centaurea rhenana* (*C. stoebe*), *Inula spiraeifolia*, *Verbascum phoeniceum*, *Armeria alliacea*, *Kochia prostrata*, *Euphorbia seguieriana*, *E. cyparissias*, *Campanula sibirica*, *Iris pumila*, *I. variegata*, *Linum flavum*, *Onosma taurica*, *O. arenaria*, *Silene otites*, *Potentilla arenaria*, *P. cinerea*, *Aster linosyris*, *Onobrychis arenaria*, *Oxytropis pilosa*, *O. halleri*, *Ononis pusilla*, *O. cenisia*, *Astragalus onobrychis*, *A. exscapus*, *A. danicus*, *A. vesicarius*, *A. austriacus*, *A. atopecuroides*, *Eryngium campestre*, *Dianthus carthusianorum*, often of oriental, mostly sarmatic, affinities.

(Braun-Blanquet 1961, 1976; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Wolking and Plank, 1981; Duvigneaud, ms, 1985; Oberdorfer, 1990)

34.311

Greek sub-Mediterranean steppic grasslands

Chrysopogo-Danthonion, *Festucion rupicolae*, *Saturejon montanae*, *Asplenion serpentinei*
Perennial, steppe-like grasslands of the sub-Mediterranean *Ostryo-Carpinion*, *Quercion frainetto* and *Fagion moesiacum* zones of Greece with, among others, *Chrysopogon gryllus*, *Festuca rupicola*, *Koeleria macrantha*, *Carex humilis*, *Stipa joannis*, *S. capillata*, *S. pulcherrima*.

34.312

Central European steppic grasslands

Festucion valesiaca, *Cirsio-Brachypodion*

Dry grasslands, developed in areas with a locally high degree of continentality, of Alsace, the upper Rhine valley and hills, Franconia, Thuringe, Saxony and Brandenburg.

34.3121

Xerophile Central European steppic grasslands

Festucion valesiaca: *Potentillo-Stipetum capillatae*, *Allio-Stipetum capillatae*

Dry formations.

34.3122

Mesophile Central European steppic grasslands

Cirsio-Brachypodion: *Stipetum stenophyllae*, *Genisto-Stipetum stenophyllae*, *Adonido-Brachypodietum*

More mesic formations.

34.3123

Central European Tor grass steppic grasslands

Brachypodium pinnatum-dominated facies of 34.3122.

34.313

Eastern inner Alpine arid grasslands

Stipo-Poion xerophilae

Formations of the isolated, low-precipitation, high insolation, high summer temperature, inner Alpine valleys of the Val Bregaglia, upper basin of the Adda, the Val Venosta (upper Adige), the middle Adige-Isarco basin, the Val Pusteria.

34.314

Western inner Alpine arid grasslands

Stipo-Poion carniolicae

Grasslands of the dry inner valleys of the south-western Alps in the upper basin of the Durance, the upper valley of the Romanche, the Maurienne and the Tarentaise, the basins of the Dora Riparia (Susa) and of the Chisone and the upper basin of the Dora Baltea (Aosta).

34.32

SUB-ATLANTIC SEMI-DRY CALCAREOUS GRASSLANDS

Mesobromion (Seslerio-Mesobromion, Potentillo-Brachypodion pinnati)

More or less mesophile, closed formations dominated by perennial, tuft-forming grasses, colonizing relatively deep, mostly calcareous soils in the sub-Atlantic domain of the *Quercion pubescenti-petraeae* and its northern irradiations and in the sub-Mediterranean mountains of the Italian peninsula, with *Bromus erectus*, *Brachypodium pinnatum*, *Koeleria pyramidata*, *Festuca guestfalica*, *F. lemarii*, *Avenula pubescens*, *Sesleria albicans*, *Briza media*, *Carex caryophyllea*, *C. flacca*, *Gentianella germanica*, *G. ciliata*, *Gentiana cruciata*, *Trifolium montanum*, *Lotus corniculatus*, *Ononis repens*, *Medicago lupulina*, *Ranunculus bulbosus*, *Sanguisorba minor*, *Cirsium acaule*, *Euphrasia stricta*, *Dianthus deltoides*, *Potentilla neumanniana*, *Anthyllis vulneraria*, *Galium verum*, *Euphorbia brittingeri* (*E. verrucosa*), *Hippocrepis comosa*, *Helianthemum nummularium*, *Thymus praecox*, *Salvia pratensis*, *Linum catharticum*, *Scabiosa columbaria*, *Centaurea scabiosa*, *Carlina vulgaris*, *Viola hirta*, *Plantago media*, *Primula veris* and numerous orchids such as *Coeloglossum viride*, *Ophrys apifera*, *O. holoserica*, *O. insectifera*, *O. sphegodes*, *Aceras anthropophorum*, *Himantoglossum hircinum*, *Anacamptis pyramidalis*, *Orchis morio*, *O. ustulata*, *O. militaris*, *O. simia*, *Gymnadenia conopsea*, *Platanthera chlorantha*, *Herminium monorchis*, *Dactylorhiza fuchsii*. Generally species-rich, these communities may be overwhelmed by the highly social *Brachypodium pinnatum*. Their range extends from the British Isles, Denmark, the Low Countries and northern Germany to the Cantabric range, the Pyrenees, Catalonia, the southern Alps, and the Central Apennines. Forming a bridge between the Mediterranean region and thermophile sites to the north, they can be identified by their high representation of Mediterranean species in the north and of Euro-Siberian ones in the south.

(Lebrun *et al.*, 1949; Vanden Berghen and Mullenders, 1957; Tüxen and Oberdorfer, 1958; Vanden Berghen, 1963; Ellenberg, 1963, 1988; Braun-Blanquet, 1963, 1967a, 1976; Sutter, 1967; Archiloque *et al.*, 1969; Petit and Ramaut, 1970, 1985; Guinochet and Vilmorin, 1973; Lambinon, 1974; Summerhayes, 1976; Schumacher, 1977; Rivas-Martinez, 1977a; Gruber, 1978; Bellot Rodriguez, 1979; Bournérias, 1979, 1984; Molinier and Martin, 1980; Sipkes, 1980; Wolking and Plank, 1981; Ozenda, 1981; Francalancia *et al.*, 1981; Noirfalise and Dethioux, 1982; Duvigneaud, 1982a, b, 1983a, b, ms 1985; Bouzillé, 1983; Guéry, 1983; Rivas-Martinez, Diaz *et al.*, 1984; Nordiska ministerradet, 1984; Polunin and Walters, 1985; Gauld and Robertson, 1985; Bradshaw, 1985; Dupias, 1985; Bobbink and Willems, 1987; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Bolos and Capdevila, 1987; Vigo and Ninot, 1987; Chas, 1989; Oberdorfer, 1990)

34.321

North-western semi-dry calcareous grasslands

Mesobromion grasslands of Denmark and the British Isles.

34.3211

Danish *Mesobromion*

Dry or mesophile calcareous grasslands of central Jutland and the Danish archipelago with *Festuca ovina*, *Avenula pratensis*, *A. pubescens*, *Galium verum*, *Plantago media*, *Pulsatilla vulgaris*, *Artemisia campestris*, *Geranium sanguineum*, *Potentilla argentea*.

34.3212

Irish *Mesobromion*

Calcareous grasslands of central and central-western Ireland.

34.3213

Scottish *Mesobromion*

Very local, dry or mesophile grasslands occupying isolated limestone outcrops or deposits of Scotland, in particular on the Durness limestone of the north-west, the Dalradian limestones of Perthshire and basalt hills of the east, with *Koeleria macrantha*, *Festuca ovina*, *F. rubra*, *Briza media*, *Avenula pratensis*, *Carex flacca*, *C. caryophyllea*, *C. capillaris*, *Helianthemum nummularium*, *Astragalus danicus*, *Thymus drucei*.

34.3214

Northern English *Mesobromion*

Grasslands of mostly carboniferous or magnesian limestone substrates in the Pennines of Derbyshire, Yorkshire and Lancashire, the Lake District and Durham, including Teesdale, rich in *Sesleria albicans* and with many isolated populations of restricted or rare plants including *Carex ericetorum*, *Viola rupestris*, *Gentiana verna*.

34.3215

Welsh *Mesobromion*

Grasslands of mostly carboniferous limestone outcrops of Wales and adjacent areas with *Koeleria macrantha*, *Avenula pubescens*, *A. pratensis*.

34.3216

Southern English *Mesobromion*

Grasslands of the chalk downs and mainly Jurassic calcareous hills of southern and eastern England, with *Bromus erectus* and *Brachypodium pinnatum*, often very rich in orchids.

34.32161

Southern English tall *Mesobromion*

Tall grasslands with *Bromus erectus*, *Brachypodium pinnatum*, *Arrhenatherum elatius*, *Avenula pratensis*, *A. pubescens*.

34.32162

Southern English tor grass *Mesobromion*

Brachypodium pinnatum-dominated facies.

34.32163

Southern English short *Mesobromion*

Short turfs with *Festuca ovina*, *F. rubra*, *Cynosurus cristatus*, *Koeleria macrantha*.

34.322

Middle European *Bromus erectus* semi-dry grasslands

Mesophile and meso-xerophile calcareous grasslands of the sub-Atlantic domain in the Low Countries, Germany, northern, central and western France and north-western Spain. They are faunistically and floristically rich and the highly discontinuous nature of their distribution gives rise to a considerable geographical variation in the composition of plant and animal communities, marked by the occurrence of numerous species of local or disjunct occurrence in addition to the basic cortège common to most of them. Besides this geographical variation, the nature of these grasslands also depends, to a great extent, on hydric regime, substrate characteristics and agro-pastoral treatment, notably on whether they are mowed or grazed and how intensively. In particular, the relative abundance of the main constituent grass species, *Bromus erectus*, *Brachypodium pinnatum* s.l., *Sesleria albicans* and *Koeleria pyramidata*, varies both geographically with climatic conditions and locally with topography and agro-pastoral regime. Thus, although separate geographical entities may differ in that relative abundance, similarly differing facies may also coexist locally, producing sharply distinct habitats. To accommodate for these concurrent axes of variation, formations dominated by *Brachypodium* or by *Sesleria*, as well as all semi-damp formations, are removed from this division and placed in 34.323, 34.324 and 34.325. Geographical subdivisions, most apt at identifying distinctive plant and animal communities, may be used in the four sections by addition of a fourth decimal digit common to all of them. The regions encompassed by the geographical subdivisions corresponding to each value of this fourth digit are in all cases described under this section although in some of them, or in parts of some of them, there may be no grasslands belonging to 34.322, but only grasslands belonging to units 34.323, 34.324 or 34.325; these cases have, as much as possible, been identified under each of the subdivisions below.

34.3221

Mosan *Mesobromion*

Mesophile grasslands of the north-western Hercynian periphery, on mostly Devonian or carboniferous limestones or dolomitic limestones, occasionally on calcschists, in the Mosan district of Belgium and the French Meuse, with isolated stations in the Ardenne-Eifel of Luxembourg and Rhineland.

34.3222

Low Meuse *Mesobromion*

Chalk grasslands of the Belgian low Meuse, extreme south-eastern Netherlands and Westphalia, generally without *Bromus erectus*, and alluvial *Mesobromion* grasslands of adjacent regions (these to be listed under 34.324).

34.3223

Harz *Mesobromion*

Closed mesophile grasslands, on substrates derived from Mesozoic limestones, of the periphery of the Harz in Saxony, Thuringe, Hesse and the hills of Lower Saxony.

34.3224

Oder *Mesobromion*

Closed mesophile calcareous grasslands of the Oder basin in Brandenburg and Mecklenburg.

- 34.3225** Paris basin Cretaceous *Mesobromion*
Mesophile grasslands of the Cretaceous north-western and western periphery of the Paris basin, the valleys of the Seine, Bray and Somme and adjacent Jurassic areas of Basse Normandie and the Boulonnais.
- 34.3226** Parisian Tertiary *Mesobromion*
Mesophile calcareous grasslands of the Parisian Tertiary in the central Paris basin.
- 34.3227** Paris basin Jurassic *Mesobromion*
Mesophile grasslands of the north-eastern, eastern and south-eastern Jurassic belt of the Paris basin and adjacent Cretaceous areas in Lorraine, Champagne, Haute-Marne, Burgundy, Haute-Saône.
- 34.3228** Middle Rhine *Mesobromion*
Closed mesophile calcareous grasslands of the Rhine, Mainz, Moselle, Neckar, Nahe, Lahn in their crossing of the northern Hercynian ranges.
- 34.3229** Upper Rhine *Mesobromion*
Closed mesophile calcareous grasslands of the upper Rhine rift and adjacent hills, in Alsace and Baden-Württemberg.
- 34.322A** Black Forest *Mesobromion*
Mesophile calcareous grasslands of the southern Black Forest.
- 34.322B** French Jura *Mesobromion*
Mesophile calcareous grasslands of the French Jura and adjacent areas.
- 34.322C** Swabian *Mesobromion*
Mesophile calcareous grasslands of the Swabian Alb and adjacent areas.
- 34.322D** Franconian *Mesobromion*
Closed mesophile calcareous grasslands of the Franconian Alb, Franconian plateaux and adjacent areas.
- 34.322E** North-western pre-Alpine *Mesobromion*
Hill and montane mesophile grasslands of the north-western calcareous pre-Alps.
- 34.322F** Bavarian *Mesobromion*
Hill and montane mesophile calcareous grasslands of the Isar valley, the Bavarian plateau and pre-Alps.
- 34.322G** Ligerian *Mesobromion*
Mesophile calcareous grasslands of the Ligerian basin in the southern Paris basin, Berry, Limagne and Forez.
- 34.322H** Aquitanian *Mesobromion*
Mesophile calcareous grasslands of south-western France in Charentes, Perigord and Aquitaine.
- 34.322I** Quercy *Mesobromion*
Closed mesophile calcareous grasslands of Quercy.
- 34.322J** Western Pyrenean *Mesobromion*
Hill and montane mesophile calcareous grasslands of the western Pyrenees.
- 34.322K** Western Iberian *Mesobromion*
Hill, montane and sometimes lower subalpine calcareous grasslands of the Picos de Europa, Cantabria, Asturias, Alava, Navarra dominated by *Brachypodium pinnatum* ssp. *rupestre* (to be listed as 34.323K) or by *Bromus erectus*, *Carex brevicollis*, *Sesleria argentea*, *Helictotrichon cantabricum*, *Avenula vasconica*, *A. marginata*, and often with *Seseli montanum*, *S. cantabricum*, *Chamaespartium sagittale*, *Pulsatilla rubra* ssp. *hispanica*, *Phyteuma orbiculare* ssp. *hispanicum*, *Carduus argemone*.

- 34.323 Middle European *Brachypodium*-dominated semi-dry grasslands**
Brachypodium pinnatum ssp. *pinnatum* or *B. pinnatum* ssp. *rupestre* facies of 34.322. Geographical subdivisions can be introduced by use of the fourth decimal digit of 34.322 in the fourth place of 34.323. *Brachypodium*-dominated facies may form in all the regional types of grasslands inventoried in 34.322 as a result of nitrification or of dominance of grazing over mowing. Such processes are accompanied by a drastic reduction in species diversity. South-western grasslands of units H to K of 34.322 and 34.323 are, however, generally rich in *Brachypodium* even in the apparent absence of degradation processes.
- 34.324 Alluvial and humid *Mesobromion* grasslands**
 Closed grasslands rich in species of the *Mesobromion* and in particular *Bromus erectus*, developed on calcareous marls, on somewhat elevated expanses of alluvial plains and on other water retentive soils within the range of the grasslands listed under 34.322. They are transitional to humid grasslands (37) and are often marked by the abundance of *Carex flacca*. Among characteristic elements are also *Thalictrum minus* ssp. *majus*, *Peucedanum carvifolia*, *Silaum silaus*, *Festuca arundinacea*. Geographical subdivisions can be introduced by use of the fourth decimal digit of 34.322 in the fourth place of 34.324. Extensive examples are known in particular from the marls of Lorraine, the Belgian low Meuse and the great rivers of The Netherlands, Westphalia, the alluvial plains of the French Moselle and Meuse, the Rhine valley in Germany and Alsace, various valleys in southern Germany and the valley of the Sarthe.
- 34.325 Middle European *Sesleria*-dominated semi-dry grasslands**
Sesleria albicans-dominated facies of 34.322, often rich in dealpine species, occurring in particular in the Alpine and Pyrenean periphery, but also occurring locally, farther from the immediate Alpine influence, in anomalous stations such as steep, more or less shaded slopes or cliffs; *Sesleria argentea*-dominated grasslands of Alava and Navarra. Geographical subdivisions can be introduced by use of the fourth decimal digit of 34.322 in the fourth place of 34.323.
- 34.326 Sub-Mediterranean *Mesobromion***
 Closed mesophile grasslands, usually rich in *Bromus erectus* and orchids, of the periphery of the Mediterranean basin in Catalonia, the eastern Pyrenees, the Corbières, the Causses, Provence, the south-western Alps and the northern Apennines. Many are comparatively dry and have sometimes been included in the *Xerobromion*.
- 34.3261 Pyreneo-Catalonian *Mesobromion***
 Formations of the supra-Mediterranean and montane zones of the mountains of Catalonia and of the supra-Mediterranean and montane zones of the Pyrenees, where the absence of *Brachypodium pinnatum* separates them from the more western formations of 34.322-34.323.
- 34.3262 Corbières *Mesobromion***
 Widespread and diverse formations of the Corbières with, in particular, isolated populations of *Ophrys catalaunica* and *Dactylorhiza insularis*.
- 34.3263 Causses *Mesobromion***
 Formations of the Causses; in the southern Causses they are mostly limited to the valleys where they occur at the base of slopes and, more rarely, on alluvial terraces; they also occupy the plateaux of the Causse de Sauveterre; the endemics *Ophrys aveyronensis* and *O. aymonini* find their optimal habitat in these communities (*Orchideto-Brometum*).
- 34.3264 Provence *Mesobromion***
 Local formations of the Mediterranean region of France developed on high plateaux, north-facing slopes and in clearings of pubescent oak woodlands.
- 34.3265 South-western Alpine *Mesobromion***
 Formations occupying considerable surfaces of the supra-Mediterranean and montane zones of the southern Alps, where their line of demarcation from the grasslands of 32.322 can be, somewhat arbitrarily, placed at the line which, through the Col de Rousset, the Col de la Croix Haute and the Col Bayard, separates the southern Alps, including the Diois, from the northern Alps, including the Vercors.

34.3266

Northern Apennine Mesobromion

Local formations of the northern Apennines, in particular in Liguria and in Tuscany.

34.327

Insubrian Mesobromion grasslands

Carici humilis-Chrysopogetum grylli fumanetosum, Andropogonetum grylli insubricum orchidetosum, i.a.

Species-rich hill and montane grasslands of Lago di Garda, Lago di Como and neighbouring areas with *Chrysopogon gryllus*, *Bromus erectus*, *Festuca rubra* s.l., *Agrostis capillaris*, *Brachypodium pinnatum*, *Carex humilis* and many orchids including the endemic *Ophrys benacensis* and *Serapias vomeracea* ssp. *vomeracea*.

34.328

Central Apennine Mesobromion grasslands

Filipendulo vulgaris-Trifolietum montani i.a.

Closed mesophile grasslands of the piani of the beech level of the Monti Sibillini and adjacent regions of the central Apennines, with a rich floristic cortège including many higher altitude species and Apennine endemics, dominated by the grasses *Bromus erectus*, *Festuca circummediterranea*, *Brachypodium pinnatum*, *Poa pratensis*, *Briza media*, *Festuca pratensis*, with *Filipendula vulgaris*, *Alchemilla glaucescens*, *Scabiosa columbaria*, *Trifolium montanum*, *Lotus corniculatus*, *Thymus longicaulis*, *Rhinanthus personatus*, *Cerastium fontanum*, *Galium anisophyllum*, and with the central Italian endemic *Gentiana columnae* on summits and slopes, *Asphodelus albus* and *Fritillaria tenella* in plains and gullies.

34.33

SUB-ATLANTIC VERY DRY CALCAREOUS GRASSLANDS

Xerobromion (Seslerio-Xerobromion)

Xerophile, open formations dominated by perennial, tuft-forming grasses, often rich in chamaephytes, colonizing superficial calcareous soils, often on steep slopes, clifftops or hilltops, in the sub-Atlantic domain of the *Quercion pubescenti-petraeae* and its northern irradiations and in the sub-Mediterranean mountains of the northern Italian peninsula, with *Bromus erectus*, *Sesleria albicans*, *Koeleria vallesiana*, *Melica ciliata*, *Stipa pennata*, *S. bavarica*, *S. capillata*, *S. pulcherrima*, *Phleum phleoides*, *Brachypodium pinnatum*, *Carex humilis*, *Fumana procumbens*, *Globularia punctata*, *Ononis pusilla*, *Helianthemum apenninum*, *H. canum*, *H. nummularium*, *Linum tenuifolium*, *Teucrium chamaedris*, *Allium sphaerocephalon*, *Arabis hirsuta*, *Anthericum liliago*, *Aster linosyris*, *Pulsatilla vulgaris*, *Biscutella laevigata*, *Orobanche teucrii*, *Artemisia alba*, *Sedum album*, *S. acre*, *Acinos arvensis*, *Hippocrepis comosa*, *Sanguisorba minor*, *Potentilla neumanniana*, *Scabiosa columbaria*, *Astragalus monspessulanus*, *Teucrium pyrenaicum*, *Ononis spinosa*, *O. natrix*.

(Lebrun *et al.*, 1949; Tüxen and Oberdorfer, 1958; Vanden Berghen, 1963; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Rivas-Martinez, 1977; Wolking and Planck, 1981; Ozenda, 1981, 1985; Noirfalise and Dethioux, 1982; Bournérias, 1984; Biondi *et al.*, 1985; Dupias, 1985; Polunin and Walters, 1985; Duvigneaud, ms, 1985; Parent, 1986; Vigo and Ninot, 1987; Oberdorfer, 1990)

34.331

British Xerobromion grasslands

Very rare, local formations of Devon and Somerset.

34.332

Middle European Xerobromion grasslands

Formations of southern Belgium, Germany, France, northern Spain and the northern Apennines. Where they occur in the vicinity of communities of the *Festucetalia valesiacae*, the latter occupy sites with more continental microclimates than those inhabited by the formations of this group.

34.3321

Mosan Xerobromion

Xerophile grasslands of the north-western Hercynian periphery, on mostly Devonian or carboniferous limestones, in the Mosan district of Belgium and the French Meuse, with outposts in the Ardenne-Eifel of Luxembourg and Rhineland; the stations are for the most part very limited in extent and widely isolated.

34.3322

Harz Xerobromion

Xerophile grasslands, on substrates derived from Mesozoic limestones of the periphery of the Harz, notably in Thuringe.

- 34.3323** **Paris basin Cretaceous *Xerobromion***
Xerophile grasslands of rare localities of the Cretaceous north-western and western periphery of the Paris basin, in particular in the valleys of the Seine and Somme.
- 34.3324** **Parisian Tertiary *Xerobromion***
Xerophile calcareous grasslands of the Parisian Tertiary in the central Paris basin.
- 34.3325** **Paris basin Jurassic *Xerobromion***
Xerophile grasslands of the north-eastern, eastern and south-eastern Jurassic belt of the Paris basin and adjacent Cretaceous areas in Lorraine, Champagne, Haute Marne, Burgundy, Haute Saône.
- 34.3326** **Middle Rhine *Xerobromion***
Xerophile calcareous grasslands of the Rhine, Mainz, Moselle, Neckar, Nahe, Lahn in their crossing of the northern Hercynian ranges.
- 34.3327** **Upper Rhine *Xerobromion***
Xerophile calcareous grasslands of the upper Rhine rift and adjacent hills, in Alsace and Baden-Württemberg.
- 34.3328** **French Jura *Xerobromion***
Xerophile calcareous grasslands of the French Jura and adjacent areas.
- 34.3329** **Swabian *Xerobromion***
Xerophile calcareous grasslands of the Swabian Alb, Lake Constance region and adjacent areas.
- 34.332A** **Franconian *Xerobromion***
Xerophile calcareous grasslands of the Franconian Alb, Franconian plateaux and adjacent areas.
- 34.332B** **North-western pre-Alpine *Xerobromion***
Hill and montane xerophile grasslands of the north-western calcareous pre-Alps.
- 34.332C** **Bavarian *Xerobromion***
Hill and montane xerophile calcareous grasslands of the Bavarian plateau.
- 34.332D** **Ligerian *Xerobromion***
Xerophile calcareous grasslands of the southern Paris basin, Berry and Auvergne.
- 34.332E** **Aquitanian *Xerobromion***
Xerophile calcareous grasslands of south-western France in Charentes, Perigord and Aquitaine.
- 34.332F** **Quercy *Xerobromion***
Xerophile calcareous grasslands of Quercy.
- 34.332G** **Pyrenean *Xerobromion***
Hill and montane xerophile calcareous grasslands of the Pyrenees and adjacent areas; in the pubescent oak level of the eastern part of the range *Xerobromion* grasslands with *Koeleria vallesiana*, *Festuca ovina s.l.* and *Bromus erectus* come in contact with *Aphyllanthion* formations occupying more humid soils and with closed postcultural *Brachypodium* grasslands of the *Brachypodium phoenicoidis*. On the south side of the range, xerophile pastures are represented in lower zones and on the protected south-facing slopes (adrets) by communities of the *Aphyllanthion*, of decidedly Mediterranean hue, while the formations of the *Xerobromion*, of more Euro-Siberian character, occupy the other situations. Chamaephytes such as *Helianthemum nummularium*, *Artemisia alba*, *Teucrium pyrenaicum*, *Ononis spinosa*, *O. natrix* are abundant alongside the gramineous *Phleum phleoides*, *Festuca ovina s.l.*, and *Carex humilis*.
- 34.332H** **South-western Alpine *Xerobromion***
Xerobromion grasslands of the south-western Alps.

34.3321

Northern Apennine Xerobromion*Coronillo minima*-*Astragaletum monspessulani*, *Xerobrometum apenninum*

Open, arid pastures developed in the thermophilous deciduous *Quercus cerris*-*Q. pubescens*-*Ostrya carpinifolia* belt of the northern Apennines, south approximately to the area of the Monte della Luna, south-eastern Tuscany, where they occupy arenaceous-marly substrates and come in contact with the grasslands of unit 34.74, located on limestones and much richer in Apennine endemics. At their southern limit, the northern formations are rich in chamaephytes, notably *Coronilla minima*, *Asperula purpurea*, *Fumana procumbens*, alongside *Astragalus monspessulanus*, *Bromus erectus*, *Brachypodium pinnatum* and *Festuca inops*.

34.34

CENTRAL EUROPEAN CALCARO-SILICEOUS GRASSLANDS*Koelerio-Phleion phleoidis* (*Armerion elongatae*, *Sedo-Cerastion* p.)

Low-altitude xerophile, rupicolous psammophilous, grasslands of slightly calcareous substrates, with *Festuca heteropachys*, *F. trachyphylla*, *Koeleria macrantha* (= *K. gracilis*), *Phleum phleoides*, *Armeria elongata*, *Artemisia campestris*, *Aster linosyris*, *Lychnis viscaria*, *Silene otites*, *S. nutans*, *Chamaespartium sagittale*, *Campanula patula*, *Potentilla rupestris*, *Helianthemum nummularium* ssp. *obscurum*, *H. apenninum*, *Scleranthus perennis*, *Allium senescens* ssp. *montanum*.

(De Sloover and Lebrun, 1984; Van Dijk *et al.*, 1984; Duvigneaud, ms, 1985; Parent, 1986; Duvigneaud and Saintenoy-Simon, 1988; Ellenberg, 1988; Oberdorfer, 1990)

34.341

Calcareo-siliceous rock grasslands

Rupicolous communities, colonizing in particular deep cracks and ledges of calcareo-siliceous rocky slopes or cliffs, with, notably, *Festuca heteropachys*, *Artemisia campestris*, *Aster linosyris*, *Lychnis viscaria*, *Potentilla rupestris*. The range of these formations is centered on the Hercynian ranges of middle Germany (notably Rhine, Nahe, Moselle, Mainz valleys and Harz periphery), extending west to Alsace and to extremely rare and isolated outposts in Ardenne valleys of Luxembourg, Belgium and France, where they are represented by *Festuca heteropachys* or *Potentilla rupestris* grasslands.

34.342

Slightly calcareous sands grasslands

Closed, perennial communities of slightly calcareous sands, in particular of old riverine dunes, with *Armeria elongata*, *Sedum sexangulare*, *Carex ligERICA*, *Helichrysum arenaria*. Mostly characteristic of central Europe, these formations extend west to the fluvial district of the Netherlands.

34.35

PALE FESCUE GRASSLANDS*Festucion pallentis* (*Seslerio-Festucion pallescentis*)

Xeric, thermophile grasslands of middle European calcareous rock cracks, mostly dominated by the strong tufts of the glaucous *Festuca pallens* and *F. pannonica* and of the green *Sesleria albicans*, and with *Dianthus gratianopolitanus*, *Melica ciliata*, *Aster alpinus*, *Artemisia campestris* ssp. *lednicensis*, *Hieracium* spp., *Biscutella laevigata* ssp. *varia*, *Teucrium botrys*, *Allium strictum*, locally distributed in the Rhenish Schist Massif, the Pfälzerwald, the Rhine-Nahe-Mainz valleys, the Rhön, the Harz and its periphery, the Black Forest foothills, the French, Swabian and Franconian Juras. The communities of the *Festucion pallescentis* often occupy isolated stations and include rare or relictual species which impart to many of them a distinctive biogeographical and physiognomic individuality. In particular, rare and highly disjunct western outposts occur in the Meuse basin of the Belgian and French Ardennes, harbouring, among others, very isolated populations of *Draba aizoides* var. *montana*, *Artemisia alba* ssp. *saxatilis* and *Hieracium vogesiacum*.

(Schumacher, 1977; Duvigneaud, 1982c, ms 1985; Parent, 1986; Ellenberg, 1988; Oberdorfer, 1990)

34.36

PHOENICIAN TORGRASS SWARDS*Brachypodietalia phoenicoidis*

Closed, dry perennial grasslands of eutrophic soils within the meso- and thermo-Mediterranean zones, often on post-cultural land, formed by relatively tall grasses and usually dominated by *Brachypodium phoenicoides*, with, among many others, *Phleum bertolonii* (= *P. nodosum*, *P. pratense*), *Elymus repens*, *Carex divisa*, *Carthamus lanatus*, *Diptotaxis viminea*, *Echinops ritro*, *Euphorbia serrata*, *Echium vulgare*, *E. pustulatum*, *Erodium acaule*, *Galactites tomentosa*, *Lepidium graminifolium*, *Medicago orbicularis*, *Salvia verbenaca*, *Foeniculum vulgare*, *Pallenis spinosa*, *Psoralea bituminosa*, *Seseli tortuosum*, *Tragopogon australis*, *Scabiosa atropurpurea*, *Verbascum sinuatum*, *Picris hieracioides*, *Calamintha nepeta*, *Centaurea aspera*, *Vicia hybrida*, *Phlomis herba-venti* and many orchids.

(Molinier, 1957; Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Rivas-Martinez, 1977a; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Devaux *et al.*, 1983; Duvigneaud, ms, 1985; Martinez Parras and Peinado Lorca, 1987; Costa, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987)

34.4

THERMOPHILE FOREST FRINGES*Trifolio-Geranietea*

Woodland edge (hem) communities of warmth-requiring drought-resistant herbaceous perennials and frutescent vegetation forming a belt between dry or mesophile grasslands and the shrubby forest mantle, on the sunny side, where the nutrient supply is limited, or, sometimes, pioneering the woodland colonization into the grasslands.

(Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Schumacher, 1977; Vanden Berghen, 1982; Duvigneaud, ms, 1985; Oberdorfer, 1990)

34.41

XERO-THERMOPHILE FRINGES*Geranium sanguinei*

Hems of xero-thermic mixed oak woods of the *Quercetalia pubescenti-petraeae* and related communities, with *Geranium sanguineum*, *Vincetoxicum hirundinaria*, *Tanacetum corymbosum*, *Bupleurum falcatum*, *B. longifolium*, *Origanum vulgare*, *Dictamnus albus*, *Anthericum ramosum*, *Fragaria viridis*, *Anemone sylvestris*, *Lathyrus pannonicus*, *Peucedanum officinale*, *P. cervaria*, *P. alsaticum*, *Laserpitium latifolium*, *Polygonatum odoratum*, *Rosa pimpinellifolia*, *Trifolium rubens*, *Clematis recta*, *Coronilla coronata*, *Melampyrum cristatum*, *Campanula bononiensis*, *C. rapunculoides*, *C. persicifolia*, *Veronica teucrium*.

34.42

MESOPHILE FRINGES*Trifolion medii*

More mesophile hems of *Carpinion* and *Fagion* woods, developed on deeper soil, with *Trifolium medium*, *T. ochroleucum*, *Campanula baumgartenii*, *Origanum vulgare*, *Melampyrum nemorosum*, *M. pratense*, *Valeriana wallrothii*, *Agrimonia eupatoria*, *Vicia cassubica*, *V. dumetorum*, *V. orobus*, *V. sylvatica*, *Lathyrus latifolius*, *Teucrium scorodonia*.

34.5

MEDITERRANEAN XERIC GRASSLANDS*Thero-Brachypodietea*

Meso- and thermo-Mediterranean xerophile, mostly open, short-grass perennial grasslands rich in therophytes; therophyte communities of oligotrophic soils on base-rich, often calcareous substrates.

(Rechinger, 1951; Duvigneaud, 1953; Molinier, 1957; Vanden Berghen, 1963, 1982; Archiloque *et al.*, 1969; Braun-Blanquet, 1971b, 1973; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Diez Garretas *et al.*, 1977; Sutter, 1977; Jovet and Vilmorin, 1979; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Barbero *et al.*, 1982; Guéry, 1983; Devaux *et al.*, 1983; Terrisse, 1983; Peinado Lorca *et al.*, 1984; Brullo, 1985; Peinado Lorca and Rivas-Martinez, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987)

34.51

WEST MEDITERRANEAN XERIC GRASSLANDS

Formations of Spain, southern France, the large west Mediterranean islands and Italy.

34.511

Retuse torgress swards*Brachypodienion retusi* (*Brachypodium retusi*)

Grasslands dominated by *Brachypodium retusum* and with many therophytes and geophytes, often alternating in mosaic fashion with garrigues or occupying their clearings.

34.512

Crau steppe*Asphodeletum fistulosi*

Open grasslands of the coussous still covering vast but dwindling expanses of the Crau, fossil delta of the Durance, with *Brachypodium retusum*, *Stipa capillata*, *Dichanthium ischaemum*, *Elymus caput-medusae*, *Thymus vulgaris*, *Bellis sylvestris*, *Asphodelus fistulosus*, *Euphorbia seguieriana*, *Linum gallicum*, *Salvia multifida*, *Bufoia macrosperma*; they support a fauna of exceptional originality.

34.513

Mediterranean annual communities of shallow soils*Brachypodietalia distachyae*

Spring-blooming, summer-dessicated formations of therophytes developed on base-rich, often calcareous, superficial soils with annual grasses such as *Bromus fasciculatus*, *Brachypodium distachyum*, *Lagurus ovatus*, *Stipa capensis*, *Parapholis incurva*, *Hainardia cylindrica*, *Echinaria todaroana*, *Desmazeria marina*, *D. sicula*, *D. zwierleinii*, *Lamarckia aurea*, *Narduroides salzmännii*, *Vulpia unilateralis*, *Ctenopsis gypsophila*, a few perennial grasses (e.g. *Koeleria splendens*, *Dactylis hispanica*) and numerous flowering plants, many of them annuals, and a very significant number restricted endemics; among the characteristic species are *Silene tridentata*, *S. neglecta*, *S. sedoides*, *Paronychia argentea*, *Arenaria capillipes*, *Ionopsidium prolongoi*, *Erophila verna*, *Astragalus sesameus*, *Ononis ornithopodioides*, *O. oligophylla*, *O. sieberi*, *Onobrychis aequidentata*, *Trigonella monspeliaca*, *T. polycerata*, *Plantago albicans*, *P. coronopus*, *P. afra*, *P. amplexicaulis*, *P. notata*, *P. ovata*, *Polygala monspeliaca*, *Convolvulus lineatus*, *Eryngium dichotomum*, *E. triquetrum*, *E. ilicifolium*, *Hedysarum spinosissimum*, *Callipeltis cucullaris*, *Catananche lutea*, *Daucus aureus*, *D. lopadusanus*, *D. bocconeii*, *Nigella arvensis*, *Scorzonera laciniata*, *Lavatera agrifolia*, *Scabiosa parviflora*, *Anthemis muricata*, *Senecio leucanthemifolius*, *Limonium calcarae*, *L. echioides*, *L. thouinii*, *Campanula fastigiata*, *C. erinus*, *Erodium pulverulentum*, *Iberis fontqueri*, *Viola demetria*, *Arabis verna*, *Brassica souliei*, *Aster sorrentinii*, *Asteriscus aquaticus*, *Echium parviflorum*, *Bellis annua*, *Matricaria aurea*, *Linaria reflexa*, *L. pseudolaxiflora*, *L. amethystea*, *L. huteri*, *L. platycalix*, *L. satirejoides*, *L. clementei*, *Filago cossyrensis*, *Valantia calva*, *Sedum litoreum*, *S. caeruleum*, *S. stellatum*, *Saxifraga tridactylites*, *Hornungia petraea*, *Parietaria cretica*, *Biscutella lyrata*, *Anagallis monelli*, *Fedia cornucopiae*, *Evax pygmaea*, *Jasione penicillata*, *Andryala ragusina*, *Allium pallens* ssp. *siciliense*, *A. agrigentinum*, *A. chamaemoly*. Various combinations of the species above enter in the constitution of numerous distinctive, often ephemeral and very local communities restricted to small surfaces among, or in clearings of, other formations. The more widespread pastures dominated by annual grasses are for the most part sub-nitrophilous and better classified under 34.8.

34.5131

Western Mediterranean calciphile annual communities*Thero-Brachypodion = Trachynion distachyae*

Thermo-, meso- and occasionally supra-Mediterranean calciphile formations of Mediterranean France, Iberia and Italy.

34.5132

South-eastern Iberian pre-desert annual communities*Stipion capensis*

Ephemereal formations of the arid Iberian South-east, appearing among the pre-desert scrub communities of 32.25.

34.5133

Iberian gypsum annual communities*Sedo-Ctenopsion gypsophilae*

Formations of small annuals developing on gypsum soils of interior Iberia, among the gypsum-scrub communities of 15.19.

34.5134

Andalusian magnesium annual communities*Omphalodion brassicifoliae*

Formations on dolomites, ophiolites, peridotites and serpentines of Andalusia, developing among garrigue communities of 32.28.

34.5135

Sicilian saxicolous annual communities*Plantagini-Catapodion marini*

Formations of Sicily, Linosa, Lampedusa and Pantelleria, sometimes subhalophile, developed on steep slopes, exposed crests, coastal rocks and volcanic material, often among the rocky shore communities of 18.22 or the pre-desert scrub of 32.255.

34.5136

Northern Sicilian aster annual communities*Dauco-Catananchion luteae: Asteretum sorrentinii*

Aster sorrentini formations of steep clay and marl slopes of northern Sicily.

34.5137

Calabro-Sicilian esparto annual communities*Dauco-Catananchion luteae p.*

Annual formations accompanying the *Lygeum spartum* steppes of southern Calabria and Sicily.

- 34.514** **Causse dolomitic arenas**
Armerion juncea
 Very open formations colonizing, within the supra-Mediterranean steppe zone of the Causses (34.71), local deposits of dolomitic sands, characterized by *Armeria girardii* (= *juncea*), *Arenaria aggregata*, *Helianthemum pilosum*, *Sedum ochroleucum*, *Alkanna tinctoria*, *Alyssum serpyllifolium*, *Helichrysum stoechas*, *Silene otites*, *Aster alpinus*, *Festuca christianii-bernardii*, *Corynephorus canescens*, *Phleum arenarium*.
- 34.52** **SOUTH-WESTERN MEDITERRANEAN PERENNIAL PASTURES**
Poetea bulbosae
 Iberian xerophile, intensively grazed pastures of both siliceous and calcareous substrates, dominated by short, perennial grasses, rich in specialized annuals, in particular peas and composites.
- 34.53** **EAST MEDITERRANEAN XERIC GRASSLANDS**
Brachypodio-Chrysopogonetea p.
 Formations of continental, peninsular and insular Greece.
- 34.531** **Eastern retuse torgrass swards**
 Grasslands dominated by *Brachypodium retusum* and with many therophytes and geophytes, often alternating in mosaic fashion with garrigues and phrygas or occupying their clearings.
- 34.532** **Eastern short-grass steppes and therophyte communities**
 Open, short, grasslands of thermo- and meso-Mediterranean Greece and its islands with numerous annual grasses such as *Bromus fasciculatus*, *B. madritensis*, *B. intermedius*, *B. alopecurus*, *B. rubens*, *Brachypodium distachyum*, *Aegilops neglecta*, *A. geniculata*, *A. triuncialis*, *Avena sterilis*, *A. barbata*, *Lagurus ovatus*, *Cynosurus echinatus*, *Stipa capensis*, but sometimes with a strong representation of short or medium-sized perennial grasses such as *Hyparrhenia hirta*, *Andropogon distachyos*, *Cynodon dactylon*, *Dactylis hispanica*. They are very rich in annual flowering plants, among which of genera *Euphorbia*, *Silene*, *Nigella*, *Adonis*, *Papaver*, *Fumaria*, *Biscutella*, *Rapistrum*, *Althaea*, *Malva*, *Linum*, *Geranium*, *Astragalus*, *Ononis*, *Trigonella*, *Medicago*, *Melilotus*, *Trifolium*, *Lotus*, *Coronilla*, *Scorpiurus*, *Hedysarum*, *Onobrychis*, *Bupleurum*, *Daucus*, *Anagallis*, *Orobanche*, *Plantago*, *Centaureum*, *Galium*, *Evax*, *Filago*, *Pallenis*, *Anthemis*, *Chrysanthemum*, *Tragopogon*, suffrutescent labiates of genera *Teucrium*, *Thymus*, *Ballota*, *Phlomis*, *Micromeria*, *Salvia* and others, and geophytes such as *Urginea maritima*, *Asphodelus microcarpus*, *Lloydia graeca*, *Allium spp.*, *Ornithogalum spp.*, *Muscari spp.*, *Romulea spp.*, *Orchis spp.*, *Ophrys spp.*, *Anacamptis pyramidalis*. They constitute a wide array of distinctive communities, many of them very local and restricted to small surfaces. Many of the more extensive pastures, in particular those dominated by annual grasses, are sub-nitrophilous or nitrophilous and may be better classified under 34.8.
- 34.6** **MEDITERRANEAN TALL-GRASS STEPPES**
Lygeo-Stipetea, Rosmarinetalia p. Brachypodio-Chrysopogonetea p.
 Meso-, thermo- and sometimes supra-Mediterranean formations physiognomically dominated by tall grasses, between which may grow communities of annuals or sometimes chamaephytes; they are most characteristic of the Iberian peninsula, with local representations in southern Provence, Sardinia, southern peninsular Italy, Sicily and Greece. They include silicolous as well as basiphile formations.
 (Rechinger, 1951; Braun-Blanquet and Bolos, 1954; Molinier, 1957; Delvosalle and Duvigneaud, 1962; Polunin and Smythies, 1973; Costa, 1973, 1974; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Peinado Lorca, *et al.*, 1984; Brullo, 1985; Polunin and Walters, 1985; Peinado Lorca and Rivas-Martinez, 1987; Asensi Marfil and Diez Garretas, 1987; Martinez Parras and Peinado Lorca, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987)
- 34.61** **ALPHA STEPPES**
Stipa tenacissima-dominated formations of Spain, distributed mostly on the Meseta, in the Maestrazgo, in the Guadalquivir basin, in Baetic regions and in the arid Iberian South-east.

- 34.62** **ESPARTO STEPPES**
Lygeum spartum-dominated formations of the Ebro basin, the arid Iberian South-east, the Guadalquivir basin, Sardinia, Sicily, southern Italy and Crete.
- 34.621** **Iberian esparto steppes**
Sometimes extensive *Lygeum spartum*-dominated formations of the Ebro basin, the arid Iberian South-east and the Guadalquivir basin.
- 34.622** **Central Mediterranean esparto steppes**
More restricted *Lygeum spartum*-dominated formations of Sardinia and Sicily.
- 34.623** **Cretan esparto steppes**
Rare and isolated *Lygeum spartum*-dominated formations of the south coast of Crete.
- 34.63** **BERCEALES, FEATHERGRASS, DISS, ANDROPOGONID, FESCUE STEPPES**
Other Mediterranean tall-grass steppes.
- 34.631** **Berceales**
Stipa gigantea-dominated formations of central and southern Spain, mostly on siliceous soils.
- 34.632** **Mediterranean feathergrass steppes**
Centaureo-Stipetum lagascae, *Inulo-Oryzopsietum milliaceae* i.a.
Meso- and thermo-Mediterranean formations of Spain, Italy, Greece and southern France, dominated by tall perennial grasses of genera *Stipa* (*S. lagascae*, *S. offneri* i.a.) or *Piptatherum* (*Oryzopsis*), other than the very tall *Stipa tenacissima* or *S. gigantea*.
- 34.633** **Diss steppes**
Formations of Italy, Spain and Greece, dominated by *Ampelodesmos mauritanica*; many chamaephyte and diss formations have the physiognomy of a garrigue or a brush and have been listed under 32.23.
- 34.634** **Andropogonid grass steppes**
Lygeo-Stipetea p.: *Hyparrhienietalia hirtae* i.a.; *Brachypodio-Chrysopogonetea* p.
Meso- and thermo-Mediterranean steppes of Spain, Italy, Greece and southern France, constituted by cespitose andropogonid grasses such as *Hyparrhenia hirta*, *Andropogon distachyos*, *Heteropogon contortus*, *Dichanthium insculptum*, *D. ischaemum* or *Chrysopogon gryllus*.
- 34.635** **Andalusian fescue and oat grasslands**
Festucion scariosae
Meso- and supra-Mediterranean grasslands of the Baetic region dominated by the tall, cespitose *Festuca scariosa*, *F. capillifolia*, *Arrhenatherum album*, *Helictotrichon filifolium* and *H. sarracenorum*.
- 34.6351** **Calicolous fescue and oat grasslands**
Helictotricho filifolii-Festucetum scariosae
Formations of calcareous and dolomitic soils of the Serrania de Ronda mountain system, the peripheral ranges of the Sierra Nevada and the Sierra de Alhamilla.
- 34.6352** **Silicicolous fescue and oat grasslands**
Dactylo hispanicae-Festucetum scariosae
Formations of siliceous soils of the Sierra Nevada, the Sierra de Cabrera and the Sierra de Alhamilla.
- 34.6353** **Carrascoy fescue and oat grasslands**
Daphno-Festucetum capillifoliae
Formations of siliceous soils of the Sierra de Carrascoy.

34.7

MEDITERRANEO-MONTANE GRASSLANDS

Ononido-Rosmarinetea p.

Open perennial grasslands, often rich in chamaephytes, most characteristic of the thermophilous oak level of Iberia, southern France, southern Italy and Greece. Some of the largest remaining expanses of unbroken grasslands in Europe, of evident importance as faunal habitats, belong to this division.

34.71

MEDITERRANEO-MONTANE STEPPES

Ononidion striatae

Sparse or discontinuous xerophile grasslands of *Stipa pennata*, *Festuca auquieri* (*F. duriuscula*), *F. hervieri*, *Koeleria vallesiana* or *Sesleria albicans* var. *elegantissima* with *Helianthemum apenninum*, *H. canum*, *Genista* spp., *Globularia* spp., *Ononis striata*, *Euphorbia seguieriana*, *Potentilla crantzii*, *Thymus dolomiticus*, *Plantago argentea*, *Rosa pimpinellifolia*, *Dianthus sylvestris*, *Lavandula angustifolia*, *Aster alpinus*, *Anthyllis* spp., *Carex humilis*, best developed in the Causses, but also present locally in Provence and Languedoc, from the Alps to Catalonia.

(Duvigneaud, 1953; Vanden Berghen, 1963; Rivas-Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969; Braun-Blanquet, 1971b; Guinochet and Vilmorin, 1973; Girerd, 1978; Jovet and Vilmoran, 1979; Martin and Molinier, 1980; Ozenda, 1981; Barbero *et al.*, 1982; Bernard and Fabre, 1983; Guillot, 1983; Terrisse, 1983; Lahondère, 1983; Deschatres, 1983; Rivas-Martinez *et al.*, 1984; Polunin and Walters, 1985; Dupias, 1985; Peinado Lorca and Rivas-Martinez, 1987)

34.711

Mediterraneo-montane *Stipa* steppes*Stipo-Ononidetum striatae p.*, *Festucetum duriusculae calciense p.*, *Potentillo velutinae-Ononidetum striatae*

Steppes dominated by *Stipa pennata*, with *Festuca auquieri*, *Koeleria vallesiana*, *Brachypodium pinnatum*, *Ononis striata*, occupying vast expanses of the Causses, and locally represented on crests and plateaux of Haute Provence, the south-eastern Alps and the Corbières.

34.7111

Causses *Stipa* steppes*Stipo-Ononidetum striatae*

Very extensive *Stipa* grasslands of the plateaux of the Causses.

34.7112

Upper Provence *Stipa* steppes

Mediterraneo-montane *Stipa*-rich grasslands of southern France outside of the Causses, for the most part occupying small surfaces interspersed with other formations, but sometimes constituting dominant habitats over very significant surfaces, such as the plateau of Caussols.

34.712

Mediterraneo-montane *Sesleria* steppes*Seslerio-Phyteumetum* = *Helianthemeto-Seslerietum*; *Conopodio-Seslerietum elegantissimae*; *Seslerieto-Gentianetum corbariensis*, *Seslerietum mediterraneo-montanum*, *Erysimito-Seslerietum caeruleae*

More closed *Sesleria albicans* var. *elegantissima*-dominated grasslands occupying usually exiguous surfaces of somewhat shaded slopes, ledges, rocky corridors and snow-retaining cliff-bases in the Causses and other low mountains of the Mediterranean periphery of southern France and Catalonia, in particular Montserrat, the Corbières, the Montagne d'Alaric and western Provence.

34.713

Mediterraneo-montane *Festuca-Koeleria* steppes

Mediterraneo-montane steppe-grasslands poor in *Stipa pennata*, for the most part *Festuca auquieri*-, *Koeleria vallesiana*- or *Carex humilis*-dominated facies of 34.711.

34.7131

Causses short *Festuca* swards*Festucetum duriusculae calciense p.*, *Astero-Anthyllidetum p.*

Short, very open grasslands of the Causses dominated by *Festuca auquieri*, *Ononis striata*, or *Thymus praecox*.

34.7132

Causses *Carex-Anthyllis* swards*Astero-Anthyllidetum montanae*

Carex humilis-*Anthyllis montana* formations of small windswept buttes and stony knolls of the Causses with *Aster alpinus* var. *cebennensis* and *Festuca auquieri*.

34.7133

Franco-Iberian Mediterraneo-montane steppes

Other Mediterraneo-montane formations with *Ononis striata*, *Anthyllis montana*, *Festuca* spp. or *Koeleria vallesiana*, locally distributed in southern France and north-eastern Spain.

34.714

Mediterraneo-montane *Artemisia* steppes

Open formations with *Artemisia alba* and *Hyssopus officinalis*, rich in chamaephytes, of eroded steep slopes of the Causses, harbouring, in particular, *Convolvulus cantabricus* and *Allium flavum*; similar formations of the south-western Alps appear best included in the sub-continental steppe-grasslands (34.314).

34.72

APHYLLANTHES GRASSLANDS AND SUPRA-MEDITERRANEAN STEPPES***Aphyllanthion* p.**

Coarse or steppe-like grasslands rich in chamaephytes of pronounced Mediterranean affinities formed as a degradation stage of thermophile deciduous oak forests, or of *Quercus rotundifolia* forests, in the supra-Mediterranean belt of Iberia, southern France and Liguria; grassland facies of the supra-Mediterranean garrigues (32.6) and hedgehog-heaths (31.7). (Duvigneaud, 1953; Vanden Berghen, 1963; Rivas-Goday and Rivas-Martinez, 1968; Guinochet and Vilmorin, 1973; Lapraz, 1976; Molinier and Martin, 1980; Ozenda, 1981; Guéry, 1983; Polunin and Walters, 1985; Dupias, 1985; Bolos and Capdevila, 1987; Vigo and Ninot, 1987)

34.721

***Aphyllanthes* grasslands**

Supra- and upper meso-Mediterranean grasslands, often on compact calcareous marls, dominated by, or rich in, the rush-like lily *Aphyllanthes monspeliensis* and with *Catananche caerulea*, *Linum suffruticosum* ssp. *suffruticosum* and ssp. *salsoloides*, *L. narbonense*, *L. strictum*, *L. campanulatum*, *L. tenuifolium*, *Dorycnium suffruticosum*, *Stachelina dubia*, *Lavandula latifolia*, *Potentilla crantzii*, *Stipa offneri*, *S. iberica*, *Koeleria vallesiana*, *Brachypodium phoenicoides*, *Carex humilis* of southern France, northern and north-eastern Spain, and Liguria.

34.722

Supra-Mediterranean feathergrass steppes

Steppe-like *Stipa*-dominated supra-Mediterranean garrigues and hedgehog-heaths of the mountains and plateaux of eastern Spain; *Stipa*-dominated facies of *Aphyllanthes* grasslands.

34.73

IBERIAN FESCUE FROST-GRASSLANDS***Festuco-Poetalia ligulatae*: *Festuco-Poion ligulatae* p., *Festucion burnatii* p.**

Supra-Mediterranean and montane psychro-xerophile, open perennial grasslands of the Cantabrian and Iberian ranges particularly characteristic of frost-fashioned, snow-free, superficial soils of the *Juniperus thurifera* and *J. sabina* environments, rich in *Festuca hystrix*, *F. burnatii*, *Poa ligulata* and with, among others, *Armeria bigerrensis* ssp. *legionensis*, *Arenaria aggregata* ssp. *cantabrica*, *Centaurea janeri* ssp. *babiana*, *Draba cantabrigae*, *Saxifraga conifera*, *Ononis striata*, *O. cristata*, *O. pusilla*, *Coronilla minima*, *Paronychia kapela* ssp. *serpyllifolia*, *Helianthemum canum*, *Carex humilis*. They ascend to the oro-Mediterranean level and extend south-east to the eastern Baetic chains.

(Rivas-Martinez, Diaz *et al.*, 1984; Navarro Andres and Valle Gutierrez, 1987; Martinez Parras and Peinado Lorca, 1987; Costa, 1987)

CENTRAL AND SOUTHERN APENNINE DRY GRASSLANDS***Crepido lacerae-Phleion ambigui***

Open grasslands of calcareous substrates of the middle and southern Apennines, southern vicariant of the *Xerobromion*, with *Bromus erectus*, *Sideritis syriaca* and many Apennine endemics or subendemics such as *Crepis lacera*, *Centaurea rupestris* ssp. *ceratophylla*, *Phleum ambiguum*, *Carex macrolepis*. Many distinctive communities exist in this unit, home still covering vast expanses of land of exceptional biological significance such as Campo Imperatore in the Gran Sasso range; a few examples are cited below, others may be added.

(Bonin, 1971; Biondi and Blasi, 1982; Biondi *et al.*, 1985)

Upper central Apennine dry grasslands***Asperulo purpureae-Brometum erecti***

Grasslands of the 350-1 350 m range of the central Apennines with *Asperula purpurea*, *Eryngium amethystinum*, *Crepis lacera*, *Allium sphaerocephalon*, *Teucrium montanum*.

- 34.742** Lower central Apennine dry grasslands
Trigonello monspeliacae-Sideritum syriacae
Grasslands of the lower sectors of the central Apennines (average 800 m) developed on well-exposed surfaces and somewhat marly calcareous soils with *Trigonella monspeliaca*, *T. gladiata*, *Sideritis syriaca*, *Ononis variegata*.
- 34.743** Apennine brushy dry grasslands
Saturejo montanae-Brometum erecti
Chamaephyte-rich grasslands of the central-southern and southern Apennines, generally below the level of 34.744, with *Satureja montana*, *Sideritis syriaca*, *Plantago sempervirens*, *Globularia punctata*, *Chamaecytisus spinescens*, *C. hirsutus*, *Scabiosa crenata*, *Helichrysum italicum*, *Lavandula angustifolia*, *Teucrium montanum*, *Asphodeline lutea*, *Stipa pennata*, *Bromus erectus*, *B. caprinus*, *Avenula pretutiana*.
- 34.744** Apennine upper montane dry grasslands
Seslerio nitidae-Brometum erecti
Grasslands of high montane zones (upper fringe of the beech zone, average 1 250 m) of the central and southern Apennines, transitional towards alpine grasslands (36), with *Sesleria nitida*, *S. tenuifolia*, *Festuca dimorpha*, *Potentilla cinerea*, *Carex macrolepis*, *Chamaecytisus polytrichus*.
- 34.75** EASTERN SUB-MEDITERRANEAN DRY GRASSLANDS
Brachypodio-Chrysopogonetea p.
Xeric grasslands of the sub-Mediterranean zones of Trieste and of the *Ostryo-Carpinion* zone of Greece, where they coexist with steppic grasslands of the *Festucetalia valesiacae* (34.311), developing in areas of lesser continentality than the latter, and incorporating a greater Mediterranean element than they do; like the steppic grasslands, however, they are often dominated by *Carex humilis* or *Festuca rupicola*.
(Horvat *et al.*, 1974)
- 34.8** MEDITERRANEAN SUBNITROPHILOUS GRASSLANDS
Brometalia rubenti-tectori i.a.
Formations composed mostly of annuals, in particular, grasses of genera *Bromus*, *Aegilops*, *Avena*, *Vulpia*, crucifers and leguminous plants, that occupy considerable expanses of the western, central and eastern meso- and thermo-Mediterranean zones on soils slightly enriched in nitrates. These communities develop as pioneers of bare soils slightly nitrified by aeration or organic addition, along roads, on land-fills and in interstitial spaces of cultivation. They also replace the oligotrophic annual communities included in the Mediterranean xeric grasslands (34.51, 34.53) under the influence of pastoral activities. They are widespread as post-cultural formations. They evolve through intensive grazing into perennial pastures of the *Poetalia bulbosae* and related communities (34.52), through increased nitrification into ruderal formations (87), through an increase in edaphic humidity into amphibious communities (22.3) and perennial andropogonid steppes (34.634) or Phoenician torgrass swards (34.36). Ligneous recolonization may lead either to halo-nitrophilous scrubs of the *Salsolo-Peganetalia* (15.17), or to maquis and garrigues of the *Rosmarinetalia*, *Lavanduletalia* or *Gypsophiletalia* (32, 15.19).
(Rechinger, 1951; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Izco, 1977; Peinado Lorca *et al.*, 1984; Herranz Sanz and Gomez Campo, 1986; Ladero Alvarez, 1987; Rivas-Martinez and Costa, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987)
- 34.81** MEDITERRANEAN SUBNITROPHILOUS GRASS COMMUNITIES
Taeniatheo-Aegilopion geniculatae, Brachypodio-Chrysopogonetea p.
Graminoid formations with *Bromus fasciculatus*, *B. madritensis*, *B. intermedius*, *B. alopecuroides*, *B. rubens*, *B. hordeaceus*, *B. tectorum*, *Aegilops neglecta*, *A. geniculata*, *A. triuncialis*, *A. ventricosa*, *Taeniatheum caput-medusae*, *Avena sterilis*, *A. barbata*, *Lagurus ovatus*, *Lolium rigidum*, *Vulpia ciliata*, *V. bromoides*, *V. geniculata*, *Lamarckia aurea*, *Trisetum paniceum*, *Cynosurus echinatus*, *Stipa capensis*, and with *Scandix australis*, *Astragalus scorpioides*, *Trifolium cherleri*, *T. hirtum*, *T. striatum*, *T. campestre*, *T. arvense*, *T. glomeratum*, *Viccia lutea*, *Medicago rigidula*, *M. sativa*, *M. littoralis*, *Melilotus sulcata*, *Coronilla scorpioides*, *Filago minima*, *Paronychia argentea*, particularly widespread in Iberia, southern Italy and Greece where they may cover vast expanses of post-cultural or extensive pasture lands, also locally represented in southern France and coastal northern Italy.

34.82

MESETA SUBNITROPHILOUS CRUCIFER COMMUNITIES

Alyso-Brassicion barrelieri

Brassicoid formations of the Spanish Meseta with *Brassica barrelieri*, *Andryala arenaria*, *Alyssum granatense*, *Rhynchosinapsis hispida*, *Euphorbia matritensis*, *Sisymbrium contortum*, *Papaver argemone*, *Hirschfeldia incana*, *Capsella rubella*.

34.83

IBERIAN SOUTH-EASTERN SUBNITROPHILOUS HERB COMMUNITIES

Carrichtero-Amberboion

Formations of the arid Iberian South-east with *Astragalus longidentatus*, *Brassica cossoniana*, *Carrichtera annua*, *Euphorbia dracunculoides*, *Lasiopogon muscoides*, *Leontodon salzmannii*, *Lotus edulis*, *Lycocarpus fugax*, *Matthiola lunata*, *M. parviflora*, *Notoceras bicornis*, *Volutaria (Amberboa) lippii*.

34.84

EASTERN MEDITERRANEAN SUBNITROPHILOUS HERB COMMUNITIES

Annual herb formations of arid areas of the Aegean (e.g. eastern Crete), developed in particular as ultimate degradation of overgrazed phrygas.

35 Dry siliceous grasslands

Poor Atlantic and sub-Atlantic mat-grasslands of strongly acid soils; grasslands of decalcified sands; Mediterranean siliceous grasslands.

35.1

ATLANTIC MAT-GRASS SWARDS AND RELATED COMMUNITIES

Nardetalia: Violo-Nardion (Nardo-Galion saxatilis, Violion caninae)

Closed, dry or mesophile, perennial grasslands occupying acid soils in Atlantic or sub-Atlantic lowland, collinar and montane regions of middle Europe and western Iberia, with *Nardus stricta*, *Festuca filiformis* (*F. tenuifolia*), *F. ovina*, *F. rubra*, *Agrostis capillaris*, *Danthonia decumbens*, *Anthoxanthum odoratum*, *Deschampsia flexuosa*, *Poa angustifolia*, *Galium saxatile*, *Polygala vulgaris*, *Viola canina*, *Meum athamanticum*, *Arnica montana*, *Centaurea nigra*, *Dianthus deltoides*, *Gentianella campestris*, *Chamaespartium sagittale*, *Jasione laevis*, *Potentilla erecta*, *Carex pilulifera*. Any of the grasses listed can dominate or co-dominate distinctive facies; *Calamagrostis epigejos* or *Carex arenaria* also can invade and dominate some formations.

(Tüxen and Oberdorfer, 1958; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Schumacker, 1973; Barkman, 1973; Stieperaere, 1973; Westhoff and den Held, 1975; Sougnez, 1977; De Sloover *et al.*, 1978; Perkins, 1978; Noirfalise *et al.*, 1980, 1985; Ratcliffe, 1980; Bournérias, 1984; Rivas-Martínez, Díaz *et al.*, 1984; Polunin and Walters, 1985; Loidi Arregui, 1987; Díaz Gonzalez and Fernandez Prieto, 1987; Vigo and Ninot, 1987; Oberdorfer, 1990; Hill *in litt.*, 1990)

35.11

MAT-GRASS SWARDS

Mesophile and xerophile *Nardus stricta*-dominated or -rich formations.

35.12

AGROSTIS-FESTUCA GRASSLANDS

Closed mesophile grasslands formed by *Agrostis spp.* and *Festuca spp.*; in particular, widespread sheep-grazed upland pastures of the British Isles, and especially the Scottish Highlands, with abundant *Agrostis capillaris*, *A. canina*, *Festuca ovina*, and with *Anthoxanthum odoratum*, *Holcus lanatus*, *Carex pilulifera*, *Alchemilla alpina*, *Galium saxatile*.

35.13

DESCHAMPSIA FLEXUOSA GRASSLANDS

Communities dominated by *Deschampsia flexuosa* forming, in particular, as degradation stages of *Calluna* and other heaths.

35.14

WOOD SMALL-REED STANDS

Tall *Calamagrostis epigejos*-dominated facies of siliceous grasslands.

35.15

SAND SEDGE GRASSLANDS

Closed acidophilous grasslands on fixed sands dominated by *Carex arenaria*.

35.2

MEDIO-EUROPEAN OPEN SILICEOUS GRASSLANDS

Thero-Airion i.a.

Open formations of dry, siliceous soils, of Atlantic, sub-Atlantic and Mediterraneo-montane distribution, often species-poor and with a strong representation of annuals.

(Guinochet and Vilmorin, 1973; Barkman, 1973; Westhoff and den Held, 1975; Wattez, 1977; Royer, 1977; Géhu and Foucault, 1977; Rivas-Martínez, 1977a; Bournérias, 1979, 1984; Noirfalise *et al.*, 1980, 1985; Polunin and Walters, 1985; Rivas-Martínez *et al.*, 1987; Ellenberg, 1988; Oberdorfer, 1990)

35.21

DWARF ANNUAL SILICEOUS GRASSLANDS

Pioneer formations of typically dwarf annuals, often ephemeral and of very limited extent, characteristic in particular of fixed sands, with *Aira caryophyllea*, *A. praecox*, *Nardurus lachenalii*, *Vulpia bromoides*, *V. myuros*, *Trisetum ovatum*, *Filago arvensis*, *F. gallica*, *F. lutescens*, *F. minima*, *F. pyramidata*, *F. vulgaris*, *Spergularia morisonii*, *Hypochoeris glabra*, *Evax carpetana*, *Moenchia erecta*, *Scleranthus polycarpus*, *Teesdalia nudicaulis*, *Myosotis discolor*, *M. stricta*, *Linaria elegans*, *L. amethystea*, *Sedum lagascae*, *S. pedicellatum*, *Ornithopus perpusillus*, *Trifolium striatum*, *T. arvense*, *T. dubium*, *T. campestre*, *T. micranthum*, *Tuberaria guttata*; typical former crop-following species also find a refuge in these communities.

35.22

PERENNIAL OPEN SILICEOUS GRASSLANDS

Very open grasslands dominated by perennial grasses such as *Agrostis capillaris*, *A. vinealis*, *A. delicatula*, *A. durieui*, *A. castellana*, *Poa angustifolia*, *Anthoxanthum odoratum*, *Festuca filiformis*, *Corynephorus canescens*, *Calamagrostis epigejos* or *Carex arenaria*, forming a transition towards 35.1.

35.23

CORYNEPHORUS GRASSLANDS

Formations of sands with *Corynephorus canescens*; most are dunal and should be listed under 64 (Inland dunes).

35.3

MEDITERRANEAN SILICEOUS GRASSLANDS

Helianthemion guttati (Tuberarion guttatae)

West Mediterranean annual-rich grasslands of siliceous gravelly, sandy or silty, usually shallow, soils that remain cohesive during the dry season; characteristic are *Tuberaria guttata*, *Helianthemum sanguineum*, *Jasione montana*, *Paronychia cymosa*, *P. echinulata*, *Pterocephalus diandrus*, *Prolongoa pectinata*, *Senecio minutus*, *Tolpis barbata*, *Filago gallica*, *F. minima*, *Teesdalia coronopifolia*, *Sedum caespitosum*, *S. arenarium*, *S. andegavense*, *Crassula tillaea*, *Saxifraga carpetana*, *Radiola linoides*, *Silene gallica*, *S. psammitis*, *S. portensis*, *Linum gallicum*, *Linaria pelisseriana*, *L. arvensis*, *Plantago bellardi*, *Galium divaricatum*, *Trifolium cherleri*, *T. strictum*, *T. suffocatum*, *T. arvense*, *T. bocconeii*, *T. purpureum*, *Lathyrus angulatus*, *Ornithopus pinnatus*, *O. sativus*, *Lupinus hispanicus*, *L. angustifolius*, *Anthyllis cornicina*, *Coronilla repanda* ssp. *dura* and the grasses *Corynephorus divaricatus*, *Aira cupaniana*, *A. tenorei*, *A. caryophyllea*, *Airopsis tenella*, *Molineria minuta*, *M. laevis*, *Vulpia geniculata*, *V. membranacea*, *V. bromoides*, *V. myuros*, *Briza maxima*, *Anthoxanthum aristatum*, *Micropyrum tenellum*.

(Duvigneaud, 1953; Molinier, 1957; Jasiewicz, 1964; Aubert and Loisel, 1971; Guinochet and Vilmorin, 1973; Braun-Blanquet, 1977; Rivas-Martinez, 1977a; Lavagne and Moutte, 1977; Lapraz, 1978; Molinier and Martin, 1980; Devaux *et al.*, 1983; Ladero Alvarez, 1987; Rivas-Martinez and Costa, 1987; Asensi Marfil and Diez Garretas, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987)

35.4

MEDITERRANEAN ANNUAL DEEP-SAND COMMUNITIES

Malcolmietalia

Open, spring-blooming communities of annuals developed on deep sands of Iberia and very locally of southern France and Italy, with *Malcolmia lacera*, *M. ramosissima*, *Anthyllis hamosa*, *Maresia nana*, *Erodium laciniatum*, *E. cicutarium* ssp. *bipinnatum*, *Arenaria emarginata*, *Hymenostemma pseudoanthemis*, *Loeflingia baetica*, *L. spartea*, *L. tavaresiana*, *L. hispanica*, *Linaria donyana*, *L. pedunculata*, *Vulpia membranacea*, *Ononis variegata*, *O. baetica*, *O. cossoniana*, *O. subspicata*, *Coronilla repanda*, *Evax astericiflora*, *E. lusitanica*, *Leucojum trichophyllum*. Many are dunal and have been listed under 16.228.

(Aubert and Loisel, 1971; Diez *et al.*, 1975; Rivas-Martinez, 1977a; Rivas-Martinez *et al.*, 1980; Géhu *et al.*, 1984; Peinado Lorca *et al.*, 1984; Asensi Marfil and Diez Garretas, 1987; Alcaraz Ariza and Peinado Lorca, 1987)

35.5

IBERIAN FESCUE-PLANTAIN SWARDS

Corynephoru-Plantaginion radicatae

Open perennial formations colonizing arenaceous or skeletal, often unstable, siliceous soils of the supra-Mediterranean levels of Iberian mountains, rich in cushion-forming, rosette-leaved chamaephytes (*Jasione crispa* ssp. *sessiliflora*, *Plantago radicata*, *Scleranthus perennis*) and caespitose, rough perennial grasses (*Festuca costei*, *F. indigesta*, *F. summilusitana*, *Corynephorus canescens*, *Koeleria caudata* ssp. *crassipes*). Various formations, characterized by, among others, *Hieracium castellanum*, *Leucanthemopsis pulverulenta*, *Dianthus merinoi*, *D. laricifolius*, *Armeria caballeroi*, *A. alliacea*, *Thymus serpylloides* ssp. *gadorenensis*, *Teucrium aureum* are distributed in the Cantabrian range, the southern Galician

and Leonese mountains, the Iberian Range, the Cordillera Central, the Montes de Toledo, the Sierra Nevada.

(Rivas-Martinez, Diaz *et al.*, 1984; Penas and Diaz-Gonzalez, 1985; Navarro Andres and Valle Gutierrez, 1987; Martinez Parras and Peinado Lorca, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Martinez Parras *et al.*, 1987)

35.6

IBERIAN TALL FESCUE GRASSLANDS

Festucion elegantis

Perennial grasslands dominated by the tall caespitose *Festuca elegans* of the supra-Mediterranean *Quercus pyrenaica* level of the Cordillera Central and Sierra Nevada with, among others, *Geum heterocarpum*, *Trifolium ochroleucon* and *Paeonia coriacea* of deep, siliceous soils.

(Rivas-Martinez *et al.*, 1987; Martinez Parras *et al.*, 1987; Martinez Parras and Peinado Lorca, 1987)

35.7

MEDITERRANEO-MONTANE MAT-GRASS SWARDS

Nardus stricta-dominated grasslands and related communities of the supra-Mediterranean level of the mountains of the Mediterranean peninsulas, either developed on siliceous soils, or, rarely, on calcareous substrates.

35

35.71

IBERIAN MONTANE MAT-GRASS SWARDS

Campanulo-Nardion p.

Supra-Mediterranean acidophilous communities rich in *Nardus stricta* with an accompanying cortège similar to that of the Iberian subalpine *Campanulo-Nardion* (36.36), rather than to that of the Atlantic and sub-Atlantic *Violion caninae* (35.1), occurring in particular in the *Quercus pyrenaica* level of the Cordillera Central.

(Rivas-Martinez *et al.*, 1987)

35.72

SOUTHERN ITALIAN MAT-GRASS SWARDS AND RELATED COMMUNITIES

Ranunculo-Nardion p.

Closed, mesophile grasslands of depressions, flats and snow patches of the beech level of the southern Apennines, with *Luzula multiflora*, *L. pindica*, *Anthoxanthum odoratum*, *Festuca rubra*, *F. varia*, *F. violacea*, *Bellardiocloa (Poa) violacea*, *Alopecurus gerardii*, *Danthonia decumbens*, *Phleum alpinum*, *Carex leporina*, *Hypochoeris laevigata*, *Dianthus deltoides*, *Nardus stricta*, *Crocus vernus*, *Sedum atratum*, *Euphrasia minima*, *Ajuga tenorei*, *Potentilla neumanniana* var. *rigoana*, *P. argentea* var. *calabra*, *Ranunculus sartorianus*, *R. polyanthemus* ssp. *thomasii*, *Meum athamanticum*, *Asphodelus albus* var. *pollinensis*, *Plantago brutia*, *Pedicularis petiolaris*, *Omalotheca sylvatica*, *Cirsium vallis-demoni*, *Viola calcarata*, *Armeria majellensis*; they are widespread in the siliceous Sila range and also occur on deep decalcified soils of the piani of the calcareous Pollino range.

(Bonin, 1972)

35.73

BALKANIC MONTANE MAT-GRASSLANDS

Closed *Nardus stricta*-dominated grasslands of the *Fagion moesiicum* zone of the Balkan peninsula.

(Horvat *et al.*, 1974)

36 Alpine and subalpine grasslands

Grasslands of the alpine and subalpine levels of the Alps, Pyrenees, Cantabrian range, Jura, Central Massif and northern Apennines, with very fragmentary outposts in the great Hercynian ranges of middle Europe, Bayerischer Wald, Harz, Black Forest, Erz-Riesengebirge and in the Caledonian system of Britain; grasslands of the oro- and cryoro-Mediterranean levels (*sensu* Peinado Lorca and Rivas-Martinez, 1987) or of the alti-Mediterranean level (*sensu* Ozenda, 1975, 1985) of the Iberian mountains, of the Apennines and of the Greek ranges.

36.1

SNOW-PATCH COMMUNITIES

Salicetea herbaceae

Vegetation of areas that retain late-lying snow. These formations are mostly characteristic of the alpine level of the Alps and Pyrenees; they extend to the Macedonian mountains and are represented by relict outposts in the Sierra Nevada, the Cordillera Central, the Monti Sibillini and Abruzzi; they occur locally in the Scottish Highlands.

(Braun-Blanquet, 1954, 1975a; Rivas-Martinez, 1963, 1975c; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Ozenda, 1975; Ratcliffe, 1980; Pignatti, 1982; Dupias, 1985; Martinez Parras *et al.*, 1987; Noirfalise, 1987; Oberdorfer, 1990; Jonglet, *in litt.*, 1990; Hill, *in litt.*, 1990)

36.11

ACID SNOW-PATCH COMMUNITIES

Salicetalia herbaceae

Snow-patch communities of acid soils.

36.111

Alpine acid snow-patch communities

Salicion herbaceae

Acid snow-patch communities of the Alps, the Pyrenees and high mountains of the Mediterranean peninsulas, with *Salix herbacea*, *Soldanella pusilla*, *Sibbaldia procumbens*, *Omalotheca (Gnaphalium) supina*, *Luzula alpino-pilosa*, *Cerastium cerastoides* and mosses.

36.1111

Alpine acid moss snow-patch communities

Polytrichetum sexangularis, *Polytrichetum norvegici*

Moss snow-patches of the Alps and Pyrenees, occupying areas free from snow for less than two months, with the mosses *Polytrichum sexangularis*, *P. juniperinum*, *Pohlia commutata*, *Kiaeria falcata (Dicranum falcatum)*, the liverwort *Anthelia juratzkana* or sometimes lichens.

36.1112

Alpine acid dwarf willow snow-patch communities

Salicetum herbaceae, *Anthelio-Salicetum herbaceae*

Dwarf willow (*Salix herbacea*) snow-patches of the Alps and Pyrenees, occupying areas covered by snow for eight to ten months.

36.1113

Alpine acid *Carex-Gnaphalium* snow-patch communities

Caricetum foetidae, *Alopecuro-Caricetum foetidae*, *Cardamino alpinae-Gnaphalietum supini*, *Cerastio-Mniobryetum*, *Gnaphalio-Sedetum candollei*, *Sedo-Gnaphalietum pusilli*, *Omalotheco pusillae-Lepidietum stylati* i.a.

Communities of areas covered by snow for six to eight months, with *Carex foetida* (western Alps), *Alopecurus gerardii*, *Omalotheca (Gnaphalium) supina* (including *O. supina* var. *pusilla*), *Lepidium stylatum*, *Alchemilla pentaphylla*, *Sedum candollei* (*Mucizonia sedoides*, *Umbelliscus sedoides*), *S. alpestre*, *Cardamine alpina*, *Carex pyrenaica*; they extend to the subalpine level and include the isolated cryoro-Mediterranean formations of the Cordillera Central and the Sierra Nevada.

36.112

Boreo-alpine snow-patch communities

Snow-patches of the high altitudes of the central and eastern Highlands of Scotland.

- 36.1121** **Highland moss snow-patch communities**
Moss snow-patches of the Scottish Highlands, formed of mats of mosses and lichens, with, in particular, *Polytrichum sexangulare*, *Kiaeria (Dicranum) starkei*, *K. falcatum*.
- 36.1122** **Highland dwarf willow snow-patch communities**
Moss and dwarf willow snow-patches of the Scottish Highlands, with *Salix herbacea*, *Saxifraga stellaris*, *Silene acaulis*, *Omalotheca supina*, *Luzula spicata* and mosses *Racomitrium heterostictum*, *R. fasciculare*, *Gymnomitrium concinnatum*, *Polytrichum norvegicum*, *Oligotrichum hercynicum*, *Nardia scalaris*.
- 36.1123** **Highland *Rhytidiadelphus-Deschampsia* snow-patch communities**
Rhytidiadelphus loreus-Deschampsia cespitosa snow-patches of the western central Highlands with *Rhytidiadelphus loreus*, *R. squarrosus*, *R. triquetrus*, *Deschampsia caespitosa*, *Anthoxanthum odoratum*, *Carex bigelowii*, *Galium saxatile*, *Alchemilla alpina*.
- 36.1124** **Highland *Silene-Festuca* snow-patch communities**
Species-rich *Silene-Festuca* snow-patch turf forming at the foot of cliffs in the central and eastern Highlands, with *Silene acaulis*, *Alchemilla alpina*, *Sibbaldia procumbens*, *Minuartia (Cherleria) sedoides*, *Cerastium alpinum*, *Festuca ovina*, *Anthoxanthum odoratum*, *Agrostis canina*, *A. capillaris*.
- 36.1125** **Highland fern snow-patch communities**
Fern snow-patch communities forming on screes with prolonged snow cover in the central and eastern Highlands, with *Cryptogramma crispera*, *Athyrium distentifolium (A. alpestre)*, *Dryopteris oreades (D. abbreviata)*, *D. expansa (D. assimilis)*, *Galium saxatile*, *Barbilophozia floerkii*, *Polytrichum alpinum*.
- 36.12** **CALCAREOUS SNOW-PATCH COMMUNITIES**
Arabidetalia caeruleae: Arabidion caeruleae
Snow-patch communities of calcareous soils with *Salix reticulata*, *S. retusa*, *Arabis caerulea*, *Carex atrata*, *Ranunculus alpestris*, *Saxifraga androsacea*.
- 36.121** **Calcareous *Arabis-Gnaphalium* snow-patch communities**
Arabidetum caeruleae, Potentillo-Gnaphalietum hoppeanae
Herbaceous snow-patch swards of humid, carbonated soils under snow for long periods, with *Ranunculus alpestris*, *Arabis caerulea*, *Omalotheca (Gnaphalium) hoppeana*, *Hutchinsia alpina*, *Potentilla brauniana (P. minima)*, *Soldanella alpina*.
- 36.122** **Calcareous espalier willow snow-patch communities**
Salicetum retuso-reticulatae
Espalier willow communities of calcareous stone fields with the net-leaved willow, *Salix reticulata*, and the retuse-leaved willow, *Salix retusa*, and *Gentiana bavarica*.
- 36.2** **ALPINE WEATHERED ROCK AND OUTCROP COMMUNITIES**
Sedo-Scleranthion, Sedion pyrenaici p.
Stoncrop and houseleak communities colonizing both calcareous and siliceous rocky outcrops of the subalpine and alpine levels of higher mountains.
(Braun-Blanquet, 1955a; Rivas-Martinez, Diaz *et al.*, 1984; Ellenberg, 1988; Oberdorfer, 1990)
- 36.3** **ALPINE AND SUBALPINE ACIDOPHILOUS GRASSLANDS**
Caricetea curvulae
Alpine and subalpine grasslands developed over crystalline rocks and other lime-deficient substrates or on decalcified soils of the calcareous ranges, with *Armeria alpina*, *Armeria montana*, *Euphrasia minima*, *Gentiana alpina*, *Geum montanum*, *Juncus trifidus*, *Lychnis alpina*, *Pedicularis pyrenaica*, *Phyteuma hemisphaericum*, *Pulsatilla alpina ssp. sulfurea*, *Ranunculus pyrenaicus*, *Sempervivum montanum*, *Botrychium lunaria*.
(Ellenberg, 1963; Guinochet and Vilmorin, 1973; Ozenda, 1985; Jonglet, *in litt.*, 1990)

36.31

MAT-GRASS SWARDS AND RELATED COMMUNITIES

Nardion

Closed grasslands of deep, acid soils of the Alps, Pyrenees, northern Apennines, Jura and higher Hercynian ranges, developed mostly and abundantly in the subalpine level, dominated or co-dominated by *Nardus stricta*, *Festuca eskia*, *F. nigrescens*, *F. rubra*, *Alopecurus gerardii*, *Bellardiochloa (Poa) violacea*, *Carex sempervirens*, *Anthoxanthum odoratum*. (Braun-Blanquet, 1953, 1954, 1969a; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Berset, 1969; Guinochet and Vilmorin, 1973; Gruber, 1978; Ochsenein, 1984; Dupias, 1985; Ozenda, 1985; Bolos y Capdevila, 1987; Vigo and Ninot, 1987; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

36.311

Pyreneo-Alpine mesophile mat-grasslands

Nardetum alpigenum = *Geo montani-Nardetum*, *Aveno versicoloris-Nardetum*, *Leontodonto-Alchemilletum alpinae*, *Nardo strictae-Polygaletum cerpyllaceae*, *Alchemillo flabellatae-Nardetum strictae i.a.*

Subalpine and lower alpine mesophile grasslands dominated by, or rich in, *Nardus stricta*, of the Alps, the Pyrenees and, very locally, the Central Massif, the Jura and the northern Apennines; for the most part, they are heavily grazed grasslands with much reduced species diversity and overwhelming dominance of mat-grass.

36.312

Pyreneo-Alpine hygrophile mat-grass swards

Selino pyrenaei-Nardetum strictae, *Ranunculo pyrenaei-Nardetum strictae p.*, *Nardetum alpigenum p.*

Subalpine and alpine hygro-mesophile, chionophilous mat-grass swards of depressions and humid flats around lakes and marshes, where snow melts slowly.

36.313

Pyreneo-Alpine hygrophile foxtail swards

Trifolio alpini-Alopecuretum gerardii, *Ranunculo pyrenaicae-Alopecuretum gerardii p.*

Subalpine and alpine hygro-mesophile, chionophilous grasslands of depressions with prolonged snow cover dominated by *Alopecurus gerardii* and *Trifolium alpinum*; they constitute a transition between siliceous grasslands and snowpatch communities, which they often ring.

36.314

Pyrenean closed *Festuca eskia* grasslands

Subalpine and lower alpine closed mesophile *Festuca eskia* grasslands of north-facing slopes (ubacs) and depressions in the Pyrenees with *Arnica montana*, *Ranunculus pyrenaicus*, *Selinum pyrenaicum*, *Trifolium alpinum*, *Campanula barbata*, *Gentiana punctata*, *Leucorchis albida*, *Phyteuma betonicifolium*.

36.315

Pyrenean *Poa violacea* swards

Subalpine *Bellardiochloa (Poa) violacea*-dominated grasslands of the Pyrenees.

36.316

Hercynian summital mat-grass swards

Summital mat-grass swards of the greater Hercynian ranges.

36.3161

Hautes Chaumes summital mat-grass swards

Violo-Nardetum

Formations of the Hautes Chaumes (high Vosges), with *Gentiana lutea*, *Arnica montana*, *Pulsatilla alba*, *Viola lutea* ssp. *elegans*, *Selinum pyrenaicum*, *Leontodon pyrenaicus*, *Hieracium vogesiacum*, *H. olivaceum*, *H. alpinum* and abundant ericoid shrubs, *Erica tetralix*, *Vaccinium myrtillus*, *V. vitis-idaea*.

36.3162

Black Forest summital mat-grass swards

Leontodonto helvetici-Nardetum

Formations of the Black Forest.

36.3163

Harz summital mat-grass swards

Pulsatillo micranthae-Nardetum

Formations of the Harz.

36.3164

Bayerischer Wald summital mat-grass swards

Lycopodio-Nardetum

Formations of the Bayerischer Wald.

- 36.32** **ORO-CALEDONIAN GRASSLANDS**
Boreo-alpine formations of the higher summits of Scotland, Cumbria, northern England and northern Wales with *Juncus trifidus*, *Carex bigelowii*, mosses and lichens. (Ratcliffe, 1977, 1980; Noifalaise, 1986, 1987; Hill, *in litt.*, 1990)
- 36.321** **Oro-Caledonian *Carex bigelowii* communities**
High-altitude formations dominated by *Carex bigelowii*. with *Dicranum fuscescens*, *Polytrichum alpinum*, *Cladonia uncialis*, *C. arbuscula*, *Galium saxatile* of the central and eastern highlands, with outliers in the northern Highlands and Cumbria (Cross Fell).
- 36.322** **Oro-Caledonian *Rhacomitrium* carpets**
Summital carpets of *Rhacomitrium lanuginosum* with *Carex bigelowii*, *Galium saxatile*, *Vaccinium myrtillus*, *Deschampsia flexuosa*, *Cladonia uncialis*, of Scotland, northern England and northern Wales.
- 36.3221** **Species-poor *Rhacomitrium* carpets**
Species-poor, nearly continuous carpets of *Rhacomitrium lanuginosum* characteristic of the Scottish Highlands, with outposts in the southern Uplands, northern England and northern Wales.
- 36.3222** **Grassy *Rhacomitrium* carpets**
Formations richer in grasses (*Festuca ovina*, *F. vivipara* and *Deschampsia flexuosa*) and with less *Rhacomitrium lanuginosum* of the southern Uplands, northern England and northern Wales.
- 36.3223** **Cushion-herb *Rhacomitrium* carpets**
Species-rich formations of the north-west Highlands, with cushion herbs including *Armeria maritima*, *Silene acaulis* and *Minuartia sedoides*, and sometimes with *Polygonum viviparum*, *Rhytidiadelphus loreus*, *Aulacomnium turgidum*.
- 36.323** **Highland *Juncus trifidus* formations**
Communities of the Scottish Highlands, limited to granitic summital plateaux, summit block detritus, steep block screes, summit ridges and very open ablation areas within *Rhacomitrium-Carex bigelowii* formations, with *Juncus trifidus*, *Rhacomitrium lanuginosum*, *Cetraria islandica*, *Cladonia sylvatica*, *C. uncialis*, *C. gracilis*, *C. arbuscula*, *Salix herbacea*, *Deschampsia flexuosa*, *Alchemilla alpina* and sometimes ericoid shrubs.
- 36.324** **Boreo-alpine mat-grass swards**
Nardus stricta communities developed in areas of prolonged snow cover in Scotland, Cumbria, the northern Pennines and north Wales, with *Carex bigelowii*, *Cetraria islandica*, *Rhacomitrium lanuginosum*, *Rhytidiadelphus loreus*, *Galium saxatile*, *Alchemilla alpina*, *Empetrum hermaphroditum*.
- 36.33** **SUBALPINE THERMOPHILE SILICEOUS GRASSLANDS**
Festucion variaae, *Festucion eskiae*, *Poion violaceae*, *Festucion spadiceae*
Subalpine thermophile formations on often skeletal soils of the southern Alps, the Pyrenees and, very locally, the Central Massif and the Apennines. (Braun-Blanquet, 1954, 1972; Ellenberg, 1963, 1988; Gruber, 1978; Dupias, 1985; Ozenda, 1981, 1985; Jonglet, *in litt.*, 1990; Salomez, *in litt.*, 1990)
- 36.331** ***Festuca paniculata* swards**
Festucion spadiceae: *Festucetum spadiceae*, *Centaureo uniflorae-Festucetum spadiceae*, *Irido-Festucetum spadiceae*, *Scorzonero-Festucetum spadiceae*, *Hieracio-Festucetum spadiceae*
Thermophile, luxuriant, relatively closed grasslands formed by the very tall, blue-grey *Festuca paniculata* (*F. spadicea*) on south-facing slopes (adrets) of the upper montane and lower subalpine levels of the Pyrenees, the southern Alps and, locally, the Central Massif and the Abruzzi; characteristic and often abundant accompanying species include *Centaurea uniflora*, *Silene nutans*, *Trifolium montanum*, *Hieracium peleterianum*, *Hypochoeris maculata*, *Potentilla grandiflora*, *Lilium martagon*, *Eryngium alpinum*, *Luzula pediformis*, *Meum athamanticum*, *Nigritella nigra*, *Helictotrichon parlatoiei*, *Asphodelus albus*, *Iris xiphoides*, *Paradisea liliastrum*, *Dianthus monspessulanus*, *Carduus defloratus*. Many have been traditionally treated as hay meadows and are of extraordinary floristic richness; they are nowadays increasingly abandoned or left to grazing.

36.3311

Xerophile rocky slope *Festuca paniculata* swards

More xero-thermophile formations on siliceous, rocky soils of steep, warm slopes of the south-western Alps, Pyrenees, Central Massif and Abruzzi.

36.3312

Mesophile deep soil *Festuca paniculata* swards

More mesophile, dense formations on deep soils of gentler slopes, often over calcareous substrates with decalcified, slightly acid, topsoil; they are mostly characteristic of the south-western Alps with representation in the Pyrenees.

36.332

Festuca eskia* garland-grasslandsFestucion eskiae*

Open, thermophile, stripped grasslands organized in ribbons retaining stony, almost bare steps on the adrets of the upper subalpine and lower alpine zones in the Pyrenees, formed by the hard, sharp-pointed, slippery, bright green, tufted *Festuca eskia*, sometimes associated with *Carex sempervirens s.l.*

36.333

Varicoloured fescue garland-grasslands*Festucion varia*: *Festucetum varia*, *Festuco-Potentilletum valderiae*

Open, thermophile, stripped grasslands of the adrets of the (mostly) southern Alps and Central Massif, formed by calcifuge species of the hard, sharp-pointed *Festuca varia* group (*F. varia*, *F. scabriculumis*), often associated with *Carex sempervirens s.l.*

36.34

CROOKED-SEDGE SWARDS AND RELATED COMMUNITIES*Caricion curvulae*, *Festucion supinae*

Mostly closed *Carex curvula*, *Festuca spp.*, *Oreochloa spp.* or *Juncus trifidus* grasslands on siliceous soils of the alpine level of the Alps and the Pyrenees, with very local outposts in the great Hercynian ranges and the Cantabrian Range. *Androsace obtusifolia*, *A. carnea* ssp. *laggeri*, *Campanula barbata*, *Juncus jacquinii*, *J. trifidus*, *Silene exscapa*, *Gentiana alpina*, *Achillea erba-rota*, *Euphrasia minima*, *Luzula lutea*, *L. spicata*, *L. hispanica*, *Lychnis alpina*, *Minuartia recurva*, *M. sedoides*, *Pedicularis kernerii*, *P. pyrenaica*, *Phyteuma globulariifolium*, *Ph. hemisphaericum*, *Potentilla frigida*, *Armeria alpina*, *Senecio incanus*, *Trifolium alpinum*, *Veronica bellidioides*, *Ranunculus pyrenaicus* are characteristic.

(Braun-Blanquet, 1954, 1969a; Ellenberg, 1963, 1988; Gruber, 1978; Ozenda, 1981, 1985; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Vigo and Ninot, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

36.341

Carex curvula* grasslandsCaricion curvulae*: *Caricetum curvulae*, *Primulo-Caricetum curvulae*; *Festucion supinae*: *Gentiano-Caricetum curvulae*, *Curvulo-Leontodetum pyrenaici*

Formations of the upper and middle alpine levels of the Alps, of the upper alpine level of the eastern Pyrenees and of the alpine level of the central and western Pyrenees, to which the dominance of the crooked sedge, *Carex curvula*, with twisted leaves withering early at the tip, gives a highly distinctive texture and yellow-brown hue.

36.342

Festuca halleri* grasslandsCaricion curvulae*: *Festucetum halleri*

Formations of flats and gentle slopes of the lower alpine level of the Alps dominated by *Festuca halleri* and *Juncus trifidus*, particularly widespread in the south-western Alps.

36.343

Festuca airoides* grasslandsFestucion supinae*: *Pumilieto-Festucetum supinae*, *Luzulo-Festucetum supinae*

Low, fairly dry swards of the alpine zone of the eastern Pyrenees dominated by *Festuca airoides* (*F. supina*), with *Carex ericetorum*, *Avenula versicolor*, *Silene ciliata*, *Lychnis alpina*, *Arenaria grandiflora*, *Jasione humilis*, *Hieracium breviscapum* (*H. pumilum*).

36.344

***Festuca borderi* swards**

Sub-nival formations of the Pyrenees with *Potentilla frigida*, *Erigeron uniflorus*, *Carex rupestris* and many cushion plants such as *Saxifraga bryoides*, *S. oppositifolia*, *Minuartia sedoides*, *Silene acaulis*.

36.345

Allgäu *Oreochloa disticha* swards

Oreochloa disticha-dominated formations, developed in particular in the northern Alps (Allgäu).

- 36.346 **Bayerischer Wald *Juncus trifidus* swards**
Formations of the Bayerischer Wald dominated by *Juncus trifidus*.
- 36.347 **Cantabrian *Oreochloa blanka* swards**
Festucion supinae: Junco trifidi-Oreochloetum blankae
Oreochloa blanka and *Juncus trifidus* formations of the alpine level of the Cantabrian Range.
- 36.35 **CLOSED GRASSLANDS OF GREEK MOUNTAINS**
Trifolion parnassi
Dense, closed, usually unsculptured, chionophilous grasslands of acid and often deep soils over siliceous or calcareous substrates of the higher Greek mountains; they develop on decalcified colluvions, on damp soils of seeps or poorly drained areas, and in depressions and other situations where snow lingers. Characteristic are *Alopecurus gerardii*, *Poa pumila*, *Anthoxanthum alpinum*, *Phleum alpinum*, *Nardus stricta*, *Bellardiochloa (Poa) violacea*, *Trisetum flavescens*, *Trifolium pallescens*, *T. parnassi*, *T. heldreichianum*, *T. alpestre*, *T. ottonis*, *Omalotheca supina*, *O. hoppeana*, *Herniaria parnassica*, *Ranunculus sartorianus*, *Lotus corniculatus*, *Thesium parnassi*, *Plantago lanceolata*, *P. atrata*, *P. holostea*, *Scleranthus perennis*, *Rorippa thracica*, *Erigeron epiroticus*, *Acinos alpinus*, *Luzula pindica*, *Crocus veluchensis*, *Scilla nivalis*, *Corydalis densiflora*, *C. parnassica*, *Beta nana*, *Trinia guicciardii*, *Botrychium lunaria*.
(Horvat *et al.*, 1974; Strid, 1980)
- 36.351 **Greek mat-grass swards**
Nardus stricta-dominated formations mostly occupying humid ground in the high ranges of, in particular, the Peloponnese, the central and northern Pindus and locally the southern Pindus.
- 36.352 **Greek *Poa violacea* swards**
Bellardiochloa violacea-dominated formations usually occupying slightly more basic soils, found, in particular, in the Pindus, on Olympus and in the Vermion.
- 36.353 **Greek foxtail swards**
Alopecurus gerardii-dominated formations mostly of areas of prolonged snow cover on Olympus, Taiyetos, Killini, Parnassus, and in the central and northern Pindus.
- 36.354 **Giona *Trisetum-Poa* swards**
Formations of Giona with *Trifolium heldreichianum*, *T. alpestre*, *T. parnassi*, *Plantago lanceolata* var. *capitata*, *Poa pratensis*, *Anthoxanthum odoratum*, *Phleum pratense*, *Trisetum flavescens*.
- 36.36 **ACIDOPHILOUS GRASSLANDS OF HIGH IBERIAN MOUNTAINS**
Nardetalia p., *Festucetalia indigestae*
Cryoro- and oro-Mediterranean grasslands of acid substrates in the higher mountain ranges of the Iberian peninsula.
(Tüxen and Oberdorfer, 1958; Duvigneaud and Delvosalle, 1962; Rivas-Martinez, 1963; Fernandez Casas, 1974; Gruber, 1978; Rivas-Martinez, Diaz *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987)
- 36.361 **Oro-Iberian acidophilous stripped grasslands**
Festucetalia indigestae
Thermophile, open, stripped and garland fescue grasslands of siliceous upper slopes and summits of the high Mediterranean mountains of the Iberian peninsula, locally extending into the Euro-Siberian domain in the subalpine level of the Cantabrian mountains.
- 36.3611 **Cantabrian acidophilous stripped grasslands**
Teesdaliopsis confertae-Festucetum indigestae, *Teesdaliopsis confertae-Festucetum eskiae*
Festuca indigesta and *Festuca eskia* grasslands of the oro- and cryoro-Mediterranean and subalpine levels of the Cantabrian mountains and other high mountains of the north-west.

- 36.3612** Iberian Range acidophilous stripped grasslands
Antennario dioicae-Festucetum indigestae
Festuca indigesta grasslands of the oro- and cryoro-Mediterranean levels of the Iberian Range.
- 36.3613** Cordilleran *Festuca* stripped grasslands
Hieracio castellanae-Festucetum indigestae, *Hieracio myriadeni-Festucetum indigestae*, *Arenario querioidis-Festucetum summilusitanae*
Festuca indigesta and *Festuca summilusitana* grasslands of the oro- and cryoro-Mediterranean levels of the Cordillera Central.
- 36.3614** Cordilleran *Agrostis* stripped grasslands
Agrostio rupestris-Armerietum bigerrensis
Agrostis rupestris grasslands of the cryoro-Mediterranean level of the Cordillera Central.
- 36.3615** Nevadan *Festuca indigesta* stripped grasslands
Arenario granatensis-Festucetum indigestae
Psychro-xerophile garland grasslands of *Festuca indigesta*, *Thymus serpylloides*, and *Arenaria tetraquetra* var. *granatensis*, widespread in the oro-Mediterranean level (2 000-2 900 m) of the Sierra Nevada.
- 36.3616** Nevadan *Agrostis* stripped grasslands
Armerio splendentis-Agrostietum nevadensis
Chionophilous grasslands with *Agrostis nevadensis* and *Armeria splendens* of depressions and sheltered areas within the oro-Mediterranean level of the Sierra Nevada, often in contact with, and forming a transition to, the closed mat-grass swards of 36.362.
- 36.3617** Nevadan tall fescue stripped grasslands
Festucetum spadiceo-pseudeskia
Pioneer grasslands formed by the robust *Festuca pseudeskia* and *F. paniculata* on steep slopes submitted to intense insolation and severe erosion of the oro-Mediterranean and locally cryoro-Mediterranean levels of the Sierra Nevada.
- 36.3618** Nevadan *Festuca clementei* stripped grasslands
Erigeronto frigidifolii-Festucetum clementei
Psychro-xerophile grasslands of the cryoro-Mediterranean level (above 2 900 m) of the Sierra Nevada, formed by *Festuca clementei*, *Erigeron frigidus*, *Artemisia granatensis*, *Ptilotrichum purpureum*, *Papaver lapeyrousianum*, all, except the last, Sierra Nevada endemics.
- 36.3619** Nevadan *Trisetum* stripped grasslands
Galio pyrenaici-Trisetetum glacialis
Communities of wind-beaten crests of the Sierra Nevada, with *Trisetum glaciale* and *Galium pyrenaicum*.
- 36.362** Oro-Iberian mat-grass swards
Nardetalia strictae p. (Udo-Nardetalia): *Campanulo-Nardion*, *Plataginion nivalis*
Nardus-dominated and related, closed, dense grasslands of oro- and cryoro-Mediterranean levels of high Iberian mountains, characteristic of seeps, poorly drained soils and areas with prolonged snow cover.
- 36.3621** Cantabrio-Cordilleran oro-Mediterranean mat-grass swards
(*Campanulo-Nardion p.*, *Poo legionensis-Nardetum*, *Campanulo herminii-Trifolietum alpini*, *Luzulo carpetanae-Juncetum squarosi*, *Campanulo herminii-Festucetum ibericae*, *Campanulo herminii-Nardetum strictae*
Hygrophile and chionophile, closed grasslands of the oro- and cryoro-Mediterranean levels of the Cordillera Central and of the high Orensano-Sanabrian mountains, and of the subalpine level of the Cantabrian mountains, with *Nardus stricta*, *Festuca iberica*, *Juncus squarrosus*, *Luzula campestris* ssp. *carpetana*, *Campanula herminii*.

- 36.3622** **Nevadan borreguiles**
Plantaginion nivalis: Nardo strictae-Festucetum ibericae, Ranunculo acetosellifolii-Vaccinietum uliginosi
Dense hygrophilous grasslands occupying humid flats around lakes, gullies, glacial basins, depressions at the oro- and cryoro-Mediterranean levels of the Sierra Nevada, with *Nardus stricta*, *Festuca hispanica*, *Agrostis nevadensis*, *Plantago nivalis*, *Carex intricata*, *Ranunculus acetosellifolius*, *Vaccinium uliginosum*, *Lotus glareosus*, *Leontodon microcephalus*, *Galium nevadense*, *Gentiana boryi*, *Meum nevadense*, *Jasione crispa* ssp. *amethystina*, many of which Sierra Nevada endemics.
- 36.37** **GRASSLANDS OF HIGH CORSICAN MOUNTAINS**
Grasslands of the subalpine (oro-Mediterranean) and alpine levels of the highest mountains of Corsica.
(Lambinon *et al.*, 1978; Gamisans, 1985)
- 36.371** **Corsican oro-Mediterranean stripped grasslands**
Stripped grasslands of adrets of the oro-Mediterranean level of Corsican mountains with *Plantago subulata* ssp. *insularis*, *Sagina pilifera*, *Armeria multiceps*, *Paronychia polygonifolia*, *Bellardiochloa violacea*, *Festuca indigesta*, associated with hedgehog-heaths (31.75).
- 36.372** **Corsican pozzine mat-grasslands**
Nardus stricta grasslands of the pozzines, wet depressions surrounding glacial lakes and basins, of the subalpine level of Corsican mountains.
- 36.373** **Corsican alpine adret grasslands**
Open grasslands of adrets and crests of the alpine level of high Corsican mountains with *Bellardiochloa violacea* and many endemics including *Erigeron paolii*, *Leucanthemopsis alpina* ssp. *tomentosa*, *Draba loiseleurii*, *Acinos corsicus*, *Myosotis corsicana*.
- 36.374** **Corsican alpine ubac grasslands**
Dense grasslands of ubacs of the alpine level of high Corsican mountains with *Phleum brachystachyum*, *Geum montanum*, *Sibbaldia procumbens*, *Veronica alpina*.
- 36.38** **CLOSED GRASSLANDS OF THE HIGH APENNINES**
Mesophile, closed, short turfs of the subalpine and alpine levels of the southern and central Apennines, developed locally above treeline, on both calcareous and siliceous substrates.
(Bonin, 1972; Pignatti, 1982; Ozenda, 1985; Rossi *et al.*, 1987)
- 36.381** **Subalpine southern Italian mat-grass swards**
Ranunculo-Nardion p.
Subalpine representative of the montane southern Italian mat-grass swards of 35.72, characteristic of karstic depressions at the highest altitudes of Pollino.
- 36.382** **Central Apennine closed grasslands**
Dense, closed, unsculptured, hygrophilous or chionophilous turfs of often deep soils over siliceous or calcareous substrates of the subalpine and alpine levels (mostly 1 800 to 2 100 m) of the central Apennines; they develop on colluvions, on damp soils of seeps or poorly drained areas, on moisture-retaining slopes and in depressions and other situations where snow lingers. Characteristic species include *Nardus stricta*, *Festuca violacea* ssp. *macrathera*, *Bellardiochloa (Poa) violacea*, *Phleum alpinum*, *Poa alpina*, *Luzula bulgarica*, *Carex laevis*, *Ranunculus montanus*, *R. oreophilus*, *Viola eugeniae*, *Dianthus deltooides*, *Potentilla crantzii*, *P. aurea*, *Geum montanum*, *Trifolium thalii*, *Anthyllis vulneraria* ssp. *vulnerarioides* s.l., *Crepis aurea*, *Plantago montana*, *P. serpentina*, *Erigeron uniflorus*, *E. epiroticus*, *Alchemilla colorata*, *Hieracium auricula*, *Armeria majellensis*, *Minuartia verna*, *Galium pumilum*, *Campanula scheuchzeri*, *Gentiana verna*, *G. nivalis*, *G. campestris* var. *neapolitana*, *G. lutea*, *Saxifraga adscendens*, *Omalotheca hoppeana*, *Euphrasia salisburgensis*, *Vaccinium myrtillus*, *Nigritella widderi*, *Coeloglossum viride*, *Botrychium lunaria*. Closed grasslands occur over both siliceous and calcareous substrates; on the latter their formation is usually accompanied by a decalcification of the topsoil linked to the hygric conditions necessary for their existence, and they may evolve into *Vaccinium myrtillus* dwarf heaths (31.4A). Thus, formations on siliceous and calcareous terrain are physiognomically similar, share many species and often grade into each other. *Nardus stricta* is present and often dominant in the more acidophilous variants, *Festuca violacea* ssp. *macrathera* and

Trifolium thalii in the more basiphilous ones. All may be conveniently referred here, though clearly calcicolous extremes may also, by analogy with similar Alpine formations, be listed under 36.41, as unit 36.4143.

36.4

ALPINE AND SUBALPINE CALCIPHILOUS GRASSLANDS*Elyno-Seslerietea*

Alpine and subalpine grasslands of base-rich soils with *Dryas octopetala*, *Gentiana nivalis*, *G. campestris*, *Alchemilla hoppeana*, *A. conjuncta*, *A. flabellata*, *Anthyllis vulneraria*, *Astragalus alpinus*, *Aster alpinus*, *Draba aizoides*, *Globularia nudicaulis*, *Helianthemum nummularium* ssp. *grandiflorum*, *H. alpestre*, *Pulsatilla alpina* ssp. *alpina*, *Phyteuma orbiculare*, *Astrantia major*, *Polygala alpestris*.

(Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Ozenda, 1985; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

36.41

RUSTY SEDGE MEADOWS AND RELATED COMMUNITIES*Caricion ferrugineae*, *Primulion intricatae*, *Laserpitio-Ranunculion thorae*, *Caricion austroalpinae*, *Armerion cantabricae*

Mesophile, mostly closed, vigorous, often grazed or mowed, grasslands on deep soils of the subalpine and lower alpine levels of the Alps, the Pyrenees and, locally, of the Apennines and the Jura.

(Braun-Blanquet, 1954, 1969a; Sutter, 1967; Berset, 1969; Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Delvosalle, 1977; Gruber, 1978; Ozenda, 1981, 1985; Barbero *et al.*, 1982; Rivas-Martinez *et al.*, 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

36.411

Mesophile evergreen sedge grasslands*Primulion intricatae* p., *Laserpitio-Ranunculion thorae*

Mesophile grasslands of the south-western Alps and the Pyrenees, occupying gentle up slopes and humid flats on deep, often slightly acid, soils over calcareous substrates, with *Sesleria albicans*, *Carex sempervirens*, *Helictotrichon montanum*, *Arenaria ciliata*, *Draba aizoides*, *Globularia nana*, *Geranium cinereum*, *Ranunculus gouani*, *R. thora*, *Primula elatior* ssp. *intricata*, *Oxytropis triflora*, *Trifolium thalii*, *Anthyllis vulneraria* ssp. *pyrenaica*, *Alchemilla plicatula* (*A. asterophylla*), *Adonis pyrenaica*, *Horminium pyrenaicum*, *Geum pyrenaicum*, *Bartsia spicata*, *B. alpina*, *Scabiosa cinerea*, *Leuzea centauroides* (*Rhaponticum cynaroides*), *Fritillaria delphinensis*, *F. burnati*, *Crocus vernus*, *Bulbocodium vernum*, *Carex tendae*, *Salix pyrenaica*.

36.4111

Alpine evergreen sedge grasslands

36.4112

Pyrenean evergreen sedge grasslands

36.412

Northern rusty sedge grasslands*Caricion ferrugineae*

Mesophile, often flower-rich grasslands of the northern Alps, occupying deep soils in the subalpine and lower alpine levels of the calcareous ranges, usually dominated by *Carex ferruginea* and with *Astragalus alpinus*, *A. frigidus*, *Hedysarum hedysaroides*, *Lathyrus laevigatus*, *Astrantia major*, *Centaurea montana*, *Anemone narcissiflora*, *Crepis pyrenaica*, *C. pontana*, *Pedicularis foliosa*, *Traunsteinera globosa*, *Phleum hirsutum*, *Agrostis agrostiflora*.

36.413

Southern rusty sedge grasslands*Caricion austroalpinae*

Mesophile, flower-rich grasslands of the subalpine and lower alpine levels of the southeastern outer Alps (Insubria, Garda, Dolomites), usually dominated by *Carex ferruginea*, *C. austroalpina* or *C. sempervirens* with, in particular, *Horminium pyrenaicum*, *Pedicularis gyroflexa*, *P. foliosa*, *Knautia transalpina*, *Astrantia major*, *Asphodelus albus*, *Traunsteinera globosa* and many composites and peas.

- 36.414** **Violet fescue swards and related communities**
Caricion ferrugineae p.: *Festuco-Trifolietum thalii*, *Primulion intricatae* p.: *Festuco rubrae-Trifolietum thalii*
 Closed grasslands of the subalpine and lower alpine levels dominated by *Festuca violacea* or *F. nigrescens* and *Trifolium thalii*, developed on deep, often superficially slightly acidified, soils.
- 36.4141** **Alpine violet fescue swards**
 Alpine formations with *Festuca violacea*, *Trifolium thalii*, *T. badium*, *Trollius europaeus*, *Linum alpinum*, *Anemone narcissiflora*, *Onobrychis montana*, *Lathyrus laevigatus*, *Oxytropis campestris*, *O. triflora*, *Pedicularis verticillata*, *Phyteuma orbiculata*; usually grazed, they tend, with increased fertilization, towards the pastures of the *Poion alpinae* (36.52).
- 36.4142** **Pyrenean blackish fescue swards**
 Eastern Pyrenean formations with *Festuca nigrescens* (*F. rubra* ssp. *commutata*) and *Trifolium thalii*.
- 36.4143** **Apennine violet fescue swards**
 Calciphilous extremes of the closed Apennine grasslands, dominated by *Festuca violacea* ssp. *macrathera* and *Trifolium thalii* (see 36.382).
- 36.415** **Cantabrian thrift swards**
Armerion cantabricae: *Pediculari fallaci-Armerietum cantabricae*
 Chionophilous grasslands of deep soils, somewhat decalcified at the surface, of the subalpine, and locally of the alpine or upper montane, levels of the calcareous Cantabrian mountains, dominated by *Armeria cantabrica*, *Carex sempervirens*, *Festuca glacialis* or *F. gautieri*, associated with *Sesleria albicans*, *Poa alpina*, *P. minor*, *Festuca burnatii*, *Bellar-diochloa violacea*, *Agrostis schleicheri*, and with *Anemone baldensis* ssp. *pavoniana*, *Aquilegia pyrenaica* ssp. *discolor*, *Jasione cavanillesii*, *Pedicularis pyrenaica* ssp. *fallax*, *Draba aizoides* ssp. *cantabrieae*, *Pimpinella siifolia*, *Oxytropis pyrenaica*, *O. halleri*.
- 36.416** **Jura summital swards**
Caricion ferrugineae: *Laserpitio-Calamagrostietum variae*
 Localized mesophile grasslands of the subalpine level of the French and Swabian Juras, with *Calamagrostis varia*, *Laserpitium siler*, *L. latifolium*, *Dryas octopetala*, *Eryngium alpinum*, and very locally, *Carex ferruginea*.
- 36.42** **WIND EDGE NAKED-RUSH SWARDS**
Oxytropo-Elynion
 Meso-xerophile, relatively closed and unsculptured swards of *Elyna myosuroides* forming on deep, fine soils of protruding ridges and edges exposed to strong winds in the alpine and nival levels of the Alps, Pyrenees, Cantabrian mountains and, very locally, the Abruzzi, with *Oxytropis jacquinii* (*O. montana*), *O. pyrenaica*, *O. carinthiaca*, *O. foucaudii*, *O. halleri*, *Antennaria carpatica*, *Dryas octopetala*, *Draba carinthiaca*, *D. siliquosa*, *D. fladnizensis*, *D. aizoides*, *Gentiana tenella*, *Erigeron uniflorus*, *Dianthus glacialis*, *D. monspessulanus* ssp. *sternbergii*, *Potentilla nivea*, *Saussurea alpina*, *Geranium argenteum*, *Sesleria sphaerocephala*, *Carex atrata*, *C. brevicollis*, *C. foetida*, *C. capillaris*, *C. nigra* and *C. curvula* ssp. *rosae*.
 (Braun-Blanquet, 1954, 1969a; Ellenberg, 1963, 1988; Braun-Blanquet, Trepp *et al.*, 1964; Sutter, 1969; Guinochet and Vilmorin, 1973; Gruber, 1978; Ozenda, 1981, 1985; Barbero *et al.*, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Vigo and Ninot, 1987; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)
- 36.421** **Alpine naked-rush swards**
Elynetum, *Caricetum curvulae elynetosum*
 Brown swards of Alpine crests and ridges submitted to extreme winds.
- 36.422** **Pyrenean naked-rush swards**
Oxytropido halleri-Elynetum, *Carici brevicollis-Elynetum*, *Carici rosae-Elynetum myosuroidis*
 Relatively extensive formations of the calcareous ranges of the Pyrenees, where the *Elyna-Oxytropis* swards represent the main grassland formation of the alpine level.

- 36.423 **Cantabrian naked-rush swards**
Oxytropido pyrenaicae-Elynetum myosuroidis
 Uncommon formations of the high summits of the Picos de Europa.

- 36.424 **Apennine naked-rush swards**
 Very local formations of the high crests of the Abruzzi.

- 36.43 **STEPPED AND GARLAND GRASSLANDS**
Seslerietalia albicantis, *Astragaletalia sempervirentis* p., *Festuco-Poetalia ligulatae* p., *Seslerietalia juncifoliae*, *Daphno-Festucetalia* p.
 Xero-thermophile, open, sculptured, stepped or garland grasslands of the Alps, the Pyrenees and the Mediterranean mountains, with very local outposts in the Jura.
 (Braun-Blanquet, 1954, 1969a; Ellenberg, 1963, 1988; Braun-Blanquet, Trepp *et al.*, 1964; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Gruber, 1978; Ozenda, 1981, 1985; Dupias, 1985; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

- 36.431 **Blue moorgrass-evergreen sedge slopes**
Seslerion albicantis p.
 Xero-thermophile stepped or garland, species-rich grasslands of the alpine and subalpine levels of the northern and south-eastern Alps, and locally, of the Jura, on slopes with shallow soil and snow-cover of short duration, with *Sesleria albicans*, *Carex sempervirens*, *C. humilis*, *Gentiana favrati*, *Helianthemum alpestre*, *H. nummularium* ssp. *grandiflorum*, *Phyteuma orbiculare*, *Leontopodium alpinum*, *Pedicularis rostrato-capitata*, *P. verticillata*, *Anthyllis vulneraria* ssp. *alpestris*, *Ranunculus thora*.
 (Braun-Blanquet, 1954, 1969a; Ellenberg, 1963, 1988; Braun-Blanquet, Trepp *et al.*, 1964; Berset, 1969; Guinochet and Vilmorin, 1973; Delvosalle, 1977; Gruber, 1978; Ozenda, 1981, 1985; Oberdorfer, 1990; Jonglet, *in litt.*, 1990)

- 36.4311 **Alpine blue moorgrass-evergreen sedge swards**
Seslerio-Caricetum sempervirentis = *Seslerio-Sempervirentum*
 Widespread calciphilous formations of the Alps.

- 36.4312 **Jura blue moorgrass-evergreen sedge swards**
Laserpitio-Seslerietum
 Very local formations of the high Jura.

- 36.432 **Southern Alpine oatgrass-blue moorgrass swards**
Avenion montanae, *Avenion sempervirentis*, *Ononidion cenisiae*
 Xero-thermophile, open, stepped or garland, species-rich grasslands of the alpine and subalpine levels of the southern Alps, and particularly of the south-western Alps, similar to those of the previous unit (36.431), but in which *Carex sempervirens* is less prominent, while various oats, *Helictotrichon* (*Avena*) *sedense* (*H. montanum*, *A. montana*), *H. sempervirens*, *H. parlatorei*, *H. setaceum*, or *Festuca dimorpha* become important components together with *Sesleria albicans*, and oro-Mediterranean species such as *Globularia nana*, *Hedysarum hedysarioides*, *Lilium pomponium*, *Centaurea triumfetti*, *Ononis cristata* (*O. cenisia*), *O. striata*, *Iberis sempervirens*, *Aethionema ovalifolium*, *Sempervivum calcareum*, *Arenaria cinerea*, *Galeopsis reuteri*, *Leuzea rhapontica* (*Rhaponticum scariosum*) ssp. *bicknellii* and the spiny *Astragalus sempervirens* appear; several of these species are local endemics of very restricted distribution.
 (Braun-Blanquet, 1954; Guinochet and Vilmorin, 1973; Gruber, 1978; Ozenda, 1981, 1985; Barbero *et al.*, 1982; Pignatti, 1982; Jonglet, *in litt.*, 1990)

- 36.433 **Cushion sedge carpets**
Seslerion caeruleae: Caricetum firmae (Firmetum)
 Open formations of the alpine level of the south-eastern Alps, and, to a lesser extent, of the north-eastern Alps, composed of cushions of *Carex firma* and other low-growing rosette or cushion plants among which *Saxifraga caesia*, *Gentiana clusii*, *G. froelichii*, *G. terglouensis*, *Crepis jacquini*, *Pedicularis rosea*, *Saussurea pygmaea*, *Dianthus monspessulanus* ssp. *sternbergii*, *Primula wulfeniana*, *Chamorchis alpina*, *Sesleria albicans*, *Carex mucronata*, sometimes in association with mats of *Dryas octopetala*.
 (Ellenberg, 1963, 1988; Braun-Blanquet, 1954, 1969a; Ozenda, 1981, 1985; Oberdorfer, 1990; Jonglet *in litt.*, 1990)

36.434

Pyrenean *Festuca gautieri* grasslands*Festucion scopariae*, *Thymelaion nivalis*, *Saponarion caespitosae*

Open, xeric, stepped, scraped, species-rich grasslands of calcareous adrets in the subalpine and lower alpine levels of the Pyrenees, formed by the smooth, sharp-pointed, often curved-leaved *Festuca gautieri* ssp. *scoparia* and often rich in small cushiony plants; characteristic elements include *Koeleria vallesiana*, *Helictotrichon sedense* (*Avena montana*), *Sesleria albicans*, *Sideritis hyssopifolia*, *S. endressii*, *Helianthemum oelandicum* var. *hirtum*, *Androsace villosa*, *Gypsophila repens*, *Acinos alpinus*, *Paronychia serpyllifolia*, *Anthyllis vulneraria*, *Arenaria grandiflora*, *Astragalus sempervirens*, *A. monspessulanus*, *Eryngium bourgati*, *Fritillaria pyrenaica*, *Teucrium pyrenaicum*, *Erigeron pyrenaicus*, *Ononis cristata* (*O. cenisia*), *Onosma fastigiatum*, *Saponaria caespitosa*, *Jurinea humilis*, *Seseli nanum*, *Arenaria tetraquetra*, *Scorzonera aristata*, *Thymelaea nivalis*, *Iberis bernardiana*, *Serratula nudicaulis*, *Asperula cynanchica*, *Polygala alpina*, *Oxytropis pyrenaica*, *Carex rupestris*. (Gruber, 1978; Dupias, 1985; Ozenda, 1985; Bolos y Capdevilla, 1987; Vigo and Ninot, 1987)

36.435

Oro-Iberian calciphilous stripped grasslands*Festuco-Poetalia ligulatae* p.

Thermophile, open, stripped and garland fescue grasslands of calcareous upper slopes and summits in the subalpine and oro-Mediterranean levels of the Cantabrian mountains, the Iberian Range and the calcareous Baetic ranges, dominated by *Festuca hystris*, *F. burnatii*, *Poa ligulata* or *Oreochloa confusa*. They are closely allied to the Iberian fescue frost-grasslands (34.73) of the supra-Mediterranean and montane levels of the same mountains. (Rivas-Martinez, Diaz *et al.*, 1984; Martinez Parras *et al.*, 1987, Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Peinado Lorca and Martinez Parras, 1987)

36.436

Apennine stripped grasslands*Seslerietalia juncifoliae*

Open, xerophile, stripped, stepped, scraped and garland grasslands of alpine and subalpine slopes and summits of the central and southern Apennines, dominated by *Sesleria tenuifolia* (*S. juncifolia*), *S. nitida*, *S. italica*, *Festuca dimorpha*, *Carex kitaibeliana* (*C. laevis*). (Bonin, 1971, 1972; Biondi and Blasi, 1982; Pignatti, 1982; Biondi *et al.*, 1985; Ozenda, 1985)

36.437

Greek stripped grasslands*Daphno-Festucetalia* p.

Open, scraped, stepped and garland grasslands of the alpine and subalpine levels of the calcareous mountains of Greece, dominated by *Sesleria korabensis*, *S. coeruleans*, *Festuca graeca*, *Carex kitaibeliana*, *Stipa pulcherrima* with *Viola heterophylla* ssp. *graeca*, *Minuartia verna*, *Paronychia rechingeri*, *Silene ciliata*, *Dianthus minutiflorus*, *Draba athoa*, *Iberis sempervirens*, *Anthyllis vulneraria* ssp. *pulchella*, *Acinos alpinus*, *Edraianthus graminifolius*, *Centaurea pindicola*, *Galium anisophyllum*, *Morina persica*, *Bornmuellera baldaccii*, *B. tymphaea*, *Poa pirinica*, *P. thessala*, *Festuca olympica*, and a few woody species, in particular *Daphne oleoides* and *Juniperus nana*. (Horvat *et al.*, 1974; Strid, 1980; Ozenda, 1985)

36.44

ALPINE HEAVY METAL COMMUNITIES*Violetalia calaminariae*: *Galio anisophylli* – *Minuartion vernae* i.a.

Formations of heavy metal soils of the alpine and subalpine levels, with, among others, *Dianthus sylvestris*, *Galium anisophyllum*, *Poa alpina* and the very restricted southern Alpine endemic *Viola dubyana*. (Pignatti, 1982; Ellenberg, 1988)

36.5

ALPINE AND SUBALPINE FERTILIZED GRASSLANDS*Arrhenatheretalia elatioris* p.

Enriched hay meadows and pastures of the subalpine and lower alpine levels. (Ellenberg, 1988; Oberdorfer, 1990)

36.51

SUBALPINE YELLOW OATGRASS HAY MEADOWS

Polygono-Trisetion p.

Trisetum flavescens-dominated grasslands of the subalpine level. Yellow oatgrass hay meadows are typically montane and have been listed and described under 38.3; subalpine representatives may, however, be coded under this unit when useful to preserve the unity of subalpine habitat complexes.

36.52

ROUGH HAWKBIT PASTURES

Poion alpinae

Species-poor manured cattle pastures of the subalpine and lower alpine levels, with *Agrostis alpina*, *Phleum alpinum*, *Poa alpina*, *Cerastium fontanum*, *Crepis aurea*, *Leontodon hispidus*, *Trifolium badium*, *T. thalii*.

37 Humid grasslands and tall herb communities

Unimproved or lightly improved wet meadows; tall herb communities.

37.1

MEADOWSWEET STANDS AND RELATED COMMUNITIES

Filipendulion ulmariae i.a.

Hygrophile tall herb strips of fertile alluvial stream banks, often dominated by *Filipendula ulmaria*, and tall herb stands (*F. ulmaria*, *Angelica sylvestris*) colonizing humid hay meadows and pastures after more or less long discontinuation of mowing or grazing; characteristic species are *Filipendula ulmaria*, *Achillea ptarmica*, *Angelica sylvestris*, *Cirsium palustre*, *Deschampsia cespitosa*, *Epilobium hirsutum*, *Geranium palustre*, *Veronica longifolia*, *Scutellaria hastifolia*, *Eupatorium cannabinum*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Phalaris arundinacea*, *Polygonum bistorta*, *Valeriana officinalis*.

(Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Mériaux, 1976; De Sloover and Lebrun, 1976; Noirfalise *et al.*, 1980; Gorissen *et al.*, 1983; Rivas-Martinez *et al.*, 1987; Oberdorfer, 1990)

37.2

EUTROPHIC HUMID GRASSLANDS

Molinietalia: *Calthion palustris*, *Bromion racemosi*, *Deschampsion cespitosae*, *Juncion acutiflori*, *Cnidion dubii*; *Agrostietalia stoloniferae*: *Agropyro-Rumicion p.*

Meadows developed on moderately to very nutrient-rich, alluvial or fertilized, wet or damp soils, often inundated at least in winter, and relatively lightly mowed or grazed, in lowland, collinar and montane western and central Europe, south to western Iberia. They form a transition between the false oatgrass mesophile meadows, the oligotrophic *Molinion* formations and the small sedge and large sedge communities. They include a large number of distinctive and often species-rich communities, many of which harbour specialized, rare and threatened species of plants and animals.

(Tüxen and Oberdorfer, 1958; Sougnez and Limbourg, 1963; Ellenberg, 1963, 1988; Braun-Blanquet, 1967a; Archiloque *et al.*, 1969; Noirfalise and Dethioux, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Delpech, 1976; O'Sullivan, 1976; Schumacker, 1976; Duvalignaud, 1976; Frileux, 1976; Sissingh, 1976; Bournérias *et al.*, 1976; Delpech and Frileux, 1976; Wattez, 1976; Rose, 1976; De Sloover and Lebrun, 1976; Brasseur *et al.*, 1978; Bournérias, 1979, 1984; Noirfalise *et al.*, 1980, 1985; De Sloover *et al.*, 1980; Rivas-Martinez *et al.*, 1980; Gorissen *et al.*, 1983; Dethioux *et al.*, 1983; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Oberdorfer, 1990)

37.21

ATLANTIC AND SUB-ATLANTIC HUMID MEADOWS

Calthion palustris, *Bromion racemosi*, *Deschampsion cespitosae*

Lightly managed hay meadows and pastures on both basocline and acidocline, nutrient-rich soils of middle European lowlands, hills and low mountains under Atlantic or sub-Atlantic climatic conditions. Among the characteristic plant components of the highly diverse communities forming this unit are *Caltha palustris*, *Cirsium palustre*, *C. rivularis*, *C. oleraceum*, *Epilobium parviflorum*, *Lychnis flos-cuculi*, *Mentha aquatica*, *Scirpus sylvaticus*, *Stachys palustris*, *Bromus racemosus*, *Crepis paludosa*, *Fritillaria meleagris*, *Geum rivale*, *Polygonum bistorta*, *Senecio aquaticus*, *Trollius europaeus*, *Lotus uliginosus*, *Trifolium dubium*, *Equisetum palustre*, *Myosotis palustris*, *Deschampsia cespitosa*, *Angelica sylvestris*, *Oenanthe silaifolia*, *Gratiola officinalis*, *Inula salicina*, *Succisella inflexa*, *Dactylorhiza majalis*, *Ranunculus acris*, *Rumex acetosa*, *Holcus lanatus*, *Alopecurus pratensis*, *Festuca pratensis*, *Juncus effusus*, *J. filiformis*.

37.211

Cabbage thistle meadows

Angelico-Cirsietum oleracei i.a.

Cabbage thistle meadows and related species-rich communities, characteristic of base-rich soils in lowland valleys.

37.212

Globe flower-brook thistle meadows

Trollio-Cirsietum rivularis i.a.

Globe flower-brook thistle meadows and related communities, replacing the cabbage thistle meadows in montane areas.

37

- 37.213** **Tufted hairgrass meadows**
Deschampsietum cespitosae i.a.
 Tufted hairgrass meadows and related communities, widespread in eastern and south-eastern Europe (northern Greece, in the *Quercion frainetto* and *Fagion moesiacum* zones).
- 37.214** **Marsh ragwort meadows**
Senecionetum aquatici i.a.
 Marsh ragwort meadows and related communities, mostly developed on lowland acidocline soils.
- 37.215** **Bistort meadows**
Deschampsio cespitosae-Polygonetum bistortae i.a.
 Bistort meadows and related communities, occupying acidocline soils of montane and sub-montane regions.
- 37.216** **Thread rush meadows**
Juncetum filiformis i.a.
 Thread rush meadows and related communities.
- 37.217** **Soft rush meadows**
Epilobio-Juncetum effusi i.a.
 Soft rush meadows and related communities.
- 37.218** **Blunt-flowered rush meadows**
Juncetum subnodulosi i.a.
 Blunt-flowered rush meadows and related communities, characteristic of very wet calcareous soils or soils flushed by calcareous waters, transitional to the small sedge fens of the *Caricion davallianae* (54.2), surviving mostly in the British Isles and in the Alpine foothills; many formations are rather oligotrophic and could equally be listed under 37.3.
- 37.219** **Wood clubrush meadows**
Scirpetum sylvatici i.a.
 Wood clubrush meadows and related communities.
- 37.22** **SHARP-FLOWERED RUSH MEADOWS**
Juncion acutiflori
 Humid meadows dominated by, or rich in, *Juncus acutiflorus*. They are floristically and phytosociologically very varied and many are as related to the oligotrophic *Molinion* communities of 37.3 as to the more eutrophic *Calthion* ones of 37.2. Sharp-flowered rush meadows are particularly characteristic of the oceanic and suboceanic regions of the western seaboard of Europe from north-western Iberia to the Low Countries.
- 37.23** **SUBCONTINENTAL CNIDIUM MEADOWS**
Cnidion dubii
 Moist-soil, flood-subjected meadows of river valleys under continental or subcontinental climatic conditions, with *Cnidium dubium*, *Viola persicifolia*, *Allium angulosum*, *Iris sibirica*, *Oenanthe lachenalii*, *O. silaifolia*, *Gratiola officinalis*, *Juncus atratus*, *Leucojum aestivum*, *Carex praecox* var. *suzae*, *Lythrum virgatum*.
- 37.24** **FLOOD SWARDS AND RELATED COMMUNITIES**
Agropyro-Rumicion crispi p.
 Grasslands of occasionally flooded river and lake banks, of depressions where rain water collects, of disturbed humid areas and of pastures submitted to intensive grazing.
- 37.241** **Tall rush pastures**
 Rush (*Juncus effusus*, *J. conglomeratus*, *J. inflexus*) colonies of intensively grazed pastures.
- 37.242** **Creeping bent and tall fescue swards**
 Flood swards with *Agrostis stolonifera*, *Carex hirta*, *Festuca arundinacea*, *Juncus inflexus*, *Alopecurus geniculatus*, *Rumex crispus*, *Mentha longifolia*, *M. pulegium*, *Potentilla anserina*, *P. reptans*, *Ranunculus repens*.

37.25

TRANSITIONAL TALL HERB HUMID MEADOWS*Calthion palustris p. i.a.*

Recently abandoned hay meadows evolving towards 37.1 or towards woodland, with invasion of *Polygonum bistorta*, *Filipendula ulmaria*, *Phragmites communis*, may, if useful, be coded under this subunit instead of 37.21.

37.3

OLIGOTROPHIC HUMID GRASSLANDS*Molinion caeruleae*, *Juncion squarrosi*

Humid grasslands of middle Europe and north-western Iberia, on soils very poor in nutrients.

37.31

PURPLE MOORGRASS MEADOWS AND RELATED COMMUNITIES*Molinietalia: Molinion caeruleae*

Humid grasslands of soils poor in nutrients, unfertilized and with a fluctuating water level, with *Molinia caerulea*, *Succisa pratensis*, *Deschampsia cespitosa*, *Potentilla erecta*, *Allium angulosum*, *A. suaveolens*, *Betonica officinalis*, *Cirsium dissectum*, *C. tuberosum*, *Dianthus superbus*, *Trollius europaeus*, *Galium boreale*, *Gentiana asclepiadea*, *G. pneumonanthe*, *Gladiolus palustris*, *Silaum silaus*, *Selinum carvifolia*, *Inula salicina*, *Iris sibirica*, *Laserpitium prutenicum*, *Lathyrus pannonicus*, *Tetragonolobus maritimus*, *Serratula tinctoria*, *Carex tomentosa*, *C. panicea*, *C. pallescens*, *Parnassia palustris*, *Platanthera bifolia*, *Colchicum autumnale*, *Ophioglossum vulgatum*, *Dactylorhiza maculata*.

(Tüxen and Oberdorfer, 1958; Ellenberg, 1963, 1988; Sougnez and Limbourg, 1963; Guinochet and Vilmorin, 1973; De Foucault, 1976; O'Sullivan, 1976; Sougnez, 1977; De Sloover *et al.*, 1978; Gruber, 1978; Brasseur *et al.*, 1978; Bournérias, 1979, 1984; De Sloover *et al.*, 1980; Noirfalise *et al.*, 1982; Dethioux *et al.*, 1983; Oberdorfer, 1990)

37.311

Calcareous purple moorgrass meadows*Eu-Molinion*

More species-rich variant, on calcareous soils, with *Silaum silaus*, *Sanguisorba officinalis*, *Selinum carvifolia*, *Betonica officinalis*, *Cirsium tuberosum*, *Carex tomentosa*, *Tetragonolobus maritimus*, *Stachys officinalis*, *Galium boreale*, *Serratula tinctoria*, *Inula salicina*, *Dianthus superbus*, *Colchicum autumnale* (abundant).

(Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Noirfalise *et al.*, 1982)

37.312

Acid purple moorgrass meadows*Junco-Molinion*

Less species-rich formations of acid soils with *Viola persiciflora*, *V. palustris*, *Galium uliginosum*, *Cirsium dissectum*, *Crepis paludosa*, *Luzula multiflora*, *Juncus subuliflorus* (= *J. conglomeratus*), *Ophioglossum vulgatum*, *Inula britannica*, *Lotus uliginosus*, *Dianthus deltoides*, *Potentilla erecta*, *P. anglica*, *Carex pallescens*.

(Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Noirfalise *et al.*, 1982)

37.32

HEATH RUSH MEADOWS AND HUMID MAT-GRASS SWARDS*Nardetalia: Juncion squarrosi*

Humid, often peaty or semipeaty swards with *Nardus stricta*, *Juncus squarrosus*, *Festuca ovina*, *Gentiana pneumonanthe*, *Pedicularis sylvatica*, *Scirpus cespitosus* and sometimes *Sphagnum spp.*

(Tüxen and Oberdorfer, 1958; Schumacker, 1973; Sougnez, 1977; De Sloover *et al.*, 1978; Noirfalise *et al.*, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Dias Gonzalez and Fernandez Prieto, 1987; Ellenberg, 1988; Oberdorfer, 1990)

37.4

MEDITERRANEAN TALL HUMID GRASSLANDS*Holoschoenetalia: Molinio-Holoschoenion*

Mediterranean humid grasslands of tall grasses and rushes with *Scirpus holoschoenus* (*Holoschoenus vulgaris*), *Agrostis stolonifera*, *A. reuteri*, *Galium debile*, *Molinia caerulea*, *Briza minor*, *Melica cupanii*, *Cyperus longus*, *Linum tenue*, *Trifolium resupinatum*, *Schoenus nigricans*, *Peucedanum hispanicum*, *Carex mairii*, *Juncus maritimus*, *J. acutus*, *Asteriscus aquaticus*, *Hypericum tomentosum*, *H. tetrapterum*, *Inula viscosa*, *Oenanthe pimpinelloides*, *O. lachenalii*, *Eupatorium cannabinum*, *Prunella vulgaris*, *Pulicaria dysenterica*, *Tetragonolobus maritimus*, *Orchis laxiflora*, *Dactylorhiza elata*, *Succisa pratensis*, *Sonchus maritimus* ssp. *aquatilis*, *Silaum silaus*, *Sanguisorba officinalis*, *Serratula tinctoria*, *Genista tinctoria*, *Cirsium monspessulanum*, *C. pyrenaicum*, *Senecio doria*, *Dorycnium rectum*, *Erica terminalis*, *Euphorbia pubescens*, *Lysimachia ephemereum*.

(Donker and Stivelink, 1962; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Pedrotti, 1976; Gruber, 1978; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Bolos y Capdevila, 1987; Costa, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Martinez Parras *et al.*, 1987; Asensi Marfil and Diez Garretas, 1987)

37.5

MEDITERRANEAN SHORT HUMID GRASSLANDS*Holoschoenetalia: Deschampsion mediae*

Very short grasslands of impermeable compact soils or marls, wet for a large part of the year, and desiccated in summer, with *Deschampsia media*, *Centaurium pulchellum*, *Lotus tenuis*, *Trifolium lappaceum*, *Prunella hyssopifolia*, *Plantago serpentina*, *Centaurea timbali*.

(Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Molinier and Martin, 1980)

37.6

EASTERN SUPRA-MEDITERRANEAN HUMID MEADOWS*Trifolio-Hordeetalia: Trifolion resupinati, Ranunculion velutini*

Humid meadows rich in clover of the Balkan peninsula and the Apennines, mostly developed at collinear levels.

(Horvat *et al.*, 1974; Pedrotti, 1976)

37.61

GREEK SUPRA-MEDITERRANEAN HUMID MEADOWS*Trifolion resupinati*

Meso-hygrophile grasslands of alluvial and other high water-table sites of the *Ostryo-Carpinion* zone of Greece, particularly of Macedonia and Thrace, with *Trifolium resupinatum*, and several other *Trifolium* species, *Alopecurus utriculatus*, *Hordeum murinum*, *Ranunculus marginatus*, *R. velutinus*, *Cirsium canum* var. *macedonicum*, *Narcissus poeticus*, *Leucojum aestivum*.

(Horvat *et al.*, 1974)

37.62

APENNINE HUMID MEADOWS*Ranunculion velutini*

Permanent humid grasslands of Apennine karstic basins, with *Ranunculus velutinus*, *Bromus racemosus*, *Hordeum secalinum*, *Trifolium dubium*, *T. resupinatum*, *T. micranthum*, *T. patens*, *T. fragiferum*, *T. pratense*, *T. repens*, *Carex distans*, *Deschampsia cespitosa*, *Gaudinia fragilis*, *Ophioglossum vulgatum*, *Centaurea jacea*, *Holcus lanatus*, *Alopecurus utriculatus*, *Orchis laxiflora*, *Colchicum lusitanica*.

(Pedrotti, 1976)

37.7

HUMID TALL HERB FRINGES*Convolvuletalia sepium, Glechometalia hederaceae p. (Calystegio-Alliarietalia)*

Watercourse veil and shady woodland edge communities

(Ellenberg, 1963, 1988; Duvigneaud, 1967; Guinochet and Vilmorin, 1973; Géhu and Géhu, 1976; Géhu, 1984; Drachenfels *et al.*, 1984; Oberdorfer, 1990)

37.71

WATERCOURSE VEILS*Senecion fluviatilis (Calystegion sepium), Convolvulion sepium p., Aegopodion podagrariae p.*

Screens or veils of perennial tall herbs, small bushes and lianas (*Calystegia sepium*, *Cuscuta europaea*) lining lowland watercourses, and sometimes other water bodies, with many ruderal and introduced plants (*Aster* spp., *Rudbeckia* spp., *Solidago* spp., *Helianthus* spp., *Impatiens* spp., *Reynoutria japonica*).

- 37.711 **Angelica archangelica fluvial communities**
Angelica archangelica ssp. *littoralis* formations of great northern rivers, presently rare and threatened.
- 37.712 **Angelica heterocarpa fluvial communities**
Angelica heterocarpa formations of tidal estuaries of the Loire, the Charente and the Gironde; the species is a rare and very narrow endemic of south-western France.
- 37.713 **Marsh mallow screens**
Althaea officinalis formations of river banks and marsh edges, particularly on somewhat saline soils.
- 37.714 **Butterbur riverine communities**
Formations of *Petasites hybridus* and *Cirsium oleraceum* of the banks of small streams.
- 37.715 **Mixed riverine screens**
Formations of *Senecio fluviatilis*, *Calystegia sepium*, *Eupatorium cannabinum*, *Epilobium hirsutum*, *Sonchus palustris*, *Urtica dioica* and other species, lining lowland water courses.
- 37.72 **SHADY WOODLAND EDGE FRINGES**
Aegopodium podagrariae p., *Alliarion* (*Geo-Alliarion*, *Lapsano-Geranion robertiani*)
Nitro-hygrophilous communities of usually large-leaved herbs developing along the shaded side of wooded stands and hedges, with *Galium aparine*, *Glechoma hederacea*, *Geum urbanum*, *Aegopodium podagraria*, *Silene dioica*, *Carduus crispus*, *Chaerophyllum hirsutum*, *Lamium album*, *Alliaria petiolata*, *Lapsana communis*, *Geranium robertianum*, *Viola alba*, *V. odorata*.
- 37.8 **SUBALPINE AND ALPINE TALL HERB COMMUNITIES**
Betulo-Adenostyletea p.; *Rumicion alpini*
Luxuriant tall herb formations of deep, humid soils in the montane to alpine, but mostly subalpine, levels of the higher mountains, with *Cicerbita alpina*, *C. plumieri*, *Cirsium helenioides*, *C. spinosissimum*, *C. flavispina*, *Geranium sylvaticum*, *Polygonatum verticillatum*, *Ranunculus platanifolius*, *Aconitum vulparia*, *A. napellus*, *A. nevadense*, *Adenostyles alliariae*, *Senecio elodes*, *Veratrum album*, *Trollius europaeus*, *Peucedanum ostruthium*, *Doronicum austriacum*, *Pedicularis foliosa*, *Eryngium alpinum*, *Centaurea rhapontica*, *Valeriana pyrenaica*, *Tozzia alpina*. Groupings of these plants can invade the *Aceri-Fagion* and reappear, along streams, lower down in montane beech forests. If useful, their presence can be noted by combining a code of 37.8 with the appropriate forest code.
(Ellenberg, 1963, 1988; Braun-Blanquet, 1969b, 1972a, 1976; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Gruber, 1978; Sutter, 1978; Rivas-Martinez, Diaz *et al.*, 1984; Ozenda, 1985; Noifalisse, 1986; Martinez Parras *et al.*, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Oberdorfer, 1990)
- 37.81 **HERCYNIO-ALPINE TALL HERB COMMUNITIES**
Adenostylion alliariae
Subalpine and alpine meso-hygrophile tall herb formations of moist hollows and gullies of the Alps, the Jura, the great Hercynian ranges, the Central Massif and the Apennines.
- 37.82 **SUBALPINE SMALL REED MEADOWS**
Calamagrostion arundinaceae
Thermophile, meso-xerophile species-rich formations of steep adrets of the subalpine level of the Alps, the Jura, the great Hercynian ranges and the Central Massif, mostly dominated by *Calamagrostis arundinaceae*, associated with plants such as *Senecio doronicum*, *Digitalis grandiflora*, *Hierachum aurantiacum*, *Aconitum vulparia*, *Geranium sylvaticum*, *Bupleurum longifolium*, *Sorbus* spp.
- 37.83 **PYRENEO-IBERIAN TALL HERB COMMUNITIES**
Adenostylion pyrenaicae
Subalpine and alpine meso-hygrophile tall herb formations of the Pyrenees, the Cantabrian mountains, the Cordillera Central, the Iberian Range, with *Valeriana pyrenaica* and *Adenostyles alliariae* ssp. *pyrenaica* (*hybrida*).

- 37.84 SOUTHERN IBERIAN TALL HERB COMMUNITIES
Cirsium flavispinae
Subalpine and alpine meso-hygrophile tall herb communities of the Sierra Nevada and other southern Iberian mountains, with the endemic *Cirsium flavispina*, *Aconitum nevadense*, *Senecio elodes*.
- 37.85 CORSICAN CYMBALARIA TALL HERB COMMUNITIES
Cymbalarion hepaticifoliae
Formations of rocky or grassy corridors in Corsica.
- 37.86 CORSICAN DORONICUM TALL HERB COMMUNITIES
Doronicion corsici
Riparian formations of Corsica.
- 37.87 GREEK TALL HERB COMMUNITIES
Cirsium appendiculati, *Geion coccinei*
Montane riparian and spring-edge vegetation of Greek mountains, with *Cirsium appendiculatum*, *Angelica sylvestris*, *Heracleum sphondylium*, *Geum coccineum*.
- 37.88 ALPINE DOCK COMMUNITIES
Glechometalia hederaceae: Rumicion alpini
Alpine and subalpine nitrophilous tall herb formations characteristic of the vicinity of cattle and game resting places, with *Rumex alpinus*, *Senecio alpinus*, *Cirsium spinosissimum*, *Peucedanum ostruthium*.

38 Mesophile grasslands

Lowland and montane mesophile pastures and hay meadows.

- 38.1** **MESOPHILE PASTURES**
Cynosurion
 Regularly grazed mesophile pastures, fertilized and on well-drained soils, with *Lolium perenne*, *Cynosurus cristatus*, *Poa* ssp., *Festuca* ssp., *Trifolium repens*, *Leontodon autumnalis*, *Bellis perennis*, *Ranunculus repens*, *R. acris*, *Cardamine pratensis*; they are most characteristic of the Euro-Siberian zone, but extend to Atlantic Iberia and the Cordillera Central, the Apennines and the supra-Mediterranean zone of Greece.
 (Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Noifalisse *et al.*, 1980, 1982; Fuller, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Rivas-Martinez *et al.*, 1987; Loidi Arregui, 1987; Oberdorfer, 1990)
- 38.11** **UNBROKEN PASTURES**
 Continuous pastureland, unrelieved by networks of ditches.
- 38.111** **Ryegrass pastures**
Lolio-Cynosuretum cristati
 Relatively species-poor grasslands, dominated by *Lolium perenne*, often with *Cynosurus cristatus*.
- 38.112** ***Cynosurus-Centaurea* pastures**
Centaureo-Cynosuretum cristati
 More species-rich grasslands dominated by *Cynosurus cristatus* and with many flowering herbs, notably *Centaurea nigra*.
- 38.12** **DITCH-BROKEN PASTURES**
 Grasslands drained by a network of ditches, fleets, streams or pools.
- 38.13** **OVERGROWN PASTURES**
 Abandoned grasslands with ruderal species.
- 38.2** **LOWLAND HAY MEADOWS**
Arrhenatherion, *Brachypodio-Centaureion nemoralis*
 Mesophile hay meadows of low altitudes, fertilized and well-drained, with *Arrhenatherum elatius*, *Trisetum flavescens*, *Anthriscus sylvestris*, *Heracleum sphondylium*, *Daucus carota*, *Crepis biennis*, *Knautia arvensis*, *Leucanthemum vulgare*, *Pimpinella major*, *Trifolium dubium*, *Geranium pratense*; they are most characteristic of the Euro-Siberian zone, but extend to Atlantic Iberia, the Cordillera Central and Montseny, to the Apennines and to the supra-Mediterranean zone of Greece.
 (Sougnéz, 1951; Ellenberg, 1963, 1988; Ilijanic, 1965; Archiloque *et al.*, 1969; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Noifalisse *et al.*, 1980, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Rivas-Martinez *et al.*, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Bolos y Capdevila, 1987; Oberdorfer, 1990)
- 38.21** **ATLANTIC HAY MEADOWS**
Brachypodio-Centaureion nemoralis
 Atlantic formations with *Centaurea nemoralis*, *Rhinanthus lanceolatus*, *Oenanthe pimpinelloides*, *Brachypodium pinnatum*.
- 38.22** **MEDIO-EUROPEAN LOWLAND HAY MEADOWS**
Arrhenatherion s.s.
 Typical medio-European formations.
- 38.23** **MEDIO-EUROPEAN SUBMONTANE HAY MEADOWS**
 Medio-European formations of mid-elevations, characteristic in particular of higher elevations of the lesser Hercynian ranges, intermediate between this unit and 38.3.

38.3

MOUNTAIN HAY MEADOWS*Polygono-Trisetion (Trisetio-Polygonion bistorti)*

Species-rich mesophile hay meadows of the montane and subalpine levels (mostly above 600 m) usually dominated by *Trisetum flavescens* and with *Heracleum sphondylium*, *Viola cornuta*, *Astrantia major*, *Carum carvi*, *Crepis mollis*, *C. pyrenaica*, *Polygonum bistorta*, *Silene dioica*, *S. vulgaris*, *Campanula glomerata*, *Salvia pratensis*, *Centaurea nemoralis*, *Anthoxanthum odoratum*, *Crocus albiflorus*, *Geranium phaeum*, *G. sylvaticum*, *Narcissus poeticus*, *Malva moschata*, *Valeriana repens*, *Trollius europaeus*, *Pimpinella major*, *Muscari botryoides*, *Lilium bulbiferum*, *Thlaspi caerulescens*, *Viola tricolor* ssp. *subalpina*, *Phyteuma halleri*, *P. orbiculare*, *Primula elatior*, *Chaerophyllum hirsutum* and many others.

(Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Gruber, 1978; Oberdorfer, 1990)

38.4

IBERIAN VALLICARES*Agrostietalia castellanae*

Summer pastures of the Iberian peninsula, submitted to poor drainage, brief flooding and rapid dessication with the first heat, constituted by perennial and annual grasses, most commonly by *Agrostis castellana*, *A. pourretii* (*A. salmantica*), *Gaudinia fragilis*, *Festuca ampla*, *Periballia involucrata*, *Vulpia ciliata*, *V. myuros*, *V. bromoides*, *Holcus setiglumis*, *Molineriella minuta*, *Anthoxanthum aristatum*, *A. ovatum* and often with *Juncus capitatus* and clovers such as *Trifolium campestre*.

(Bellot Rodriguez, 1979; Rivas-Martinez *et al.*, 1980; Martinez Parras *et al.*, 1987; Rivas-Martinez *et al.*, 1987; Asensi Marfil and Diez Garretas, 1987)

38.41

PERENNIAL VALLICARES

Perennial *Agrostis castellana*-dominated grasslands.

38.42

ANNUAL VALLICARES

Annual *Agrostis pourretii*-dominated grasslands.

38.43

ANDALUSIAN THRIFT VALLICARES

Armeria gaditana, *Gaudinia fragilis*, *Centaurea exarata* and *Asphodelus aestivus* grasslands of south-western Iberia.

38.5

MACARONESIAN MESOPHILE GRASSLANDS

Secondary grasslands of the highest levels of the Atlantic islands.
(Machado Carrillo, *in litt.*, 1989)

4 Forests



41 Broad-leaved deciduous forests

Forests and woodland of native deciduous trees, other than floodplain or mire woods; forests dominated by broad-leaved deciduous trees, but comprising broad-leaved evergreen trees, are included.

41.1

BEECH FORESTS

Forests dominated by *Fagus sylvatica* or, in Greece, *F. orientalis* or *F. moesiaca*. Many montane formations are beech-fir or beech-fir-spruce forests, to be noted as 43 (mixed forests), but with the suffixes below; they are discussed with the corresponding deciduous forest.

41.11

CENTRAL EUROPEAN ACIDOPHILOUS BEECH FORESTS WITH WOODRUSH *LUZULO-FAGENION*

Medio-European beech and, in higher mountains, beech-fir or beech-fir-spruce forests on acid soils, with *Luzula luzuloides*, *Polytrichum formosum*, and often *Deschampsia flexuosa*, *Vaccinium myrtillus*, *Pteridium aquilinum*.

(Noirfalise, 1956, 1984, 1986, 1987; Vanden Berghen and Mullenders, 1957; Roisin, 1962; Ellenberg, 1963, 1988; Oberdorfer, 1967, 1990; Noirfalise and Vanesse, 1977; Renault, 1978; Ozenda, 1979, 1985; Ozenda *et al.*, 1979; Petermann and Seibert, 1979; Timbal, 1981; Thill *et al.*, 1988)

41.111

Collinar woodrush beech forests

Beech forests of the lesser Hercynian ranges and Lorraine, never accompanied by spontaneous conifers.

41.112

Montane woodrush beech forests

Beech, beech-fir or beech-fir-spruce (43.112) of the greater Hercynian ranges, the Jura, the Alps and the Bavarian Plateau.

41.1121

Bayerischer Wald woodrush beech forests

Near-natural forests of the Bayerischer Wald.

41.1122

Semi-natural montane woodrush beech forests

Other formations.

41.12

ATLANTIC ACIDOPHILOUS BEECH FORESTS

Ilici-Fagenion

Atlantic forests on acid soils, differing from 41.11 by the absence of *Luzula luzuloides* and a greater abundance of *Ilex aquifolium*.

(Tüxen and Oberdorfer, 1958; Roisin, 1961; Hofmann, 1966; Braun-Blanquet, 1967a; Durin *et al.*, 1967; Baudière, 1974a; Bugnon and Rameau, 1974; Clément *et al.*, 1974; Frileux, 1974; Géhu, 1974; Ozenda, 1979, 1985; Ozenda *et al.*, 1979; Aaby, 1983; Noirfalise, 1984, 1986, 1987; Coquillard *et al.*, 1985; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Izco Sevillano, 1987; Peinado Lorca and Martinez Parras, 1987; Rivas-Martinez *et al.*, 1987; Oberdorfer, 1990; Rodwell, 1991)

41.121

North Sea acidophilous beech forests

Periclymeno-Fagetum, *Ilici-Fagetum*, *Milio-Fagetum*, *Fago-Quercetum p.*

Fragmented and insularized forests of the western seaboard of Europe, in Denmark, northern Germany, The Netherlands, middle Belgium, Picardy, Normandy and southern England.

41.122

Sub-Atlantic acidophilous beech forests

Deschampsio-Fagetum i.a.

Transition forests of the Paris basin, the Morvan, the periphery of the Central Massif, the eastern and central Pyrenees.

- 41.123** **Armorican acidophilous beech forests**
Rusco-Fagetum
Hyper-Atlantic forests of Brittany with an abundance of epiphytes and an understorey of ferns and evergreen bushes.
- 41.124** **Pyreneo-Cantabrian acidophilous beech forests**
Saxifrago hirsutae-Fagetum
Humid forests with luxuriant epiphytism of the western Pyrenees and eastern Cantabrian mountains.
- 41.125** **Western Cantabrian acidophilous beech forests**
Luzulo henriquesii-Fagetum
Humid acidophilous beech forests of western Cantabrian and Asturian mountains.
- 41.126** **Galician acidophilous beech forests**
Luzulo henriquesii-Fagetum mercurialetosum perennis
Humid beech forests of high, snowy dolomitic and calcareous sierras of Galicia (Ancares, Cebreiro, Caurel), somewhat intermediate between unit 41.12 and unit 41.13.
- 41.127** **Humid Iberian acidophilous beech forests**
Galio rotundifolii-Fagetum p.
Humid acidophilous beech forests of the northern Iberian Range.
- 41.128** **Hyper-humid Iberian acidophilous beech forests**
Ilici-Fagetum
Hyper-humid acidophilous beech forests of the northern Iberian Range.
- 41.129** **Ayllon acidophilous beech forests**
Galio rotundifolii-Fagetum p.
Relict acidophilous beech forests of the Sierra de Ayllon (Montejo, Puerto de la Quesera, Cantalojas).
- 41.13** **NEUTROPHILOUS BEECH FORESTS**
Asperulo-Fagenion (Galio odorati-Fagenion)
Medio-European and Atlantic forests, on neutral or near-neutral soils, with mild humus (mull), characterized by a strong representation of species belonging to the ecological groups of *Anemone nemorosa*, of *Lamium galeobdolon*, of *Galium odoratum* and *Melica uniflora* and, in mountains, various *Dentaria*, forming a richer and more abundant herb layer than in 41.11 and 41.12.
(Vanden Berghen and Coûteaux, 1955; Noifalaise, 1962, 1984, 1986, 1987; Noifalaise and Sougnez, 1963; Ellenberg, 1963, 1988; Sougnez, 1967; Dethioux, 1969; Coûteaux, 1969; Renault, 1978; Rogister, 1978, 1981; Ozenda, 1979, 1982, 1985; Bournérias, 1979; Petermann and Seibert, 1979; Ozenda *et al.*, 1979; Timbal, 1981; Oberdorfer, 1990; Rodwell, 1991)
- 41.131** **Wood melick beech forests**
Melico-Fagetum, Asperulo-Fagetum, Cardamino bulbiferae-Fagetum, Hordelymo-Fagetum, Lathyro-Fagetum
Medio-European collinar beech and beech-oak forests of the Hercynian arc and peripheral regions, the Jura, Lorraine, the Paris basin, Burgundy and a few localities of the North Sea-Baltic plain.
- 41.1311** **Calcicline wood melick beech forests**
Slightly-moist beech forests developed over calcareous bedrock on stony, neutral or weakly acid rendzina or similar humus-carbonate soils, with *Galium odoratum*, *Melica uniflora*, *Mercurialis perennis*, *Lathyrus vernus*, *Asarum europaeum*, *Hordelymus europaeus*, *Epipactis helleborine*, *E. leptochila*, *Neottia nidus-avis*, *Circaea lutetiana*, *Viola reichenbachiana*.
- 41.1312** **Neutrocline wood melick beech forests**
Beech forests developed on a more or less deep layer of brown loess-loam, less rich in calciphile plants and richer in acid- and drought-tolerant species; *Melica uniflora* (in northern formations) and *Galium odoratum* are usually well represented; *Carex brizoides*, *C. pilosa*, *Milium effusum* are characteristic of various subtypes.

41.132

Bluebell beech forests*Endymio-Fagetum*

Atlantic beech and beech-oak forests with *Hyacinthoides non-scripta*, of southern England, the Boulonnais, Picardy, the Oise, Lys and Schelde basins.

41.1321

Calcicline bluebell beech forests

Atlantic beech, beech-oak or beech-ash forests developed on base-rich and calcareous soils, particularly of limestone scarplands, of southern England (*Fagus sylvatica-Mercurialis perennis* woodland) and neighbouring regions of western France.

41.1322

Neutrocline bluebell beech forests

Atlantic beech and beech-ash forests developed on neutral or slightly acid brown soils of southern England (*Fagus sylvatica-Rubus fruticosus* woodland) and adjacent regions of the mainland.

41.133

Bittercress beech forests*Lonicero alpigenae-Fagenion: Abieti-Fagetum, Dentario enneaphyllidi-Fagetum, Aposeri-Fagetum, Dentario heptaphyllidi-Fagetum, Cardamino trifoliae-Fagetum*

Montane beech or beech-fir (43.133) formations of the Jura, the northern Alps and the great Hercynian ranges.

41.14

PYRENEO-CANTABRIAN NEUTROPHILE BEECH FORESTS*Scillo-Fagenion*

Neutrophile beech forests of the south-western Central Massif, the Pyrenees, the Cantabrian mountains, and, very locally, the northern Iberian Range.

(Tüxen and Oberdorfer, 1958; Braun-Blanquet, 1967a; Vanden Berghen, 1969; Dendaletche, 1973; Gruber, 1978; Ozenda, 1979, 1985; Bernard, 1983; Rivas-Martinez *et al.*, 1984; Dupias, 1985; Noirfalise, 1986, 1987; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Bolos y Capdevila, 1987)

41.141

Hygrophile Pyrenean beech forests*Scillo-Fagetum p.*

Humid montane beech and beech-fir (43.141) forests on neutral soils with mild humus (mull) of the western Pyrenees, characterized by the vernal bloom of *Scilla lilio-hyacinthus* and *Lathraea clandestina* and by a summer cover rich in ferns (*Athyrium filix-femina*, *Gymnocarpium dryopteris*, *Asplenium scolopendrium*, *Dryopteris spp.*, *Polystichum spp.*) and species of the ecological group of *Melica uniflora* and *Galium odoratum*; they are locally represented in the eastern Pyrenees and the Montes Olositanicos.

41.142

Mesophile Pyrenean beech forests*Helleboro-Fagetum*

Neutrophilous mesophile beech forests of the Pyrenees, the Montes Olositanicos and the northern Montes Catalanidicos, less species-rich than the preceding, characterized by the abundance of *Helleborus viridis* ssp. *occidentalis*.

41.143

Sub-humid oro-Cantabrian beech forests*Carici sylvaticae-Fagetum*

Neutrophilous beech forests of the subhumid montane areas of the Cantabrian mountains and, locally, of the northern Iberian Range, with *Carex sylvatica*, *Galium odoratum*, *Lathyrus occidentalis*, *Melica uniflora*, *Mercurialis perennis*, *Paris quadrifolia*, *Scilla lilio-hyacinthus*.

41.144

Humid Central Massif fir-beech forests*Scillo-Fagetum p.*

Fir-birch or beech forests of volcanic soils in the 1 100-1 600 metre range of the central and southern Massif Central, with *Galium odoratum*, *Euphorbia hyberna*, *Lilium martagon*, *Scilla lilio-hyacinthus*.

- 41.15** SUBALPINE BEECH WOODS
Aceri-Fagenion
Woods usually composed of low, low-branching trees, with much sycamore (*Acer pseudo-platanus*) situated near the tree limit, mostly in low mountains with oceanic climate (Vosges, Black Forest, Rhön, Jura, outer Alps, Central Massif, Pyrenees). Herb layer similar to that of 41.13 or locally 41.11 and with elements of adjacent open grasslands. (Ozenda, 1979, 1985; Timbal, 1981; Oberdorfer, 1990)
- 41.16** BEECH FORESTS ON LIMESTONE
Cephalanthero-Fagenion
Xero-thermophile medio-European and Atlantic forests on calcareous, often superficial, soils, usually of steep slopes, with a generally abundant herb and shrub undergrowth, characterized by sedges (*Carex digitata*, *C. flacca*, *C. montana*, *C. alba*), grasses (*Sesleria albicans*, *Brachypodium pinnatum*), orchids (*Cephalanthera* spp., *Neottia nidus-avis*, *Epipactis leptochila*, *E. microphylla*) and thermophile species, transgressive of the *Quercetalia pubescenti-petraeae*. The bush-layer includes several calcicolous species (*Ligustrum vulgare*, *Berberis vulgaris*) and *Buxus sempervirens* can dominate. (Tüxen and Oberdorfer, 1958; Duvigneaud, 1961; Noirfalise, 1962, 1984, 1986, 1987; Ellenberg, 1963, 1988; Durin *et al.*, 1964; Bournérias, 1979; Ozenda *et al.*, 1979; Ozenda, 1979, 1982, 1985; Timbal, 1981; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Oberdorfer, 1990)
- 41.161** Sedge beech forests
Carici-Fagetum s.l.
Middle European slope sedge and orchid beech woods.
- 41.162** North-western Iberian xerophile beech woods
Epipactido helleborine-Fagetum
Beech forests of relatively low precipitation zones of the southern ranges of the Pais Vasco and of superficially dry calcareous soils of the Cordillera Cantabrica, with *Brachypodium pinnatum* ssp. *rupestre*, *Sesleria argentea* ssp. *hispanica*, *Carex brevicollis*, *C. ornithopoda*, *C. sempervirens*, *C. caudata*, *Cephalanthera damasomium*, *C. longifolia*, *Epipactis helleborine*, *E. microphylla*, *Neottia nidus-avis*.
- 41.17** SOUTHERN MEDIO-EUROPEAN BEECH FORESTS
Fagion sylvaticae p.
Forests of the southern flanks of the Alps and the western Mediterranean mountains with an often species-rich herb layer composed of an admixture of medio-European, Mediterranean and local endemic species. (Delvosalle, 1953; Malaisse, 1963, 1964a, b and c, 1975; Vanden Berghen, 1963; Barbero, 1970; Tomaselli, 1973; Baudière, 1974a and b; Ozenda, 1975, 1981, 1985; Gruber, 1978; Dupias, 1985; Gamisans, 1985; Noirfalise, 1986, 1987; Vigo and Ninot, 1987; Bolos y Capdevila, 1987; Bassani, 1987; Ellenberg, 1988)
- 41.171** Southern Alpine and Apennine acidophilous beech forests
Luzulo niveae-Fagetum, *Luzulo pedemontanae-Fagetum*
Acidophilous forests with *Luzula nivea* and *Luzula pedemontana* of the Maritime, Ligurian, Insubrian and Illyro-Gardesian Alps and pre-Alps and of the northern and central Apennines.
- 41.172** Eastern Pyrenees and Cévennes acidophilous beech forests
Similar acidophilous forests of the eastern Pyrenees and Cévennes, with *L. nivea*, clearly distinguished from forests of the *Scillo-Fagenion* by their impoverished herb layer and replacing the more Atlantic forests of the *Ilici-Fagenion*.
- 41.173** Corsican beech forests
Poo-Fagetum, *Helleboro lividi-Fagetum*
Beech forests of Corsica, acidophilous, with *Luzula pedemontana*, *Galium rotundifolium* and insular endemics such as *Helleborus lividus*.

- 41.174 Southern Alpine and Apennine neutrophile beech forests**
Trochischanto-Fagetum, *Geranio nodosi-Fagetum* i.a.
 Neutrophile montane beech forests of the south-western Alps, the Maritime Alps, the Ligurian Alps, the Insubrian, Gardesian and Illyric southern pre-Alps, the northern and central Apennines, with *Trochischantes nodiflorus*, *Geranium nodosum*, *Calamintha grandiflora*, various *Dentaria*.
- 41.1741 South-western Alpine neutrophile beech forests**
 Hygrophile and meso-hygrophile forests of the upper montane level of the south-western outer Alps in the Baronnies, the Ventoux, the Montagne de Lure.
- 41.1742 Maritime Alps neutrophile beech forests**
 Isolated La Cabanette beech forest of Peira-Cava, in the Maritime Alps, with a unique species cortège.
- 41.1743 Southern Alpine neutrophile beech forests**
 Ligurian, Insubrian, Gardesian and Illyric hygrophile and meso-hygrophile beech forests with *Cardamine (Dentaria) spp.*, including the eastern *Cardamine Kitaibelii (C. polyphylla)*, or with *Calamintha grandiflora*.
- 41.1744 Northern Apennine neutrophile beech forests**
 Mesotrophic beech forests of the Toscano-Emilian and Abruzzian Apennines, with *Trochiscanthes nodiflora*, *Geranium nodosum*, *G. reflexum*, *Aquilegia vulgaris*, *Pulmonaria saccharata*, *Neottia nidus-avis*.
- 41.175 Sub-Mediterranean calcicolous beech forests**
Buxo-Fagetum
 Thermophile beech forests often rich in box and lavender of the warm, calcareous slopes of the south-western pre-Alps, Haute Provence, Maritime Alps, of the Causses, the eastern Pyrenees, the Aragonese central Pyrenees.
- 41.1751 Box beech forests**
 Beech forests with an undergrowth dominated by *Buxus sempervirens*.
- 41.1752 Androsace beech forests**
 Beech forests with a more reduced shrub layer and a herb layer characterized by the presence of the restricted south-western Alpine endemics *Androsace chaixii* and *Fritillaria involucreta*.
- 41.1753 Lavender beech forests**
 Beech forests with *Lavandula angustifolia*.
- 41.1754 Sainte-Baume beech forest**
 Isolated, species-rich beech forest of the Sainte-Baume range of Provence, characterized by the strong representation of evergreen undergrowth, the development of the vegetation strata and the multiple waves of flowering. Among accompanying species are *Taxus baccata*, *Ilex aquifolium*, *Acer opulifolium*, *Viburnum lantana*, *Coronilla emerus*, *Ruscus aculeatus*, *Mycelis muralis*, *Lilium martagon*, *Neottia nidus-avis*, *Helleborus foetidus*, *Digitalis lutea*.
- 41.176 Beech forests with hop-hornbeam**
Ostryo-Fagenion
 Thermophile calcicolous forests rich in *Ostrya* and *Fraxinus ornus* of the sub-montane level of the Ligurian and Gardesian southern pre-Alps, mostly reduced to tall coppice.
- 41.18 SOUTHERN ITALIAN BEECH FORESTS**
Geranio versicolori-Fagion
 Forests of Italian mountains, south of 42°N. They are highly fragmented and harbour many endemics. Altitudinal and hygric variants can be distinguished.
 (Bonin, 1968; Fenaroli, 1970; Tomaselli, 1973; Ozenda, 1973, 1979; Bonin and Gamisans, 1976; Ozenda *et al.*, 1979; Pignatti, 1982; Pratesi and Tassi, 1985; Noirfalise, 1986, 1987)

- 41.181** **Gargano beech forest**
Monte Gargano Foresta Umbra, rich in *Taxus baccata*, extremely isolated.
- 41.182** **Campano-Lucanian beech forests**
Still relatively extensive beech forests of Campania and Basilicata with *Daphne laureola*, *Galium odoratum*, *Ranunculus brutius*, *Geranium versicolor*, *Melica uniflora*, *Lathyrus venetus*, *Euphorbia amygdaloides*, *Aquilegia vulgaris*, *A. viscosa*, *Cardamine bulbifera*.
- 41.183** **Pollino beech forests**
Extensive calcicolous beech forests of the montane level of the Pollino system, with *Lathyrus venetus*, *Daphne laureola*, *Melica uniflora*, *Ranunculus brutius*, *Geranium versicolor*, *Doronicum orientale*, *Calamintha grandiflora*, *Epipactis microphylla*, *E. gracilis*, *E. purpurata*, *Monotropa hypopitys*.
- 41.184** **Sila beech forests**
Silicolous beech forests occupying more humid locations of the Sila, alternating with forests of *Pinus laricio*.
- 41.185** **Aspromonte beech forests**
Silicolous beech forests of the Aspromonte range of Calabria with *Taxus baccata*, *Populus tremula*, *Sorbus aucuparia*, *Betula pendula*.
- 41.186** **Northern Sicilian beech forests**
Relict beech forests of the Madonie, Nebrodi and, very locally, the Monti Peloritani, with *Ilex aquifolium*, *Daphne laureola*, *Crataegus monogyna*, *Prunus spinosa*.
- 41.187** **Etna beech forests**
Isolated beech forests of Mount Etna, at the southern limit of the range of the species.
- 41.19** **BALKANIC BEECH FORESTS**
Fagion moesiacum
Forests of the mountains of north-eastern Greece (Vermion, Vernon, border ranges of northern Macedonia, the Chalkidiki, Thrace, and locally, Olympus and Ossa), with a pronounced medio-European character, marked by the frequency of *Acer pseudoplatanus*, *Quercus petraea*, *Fragaria vesca*, *Oxalis acetosella*, mostly without fir, or, very locally, with *Abies alba*.
(Horvat *et al.*, 1974; Ozenda, 1975, 1979; Mavrommatis, 1978; Gamisans and Hebrard, 1979; Noirfalise, 1987)
- 41.1A** **HELLENIC BEECH FORESTS**
Fagion hellenicum
Forests of the central Pindus, the Smolikas, the Grammos, the Hasia and Olympus, with reduced medio-European character and high endemism, characterized by *Abies borisii-regis*, *Doronicum caucasicum*, *Galium laconicum*, *Lathyrus venetus*, *Helleborus cyclophyllus*.
(Horvat *et al.*, 1974; Ozenda, 1975, 1979; Gamisans and Hebrard, 1979; Strid, 1980; Noirfalise, 1987)
- 41.1B** **BEECH FORESTS WITH HUNGARIAN OAK**
Quercion frainetto p.
More thermophile forests of the transition zone between the supra-Mediterranean and montane levels of Thrace and Macedonia, characterized by the presence of numerous species of the *Quercion frainetto*.
(Gamisans and Hebrard, 1979)

41.2

OAK-HORNBEAM FORESTS*Carpinion betuli*

Atlantic and medio-European forests dominated by *Quercus robur* or *Q. petraea*, on eutrophic or mesotrophic soils, with usually ample and species-rich herb and bush layers. *Carpinus betulus* is generally present. They occur under climates too dry or on soils too wet or too dry for beech or as a result of forestry practices favouring oaks.

(Mullenders, 1955; Breton, 1957; Vanden Berghen and Mullenders, 1957; Ellenberg, 1963, 1988; Izard *et al.*, 1963; Tanghe, 1964b, 1967, 1968, 1970; Gaussen, 1964; Dupias, 1966, 1985; Durin *et al.*, 1967; Oberdorfer, 1967, 1990; Sougnez, 1967; Noiralise, 1968, 1969, 1984, 1986, 1987; Couteaux, 1969; Lavergne, 1969; Duvigneaud and Denaeyer-De Smet, 1970; Fenaroli, 1970; Barbero *et al.*, 1971; Dendaletche, 1973; Sougnez, 1973, 1978; Baudière, 1974a; Bugnon and Rameau, 1974; Richard, 1974; Ozenda and Wagner, 1975; Westhoff and den Held, 1975; Caron and Géhu, 1976; Chastagnol *et al.*, 1978; Dethioux, 1978; Braque, 1979; Ozenda *et al.*, 1979; Rameau and Timbal, 1979; Thill and Palm, 1979; Bournérias, 1979, 1984; Chastagnol and Vilks, 1982; Bernard, 1983; Botineau and Chastagnol, 1983; Gésan and Plat, 1983; Rivas-Martinez *et al.*, 1984; Ozenda, 1985; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Bolos y Capdevila, 1987; Vigo and Ninot, 1987; Gruber, 1988; Rodwell, 1991)

41.21

MIXED ATLANTIC BLUEBELL OAK FORESTS*Endymio-Carpinetum, Corylo-Fraxinetum p.*

Atlantic forests of the British Isles, western Belgium and north-western France, mostly on more or less water-retaining soils, characterized by a diverse tree layer, dominated by *Quercus robur* and rich in *Fraxinus excelsior*, and by a herb layer rich in species of the group of *Hyacinthoides non-scripta*. Included are British *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodlands.

41.22

AQUITANIAN ASH-OAK AND OAK-HORNBEAM FORESTS*Rusco-Carpinetum, Saniculo-Carpinetum*

Ash-oak forests of valley bottoms and cool, damp lower slopes of south-western France, south to the Pyrenean piedmont, with *Sorbus torminalis*, *Ruscus aculeatus* and many thermocline, acidocline and Mediterraneo-Atlantic species.

41.23

SUB-ATLANTIC OXLIP ASH-OAK FORESTS*Primulo-Carpinetum*

Oak-hornbeam forests rich in ash, on more or less wet, meso-eutrophic soils, in regions of moderate Atlantic influence, characterized by the abundance of species of the ecological groups of *Primula elatior*, of *Lamium galeobdolon*, of *Anemone nemorosa* and by the absence of *Hyacinthoides non-scripta*.

41.231

Arum ash-oak forests

Typical neutrocline and acidocline ash-oak forests with primrose, developed on silts, marls and clays, characterized by the presence of the ecological groups of *Galium odoratum* of *Arum maculatum*, or by the abundance of *Lamium galeobdolon*.

41.232

Corydalis ash-oak forests

Ash-oak forests occupying damp colluvions at the bottom of slopes in valleys within sub-Atlantic forests, characterized by the presence of the group of *Anemone ranunculoides*, *Corydalis solida*, *Gagea lutea* and *Lathraea squamaria* or of *Aconitum vulparia*, transitional to ravine or alluvial forests.

41.233

Garlic ash-oak forests

Ash-oak forests rich in *Allium ursinum*, of alluvial terraces and adjacent colluvions.

41.24

SUB-ATLANTIC STITCHWORT OAK-HORNBEAM FORESTS*Stellario-Carpinetum s.l.*

Sub-Atlantic and medio-European forests of *Quercus robur* and *Quercus petraea*, on meso-oligotrophic and less hydromorphic soils, characterized by the replacement of the groups of *Primula elatior* and *Lamium galeobdolon* by those of *Deschampsia flexuosa* and of *Maianthemum bifolium*, transgressives from the *Quercion*.

- 41.241 North-western oak-hornbeam forests**
Stellario-Carpinetum s.s.
 Typical formations of northern Europe, the eastern Paris basin and Lorraine, with *Stellaria holostea*, *Carex brizoides*, *Narcissus pseudonarcissus*, *Polygonatum verticillatum*, *Potentilla sterilis*, *Ranunculus nemorosus*, *Poa chaixii*, *Luzula sylvatica*, *L. luzuloides*.
- 41.242 Lorraine marl oak-hornbeam forests**
Pulmonario-Carpinetum
 Oak-hornbeam forests of Lorraine marls, with *Quercus robur*, *Carpinus betulus*, *Acer campestre*, *Sorbus torminalis*, *Lonicera xylosteum*, *Galium odoratum*, *Carex umbrosa*, *Pulmonaria obscura* and *Ornithogalum pyrenaicum*.
- 41.243 Burgundy collinar oak-hornbeam forests**
Scillo-Carpinetum p., *Poo-Carpinetum*
 Oak-hornbeam forests of the mesozoic hills and plateaux of north-western Burgundy (Nivernais, Langres Plateau, Barrois, Morvan piedmont).
- 41.244 Burgundy plain oak-hornbeam forests**
 Oak-hornbeam forests of the Saône plain in southern Burgundy and Bresse, of the southern Lyonnais and of the Limagne basin, including the outstanding multicentury-old stands of Cîteaux and similar stations.
- 41.25 FAMENNIAN OAK-HORNBEAM FORESTS**
Stellario-Carpinetum caricetosum
 Sub-Atlantic forests, generally with a low canopy, on soils with an alternating hydric regime, characterized by the abundance of *Carex flacca* and the coexistence of acidocline and calcicline species.
- 41.26 EASTERN OAK-HORNBEAM FORESTS**
Galio-Carpinetum, *Tilio-Carpinetum*
 Sub-continental and continental forests dominated by *Quercus petraea* and richer in lime, *Tilia cordata*, than the previous formations.
- 41.261 Wood bedstraw oak-hornbeam forests**
Galio-Carpinetum
 Oak-hornbeam forests of regions with subcontinental climate within the central European range of *Fagus sylvatica*, such as the Upper Rhine plain, the rain shadows of the Harz, Rhön and Spessart, the Swabian-Franconian basin, the Bavarian plateau and Thuringe, with *Sorbus torminalis*, *S. domestica*, *Ligustrum vulgare*, *Convallaria majalis*, *Carex montana*, *C. umbrosa*, *Festuca heterophylla*.
- 41.262 Mixed lime-oak-hornbeam forests**
Tilio-Carpinetum
 Lime-oak forests of eastern central European regions with continental climate, east of the range of *Fagus sylvatica*, with *Quercus petraea*, *Q. robur*, *Tilia cordata*, *Acer platanoides*, *Carpinus betulus*.
- 41.27 CALCIPHILE OAK-HORNBEAM AND ASH-OAK FORESTS**
Antherico-Carpinetum, *Carici-Carpinetum (Ligustro-Carpinetum)*, *Scillo-Carpinetum p.*, *i.a.*
 Often low, open formations dominated by *Quercus robur* or *Q. petraea*, developed on superficial to deep soils associated with calcareous substrates in southern Germany, eastern and southern Belgium, eastern and central France; they generally constitute substitution forests of the *Cephalanthero-Fagion*, either regressive phases brought about by coppicing or recolonization phases permitted by abandonment of *Bromion* grasslands.
- 41.271 Limestone xerophile oak-hornbeam forests**
 Generally low formations characteristic of superficial calcareous soils on often steep sunny slopes of southern Germany, southern Belgium and eastern France, with *Quercus robur* (usually dominant). *Q. petraea*, *Tilia platyphyllos*, *Fraxinus excelsior*, *Carpinus betulus*, *Acer campestre*, *Corylus avellana*, *Cornus sanguinea*, *C. mas*, *Crataegus laevigata*, *C. monogyna*, *Prunus spinosa*, *Euonymus europaeus*, *Ligustrum vulgare*, *Viburnum lantana*, *Daphne laureola*, *Primula veris*, *Viola hirta*, *Mercurialis perennis*, *Scilla bifolia*, *Orchis mascula*, *Carex digitata*, *C. montana*.

41.272

Schist xerophile oak-hornbeam forests

Low, open formations characteristic of steep, sunny slopes on slightly calcareous schists in the Ardenne-Eifel periphery, with *Quercus petraea* (dominant). *Carpinus betulus*, *Quercus robur*, *Sorbus torminalis*, *S. aria*, *Pyrus pyraster*, *Malus sylvestris*, *Prunus avium*, *Amelanchier ovalis*, *Stellaria holostea*, *Anemone sylvestris*. *Silene nutans*, *S. inflata*, *Campanula persicifolia*, *Anthericum liliago*, *Melica nutans*, *Carex montana*.

41.273

Calciphile ash-oak forests

Formations richer in *Fraxinus excelsior* and in species characteristic of well-drained, often deep, sometimes rocky, moist or partly dry calcareous soils on gentle slopes of the south Paris basin and adjacent regions, with *Quercus robur*, *Fraxinus excelsior*, *Carpinus betulus*, *Acer campestre*, *Cornus mas*, *Pyrus pyraster*, *Daphne laureola*, *Arum italicum*, *Asarum europaeum*, *Doronicum plantagineum*, *Helleborus foetidus*, *Hepatica triloba*, *Orobancha hederatae*, *Lilium martagon*, *Carex montana*.

41.28

SOUTHERN ALPINE OAK-HORNBEAM FORESTS

Salvio-Fraxinetum, *Physospermo-Quercetum petraeae*, *Euphorbio-Carpinetum*

Fragmentary mesophile or mesohygrophile formations of the Insubrian pre-Alps, the Ligurian Apennines, the Esterel and the Tanneron and very locally, the southern French Alps (forêt du Saou, Drôme), with *Quercus petraea*, *Q. robur*, *Fraxinus excelsior*, *Tilia platyphyllos*, *T. cordata* and *Carpinus betulus*, developed on deep soils in conditions of sufficient atmospheric and edaphic humidity.

41.29

PYRENEO-CANTABRIAN OAK-ASH FORESTS

Polysticho setiferi-Fraxinetum excelsioris, *Crataego laevigatae-Quercetum roboris*, *Mercurialidi perennis-Fraxinetum excelsioris*, *Isopyro-Quercetum roboris*

Forests dominated by *Quercus robur*, or, in parts of the Pyrenees and in the Oro-Cantabrian interior, *Q. petraea*, with *Fraxinus excelsior*, *Tilia platyphyllos*, *Corylus avellana*, *Acer campestre*, *A. pseudoplatanus*, *Prunus avium*, *Ulmus glabra*, many shrubs and lianas, abundant *Hedera helix*, many ferns, such as *Polystichum setiferum*, *Dryopteris affinis*, *D. dilatata*, *Asplenium scolopendrium*, and with *Arum italicum*, *Veronica montana*, *Hypericum androsaemum*, *Primula vulgaris*, *Pulmonaria longifolia*, *Helleborus viridis* ssp. *occidentalis*, *Isopyrum thalictroides*, *Ajuga reptans*, *Carex sylvatica*, *Bromus racemosus*, *Melica uniflora*, of the collinar, sub-montane and, in a somewhat impoverished form with *Crataegus laevigata*, montane levels of the piedmont of the Cordillera Cantabrica, in Navarra, Guipuzcoa, Vizcaya, Cantabria, Asturias and Castilla-Leon, as well as of the sub-montane level of the northern slope, and locally in Navarra and Catalonia, the southern slope of the Pyrenees.

41.3

ASH FORESTS

Carpinion betuli (*Fraxino-Carpinion*): *Corylo-Fraxinetum* p., *Polysticho setiferi-Fraxinetum excelsioris* p., *Mercurialidi perennis-Fraxinetum excelsioris* p., *Isopyro-Quercetum roboris*, *Adoxo-Aceretum*

Non-alluvial Atlantic or sub-Atlantic forests dominated by *Fraxinus excelsior*, particularly characteristic of Britain, of the north-western Iberian peninsula and of the Baltic moraine hills of Mecklenburg. Secondary formations pioneering on abandoned cultivated land (e.g. Belgian Condroz) are included.

(Saintenoy-Simon, 1965; Thill, 1970; Bournérias, 1979, 1984; Ozenda *et al.*, 1979; Vanden Berghen, 1979; Noirfalise, 1984, 1986, 1987; Rivas-Martinez *et al.*, 1984; Dupias, 1985; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Ellenberg, 1988; Rodwell, 1991)

41.31

ASH-ROWAN-MERCURY FORESTS

Forests and woodland of *Fraxinus excelsior*, with some *Ulmus glabra*, *Acer pseudoplatanus*, *Quercus petraea*, *Betula pubescens*, *Sorbus aucuparia* and an understorey dominated by *Corylus avellana*, often accompanied by *Crataegus monogyna* or occasionally *C. laevigata*, characteristic of sub-montane climates and moist soils on calcareous bedrocks of the northern and western British Isles, particularly in valley heads of the upland fringes, distributed in Ireland, Scotland, northern England, Wales and locally Devon. Ferns (*Athyrium filix-femina*, *Dryopteris* spp., *Blechnum spicant*) grasses (*Brachypodium sylvaticum*, *Deschampsia cespitosa*, *Poa trivialis*, *Arrhenatherum elatius*, *Dactylis glomerata*, *Holcus lanatus*, *H. mollis*, *Agrostis capillaris*, *Anthoxanthum odoratum*), *Oxalis acetosella* are abundant and characteristic in the field layer. often with *Hyacinthoides non-scripta*, *Mercurialis perennis*, tall herbs (*Crepis paludosa*, *C. mollis*, *Filipendula ulmaria*, *Conopodium majus*, *Trollius europaeus*) and an extensive and diverse bryophyte flora.

- 41.32** **BRITISH ASH-FIELD MAPLE-MERCURY FORESTS**
Forest and woodland of *Fraxinus excelsior*, with *Quercus robur* (in the south-west), or *Q. petraea*, *Acer pseudoplatanus*, *Ulmus glabra* (in the north-west), with an understorey dominated by *Corylus avellana*, frequently accompanied by *Crataegus monogyna*, *C. laevigata*, *Acer campestre*, *Sambucus nigra*, characteristic of often calcareous base-rich soils in relatively warm and dry lowlands of southern Britain, distributed mostly in southern and central England, eastern Wales, southern and eastern Scotland. The field layer comprises *Mercurialis perennis*, *Hyacinthoides non-scripta*, *Circaea lutetiana*, *Geum urbanum*, *Arum maculatum*, *Viola riviniana*, *V. reichenbachiana*, *Sanicula europaea*, *Lamium galeobdolon*, *Carex sylvatica*; *Primula vulgaris* and *Glechoma hederacea*, *Anemone nemorosa*, *Deschampsia cespitosa*, *Hedera helix*, *Geranium robertianum*, *Allium ursinum*, *Teucrium scorodonia* characterize geographical and edaphic subtypes. In humid northern and western Britain, well outside of the range of *Fagus sylvatica* and *Carpinus betulus*, the separation between this unit and the ravine forests of 41.41, developed on unstable scree and colluvions, is poorly marked.
- 41.33** **PYRENEO-CANTABRIAN ASH FORESTS**
Fraxinus excelsior-dominated facies of the Pyreneo-Cantabrian ash-oak forests (41.29).
- 41.34** **BALTIC MOSCHATEL ASH-SYCAMORE FORESTS**
Fraxinus excelsior forests of Baltic moraine hills (Mecklenburg), possibly related to the peri-Alpine slope-foot forests of 41.43.
- 41.35** **MIXED ATLANTIC BLUEBELL ASH FORESTS**
Fraxinus excelsior-dominated facies of the mixed Atlantic bluebell oak forests (41.21), including ash-dominated facies of British oak-bracken-bramble woodland.
- 41.36** **AQUITANIAN ASH FORESTS**
Fraxinus excelsior-dominated facies of Aquitanian ash-oak forest (41.22).
- 41.37** **SUB-ATLANTIC ASH FORESTS**
Fraxinus excelsior-dominated facies of sub-Atlantic oxlip oak forests (41.23).
- 41.38** **LUTETIAN CALCIPHILE ASH FORESTS**
Fraxinus excelsior-dominated facies of calciphile oak-ash forests (41.273), characteristic of the French Paris basin, particularly on chalk deposits; their affinities are with the south-eastern British formations of 41.31.
- 41.39** **POST-CULTURAL ASH WOODS**
Corylo-Fraxinentalia
Pioneer formations of *Fraxinus excelsior* occupying abandoned agricultural land.
- 41.4** **MIXED RAVINE AND SLOPE FORESTS**
Tilio-Acerion, *Carpinion betuli p.*
Cool, moist forests with a multispecific tree layer of variable dominance, most often on more or less abrupt slopes.
(Lebrun *et al.*, 1949; Vanden Berghen, 1953, 1969; Tüxen and Oberdorfer, 1958; Tanghe, 1959, 1964a, 1964b, 1968, 1970; Noirfalise, 1960, 1984, 1986, 1987; Duvigneaud and Mullenders, 1962; Roisin and Thill, 1962; Ellenberg, 1963, 1988; Durin *et al.*, 1967; Oberdorfer, 1967, 1990; Seibert, 1969; Duvigneaud and Denaeyer-De Smet, 1970; Horvat *et al.*, 1974; Ozenda and Wagner, 1975; Bournérias, 1979, 1984; Ozenda, 1985; Vigo and Ninot, 1987; Rodwell, 1991)
- 41.41** **RAVINE ASH-SYCAMORE FORESTS**
Fraxino-Aceretum pseudoplatani (*Phyllitido-Fraxinetum*, *Tilio-Aceretum*, *Ulmo-Aceretum*, *Dicrano-Aceretum*, *Arunco-Aceretum*, *Lunario-Aceretum*, *Aceri-Fraxinetum*)
Atlantic and medio-European forests of *Fraxinus excelsior*, *Acer pseudoplatanus*, *A. platanoides*, *Ulmus glabra*, *Tilia platyphyllos*, *Fagus sylvatica*, *Quercus robur*, on unstable scree or colluvions of abrupt, shady and humid slopes, with abundant ferns, characterized by *Asplenium scolopendrium* and the ecological group of *Actaea spicata*, *Lunaria rediviva* and *Helleborus viridis*.

41.42

HERCYNIAN SLOPE FORESTS

Carpineto-Fraxinetum

Mixed forests of *Quercus robur*, *Q. petraea*, *Fagus sylvatica*, *Ulmus glabra*, *Acer pseudo-platanus*, *A. platanoides*, *Tilia platyphyllos*, *Fraxinus excelsior*, *Carpinus betulus*, *Alnus glutinosa*, with *Hedera helix*, *Polygonatum verticillatum*, *Galium odoratum*, *Ranunculus platanifolius*, *Centaurea montana*, *Poa chaixii*, *Pulmonaria montana*, *Circaea alpina*, *Sambucus racemosa* of large, shaded slopes of the Ardennes and Lorraine, probably also represented in other Hercynian ranges and their periphery, within the zone of transition from oceanic to continental climates.

41.43

ALPINE AND PERI-ALPINE SLOPE FORESTS

Aceri-Fraxinetum sensu

Mixed forests of *Acer pseudoplatanus*, *A. platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, *Fagus sylvatica*, *Carpinus betulus*, *Quercus robur* developed on colluvial deep soils at the foot of very rainy slopes of the collinar to sub-montane belts of the Alps and neighbouring ranges, often with *Allium ursinum*, *Mercurialis perennis* or the ecological group of *Corydalis solida* in the luxuriant herb layer; more montane form of 41.42. (Etter, 1947)

41.44

PYRENEO-CANTABRIAN MIXED ELM-OAK FORESTS

Androsaemo-Ulmetum

Mixed forests of *Ulmus glabra*, *Acer campestre*, *A. opalus*, *Fraxinus excelsior*, *Fagus sylvatica*, *Quercus petraea*, *Q. robur*, *Tilia cordata*, *T. platyphyllos*, *Sorbus aria*, *S. mougeotii*, *Alnus glutinosa*, *Pinus sylvestris*, *Hedera helix*, with an understorey comprising numerous shrubs, such as *Corylus avellana* and *Crataegus monogyna*, and a rich and luxuriant herb layer including numerous ferns, characteristic of the bottom colluvions of steep, shaded valleys, canyons and gorges of the collinar to montane levels of the Pyrenean and Cantabrian ranges.

41.45

THERMOPHILOUS ALPINE AND PERI-ALPINE MIXED LIME FORESTS

Asperulo-Tilietum, *Seslerio-Tilietum*

Thermophilous forests of *Tilia cordata*, *T. platyphyllos*, *Acer platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, *Fagus sylvatica* with *Euonymus latifolia*, *Corylus avellana*, restricted to the warm valleys of the Alpine system and some peripheral ranges, characterized by *Asperula taurina*, *Cyclamen purpurascens* and numerous transgressives of the *Quercetalia pubescenti-petraeae*. These remarkable relict forests are particularly characteristic of the föhn valleys of the Insubrian and northern Alps; they occur in similar situations in the Jura and the Hercynian ranges, north to the Harz.

41.46

GREEK CHASM FORESTS

Formations of *Aesculus hippocastanum*, *Juglans regia*, *Fraxinus excelsior* of narrow, warm, humid, shaded ravines, gorge walls and abrupt slopes of the beech zone of the Pindus.

41.5

ACIDOPHILOUS OAK FORESTS

Quercion robori-petraeae

Forests of *Quercus robur* or *Q. petraea* on acid soils with a herb layer mostly constituted by the ecological groups of *Deschampsia flexuosa*, *Vaccinium myrtillus*, *Pteridium aquilinum*, *Lonicera periclymenum*, *Holcus mollis*, and of *Maianthemum bifolium*, *Convallaria majalis*, *Hieracium sabaudum*, *Hypericum pulchrum*, *Luzula pilosa*, and the mosses *Polytrichum formosum* and *Leucobryum glaucum*.

(Roisin, 1962; Ellenberg, 1963, 1988; Oberdorfer, 1967, 1990; Durin *et al.*, 1967; Delelis-Dusollier and Géhu, 1974; Barkman, 1974; Olsson, 1974; Sougnéz, 1974; Kelly and Moore, 1974; Tosco, 1975; Westhoff and den Held, 1975; Noirfalise, 1986, 1987)

- 41.51** **PEDUNCULATE OAK AND BIRCH WOODS**
Quercus-Betuletum, Trientalo-Quercetum roboris
 Acidophilous forests of the Baltic-North Sea plain, composed of *Quercus robur*, *Betula pendula* and *B. pubescens*, often mixed with *Sorbus aucuparia* and *Populus tremula*, on very oligotrophic, often sandy and podsolized or hydromorphic soils; the bush layer, poorly developed, includes *Frangula alnus*; the herb layer, formed by the group of *Deschampsia flexuosa*, always includes *Molinia caerulea* and is often invaded by bracken. Forests of this type often prevail in the northern European plain, from Jutland to Flanders; they occupy more limited edaphic enclaves in the Ardennes, in north-western France, Normandy, Brittany, the Paris basin, the Morvan and Great Britain.
 (Oberdorfer, 1967, 1990; Durin *et al.*, 1967; Tüxen, 1974; Tombal, 1974; Bugnon and Rameau, 1974; Sissingh, 1974; Sougnez, 1974; Clément *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Noirfalise *et al.*, 1980; Aaby, 1983; Noirfalise, 1984, 1987; Ellenberg, 1988)
- 41.52** **ATLANTIC ACIDOPHILOUS OAK FORESTS WITH BEECH**
Fago-Quercetum (Ilici-Quercetum, Polypodio-Quercetum, Convallario-Quercetum, Violo-Quercetum, Holco-Quercetum)
 Forests analogous to those of the *Ilici-Fagion* but dominated by *Quercus petraea*, accompanied by *Q. robur* and *Fagus sylvatica*. They differ from 41.51 by the representation of the group of *Maianthemum bifolium* in the herb layer.
 (Roisin, 1962; Noirfalise and Sougnez, 1963; Oberdorfer, 1967, 1990; Durin *et al.*, 1967; Tüxen, 1974; Sissingh, 1974; Frileux, 1974; Géhu, 1974; Clément *et al.*, 1974; Tombal, 1974; Bugnon and Rameau, 1974; Timbal, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Aaby, 1983; Noirfalise, 1984, 1987; Rodwell, 1991)
- 41.521** **North-western sessile oak forests**
 Typical formations of the Baltic and North Sea plains, Picardy, Normandy, Perche, Paris region, western Morvan, Argonne, middle Belgium.
- 41.522** **Armorican sessile oak forests**
Polypodio-Quercetum
 Formations of Brittany, richer in epiphytes, mosses and evergreen shrubs, transitional to 41.53.
- 41.523** **Dutch dune oak woods**
Convallario-Quercetum dunense
 Oak formations on dunes of the Netherlands, with *Acer pseudoplatanus*, *Euonymus europaeus*, *Primula vulgaris*, *Cynoglossum officinale*, *Cirsium palustre*, *Doronicum pardalianches*, *D. plantagineum*, *Convallaria majalis*, *Hyacinthoides non-scripta*, *Polygonatum odoratum*, *Ornithogalum umbellatum*, *Asparagus officinalis*, *Calamagrostis epigejos*, *Carex arenaria*, *Dryopteris carthusiana*, *D. dilatata*, *Mnium hornum*.
- 41.524** **Pennine sessile oak-birch-wavy hairgrass woods**
 Woods of *Quercus petraea*, *Betula spp.* and *Sorbus aucuparia*, with abundant ericoid shrubs, in particular *Vaccinium myrtillus*, *Deschampsia flexuosa*, ferns, notably *Pteridium aquilinum* and *Dryopteris dilatata*, and a rather sparse muscinal layer, which is, however, more diverse than in the next unit. They are characteristic of very acid soils on the Pennine fringes, in northeastern England, the central Pennines, Lancashire, the Welsh border hills and the western Midlands.
- 41.525** **English pedunculated oak-birch-wavy hairgrass woods**
 Woods of *Quercus robur* and *Betula pendula*, occasionally *Quercus petraea*, with a species-poor field layer often almost limited to *Deschampsia flexuosa* and *Pteridium aquilinum*, with, locally, *Calluna vulgaris* and *Vaccinium myrtillus*, characteristic of very acid soils, in central, south-eastern, and locally south-western, England. Differentiation from this unit of the uncommon English representatives of 41.51 is probably not well-marked and all highly acidophilous *Q. robur* stands are perhaps best listed here.

- 41.53** **BRITISH AND IRISH SESSILE OAK WOODS**
Blechno-Quercetum petraeae
 Acidophilous *Q. petraea* woods of the British Isles, with low, low-branched, trees, with many ferns, mosses, lichens and evergreen bushes; the herb layer is formed by the group of *Deschampsia flexuosa*.
 (Massey, 1974; Kelly and Moore, 1974; Ozenda *et al.*, 1979; Condry, 1981; Noirfalise, 1987; Rodwell, 1991)
- 41.531** **Irish sessile oak woods**
 Formations of Ireland, particularly rich in evergreen bushes, including *Arbutus unedo*.
- 41.532** **British sessile oak woods**
 Acidophilous *Quercus petraea* woods of western Britain, mostly found in Scotland, Cumbria, Wales and south-western England, with a few outliers in northern England, in particular in Yorkshire.
- 41.5321** **Sessile oak-pubescent birch-wood sorrel woods**
 More neutrocline formations, characteristic of argilous soils, shales, colluvions, till and fluvio-glacial deposits, dominated by *Quercus petraea* — occasionally *Q. robur* — with *Betula pubescens*, *B. pendula*, *Sorbus aucuparia*, occasional *Tilia cordata*, *Fraxinus excelsior*; the bush layer is generally sparse, with *Corylus avellana* the most abundant species; grasses are prominent in the herb layer, in particular *Holcus mollis*, *Deschampsia flexuosa*, *Anthoxanthum odoratum*, *Agrostis spp.*, *Festuca spp.*; *Hyacinthoides non-scripta* is often a typical vernal dominant; other components of the field layer, some characteristic of various subtypes, are *Anemone nemorosa*, *Trientalis europaea*, *Viola riviniana*, *Oxalis acetosella*, *Galium saxatile*, *Potentilla erecta*, *Stellaria holostea*, *Hypericum pulchrum*, *Luzula sylvatica*, *Dryopteris dilatata*, *Blechnum spicant*, *Pteridium aquilinum*. Bryophytes are abundant and varied, in particular, *Rhytidiadelphus squarrosus*, *Pseudoscleropodium purum*, *Thuidium tamariscinum*, *Hylocomium splendens*.
- 41.5322** **Sessile oak-pubescent birch-Dicranum majus woodland**
 Highly acidophile formations characteristic of often shallow, strongly leached soils developed over Palaeozoic sandstones and igneous rocks in cooler and wetter parts of western Britain, dominated by *Quercus petraea* — rarely *Q. robur* — with *Betula pubescens*, *B. pendula*, *Sorbus aucuparia*, occasional *Tilia cordata*, *Fraxinus excelsior*, *Acer pseudoplatanus*. *Corylus avellana* and occasional *Ilex aquifolium*, together with tree saplings form the bush layer. Grasses (mostly *Deschampsia flexuosa*), bracken and ericoid shrubs (*Vaccinium myrtillus*, *Calluna vulgaris*, *Erica cinerea*) constitute the herb layer. Bryophytes are abundant and varied, often forming a dense carpet that covers ground, rocks, roots and lower trunks of trees; *Dicranum majus*, *Rhytidiadelphus loreus*, *Polytrichum formosum*, *Pleurosum schreberi*, *Plagiothecium undulatum* are characteristic.
- 41.54** **AQUITANO-LIGERIAN OAK FORESTS ON PODSOLS**
Peucedano-Quercetum roboris
 Forests of *Q. robur* and, sporadically *Q. pyrenaica* or hybrids, on podzols of south-western France, with a herb layer constituted by the group of *Deschampsia flexuosa*, with *Molinia caerulea* and *Peucedanum gallicum*.
 (Braun-Blanquet, 1967; Delelis-Dusollier and Géhu, 1974; Bournérias, 1979, 1984; Noirfalise, 1986, 1987)
- 41.55** **AQUITANO-LIGERIAN OAK FORESTS ON LEACHED OR ACID SOILS**
Rusco-Quercetum petraeae
 Silicolous thermocline forests of *Quercus petraea*, *Q. robur*, *Sorbus torminalis*, *S. domestica*, *Pyrus communis*, *Malus acerba*, *Ilex aquifolium*, *Mespilus germanica* with an undergrowth of *Ruscus aculeatus*, *Festuca heterophylla*, *Pulmonaria longifolia*, *Melica uniflora* and the *Deschampsia flexuosa* and *Convallaria majalis* groups of the *Quercion*.
 (Izard *et al.*, 1963; Lavergne, 1963, 1969; Gaussen, 1964, 1974; Dupias, 1966; Braun-Blanquet, 1967, 1970; Durin *et al.*, 1967; Izard *et al.*, 1968; Delelis-Dusollier and Géhu, 1974; Rameau and Royer, 1974; Chastagnol *et al.*, 1978; Braque, 1979; Bournérias, 1979, 1984; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987)

41.56

IBERO-ATLANTIC ACIDOPHILOUS OAK FORESTS

Blechno-Quercetum roboris, *Tamo-Quercetum roboris*, *Linario-Quercetum petraeae*, *Teucro-Quercetum petraeae*, *Veronico-Betuletum*, *Rusco-Quercetum roboris p.*, *Vaccinio-Quercetum roboris*, *Narcisso-Quercetum roboris*

Forests or tall coppice of *Quercus robur* or *Quercus petraea* of the Pyrenees and north-western Iberia, with an often species-poor herb layer formed by the groups of *Deschampsia flexuosa* and of *Hypericum pulchrum*, by *Ruscus aculeatus* and often various ericaceous plants including *Daboecia cantabrica*.

(Braun-Blanquet *et al.*, 1956; Tüxen and Oberdorfer, 1958; Vanden Berghen, 1969; Dendaletche, 1973; Ozenda *et al.*, 1979; Rivas-Martinez *et al.*, 1984; Dupias, 1985; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Bolos y Capdevila, 1987, Vigo and Ninot, 1987; Izo Sevillano, 1987)

41.561

Pyrenean acidophilous oak forests

Quercus petraea forests, often with *Tilia platyphyllos*, *Prunus avium*, *Quercus robur*, *Betula pendula*, *Sorbus torminalis*, *Castanea sativa* and with *Rhamnus frangula*, *Ilex aquifolium*, *Mespilus germanica*, *Corylus avellana*, *Vaccinium myrtillus*, *Pteridium aquilinum*, *Teucrium scorodonia*, *Melampyrum pratense*, *Lathyrus montanus*, *Luzula sylvatica*, *L. forsteri*, *Deschampsia flexuosa*.

41.5611

Mesophile Pyrenean acidophilous oak forests

Teucro-Quercetum petraeae

Mesophile, typical formations.

41.5612

Hygrophile Pyrenean acidophilous oak forests

Veronico-Betuletum

Hygrophile formations, characteristic of humid uplands and valley floors, with abundance of *Vaccinium myrtillus* and presence of beech forest species.

41.562

Cantabrian acidophilous oak forests

Cantabrian and peri-Cantabrian acidophilous *Quercus robur* or *Q. petraea* forests, sometimes rich in *Betula celtiberica*, *Quercus pyrenaica* or *Castanea sativa*, with *Teucrium scorodonia*, *Blechnum spicant*, *Lonicera periclymenum*, *Deschampsia flexuosa*, *Veronica officinalis*, *Hypericum pulchrum*, *Lathyrus montanus*, *Melampyrum pratense*, *Euphorbia dulcis*, *E. amygdaloides*, *Stellaria holostea*, *Oxalis acetosella*, *Pteridium aquilinum*, *Dryopteris dilatata*, *D. affinis*, *D. aemula*, *Oreopteris limbosperma*, *Polypodium vulgare*, *Ulex europaeus*, *U. gallii*, *Vaccinium myrtillus*, *Daboecia cantabrica*, *Erica cinerea*, *E. vagans*.

41.5621

Eastern Cantabrian acidophilous oak forests

Tamo communis-Quercetum roboris

Cantabro-Euskaldian collinar to montane *Quercus robur* forests.

41.5622

Western Cantabrian acidophilous oak forests

Blechno spicanti-Quercetum roboris

Galicio-Asturian collinar to montane *Quercus robur* forests, richer in western Iberian species such as *Linaria triornithophora*, *Omphalodes nitida*, *Saxifraga spathularis*.

41.5623

Oro-Cantabrian acidophilous oak forests

Linario triornithophorae-Quercetum petraeae

Oro-Cantabrian montane *Quercus petraea* forests.

41.563

Luso-Galician collinar acidophilous oak forests

Galician and northern Portuguese collinar *Quercus robur* forests, with *Ilex aquifolium*, *Frangula alnus*, *Pyrus communis*, *Laurus nobilis*, *Crataegus monogyna*.

41.5631

Mesophile Luso-Galician collinar acidophilous oak forests

Rusco aculeati-Quercetum roboris p.

Widely distributed mesophile formations.

41.5632

Humid Luso-Galician collinar acidophilous oak forests*Narcisso cyclaminei-Quercetum roboris*

Meso-hygrophile formations rich in ferns, with *Betula celtiberica* and the north-western Iberian endemic *Narcissus cyclamineus*, limited to valley situations in contact with riparian forests.

41.564

Luso-Galician montane acidophilous oak forests*Vaccinio myrtilli-Quercetum roboris*

Galician and extreme northern Portuguese (Serra do Gerez) montane *Quercus robur* forests, characterized by the presence of *Betula celtiberica*, *Vaccinium myrtillus*, *Saxifraga spathularis*, *Melampyrum pratense* and the absence of thermophile, in particular lauriphyllous, species.

41.57

MEDIO-EUROPEAN ACIDOPHILOUS OAK FORESTS*Luzulo-Quercetum (Genisto tinctoriae-Quercetum petraeae), Sileno-Quercetum petraeae, Calamagrostio-Quercetum*

Medio-European acidophilous forests of *Quercus petraea*, sometimes accompanied by *Fagus sylvatica* and *Q. robur*, with a shrub layer comprising *Sorbus aucuparia*, *Frangula alnus*, often *Ilex aquifolium*, and a herb layer similar to that of the *Luzulo-Fagion*, of which they often constitute a substitution formation.

(Noirfalise and Sougnez, 1956; Noirfalise and Thill, 1958; Roisin, 1962; Oberdorfer, 1967, 1990; Sougnez, 1967, 1974; Tanghe, 1968, 1970; Bugnon and Rameau, 1974; Dumont, 1974; Duvigneaud, 1974; Ozenda and Wagner, 1975; Ozenda *et al.*, 1979; Noirfalise, 1984, 1987; Ellenberg, 1988)

41.571

Woodrush oak forests*Luzulo-Quercetum*

Mesophile, meso-xerophile or meso-hygrophile oak forests with wood-rush of the middle European Hercynian ranges and their periphery (central, southern and eastern Germany, southern Belgium, Lorraine, Champagne, Burgundy, eastern Morvan).

41.572

Xero-thermophile acidophilous oak forests*Sileno-Quercetum petraeae*

Xerophile oak woods on sunny escarpments with dry superficial, siliceous, often schistous soils of the Rhine rift and the schistous Hercynian ranges.

41.58

SUBCONTINENTAL PINE-OAK FORESTS*Vaccinio vitis-idaeae-Quercetum (Pino-Quercetum)*

Acidophilous forests of *Quercus robur*, *Q. petraea* and *Pinus sylvestris* on sandy substrates and granitic arenas of subcontinental climate regions in High-Palatinat, Erz, Vogtland, the southern Saxony hills and Brandenburg, with an undergrowth of *Vaccinium myrtillus*, *V. vitis-idaea*, *Calluna vulgaris*, *Deschampsia flexuosa*, *Melampyrum pratense*, *Luzula luzuloides*, *Dicranum spp.*, *Polytrichum spp.*

(Oberdorfer, 1957, 1990; Tüxen, 1974; Ozenda and Wagner, 1975; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987; Ellenberg, 1988)

41.59

INSUBRIAN ACIDOPHILOUS OAK FORESTS*Castaneo-Quercetum*

Acidophilous forests of *Quercus petraea*, often mixed with *Castanea sativa*, of the southern foothills of the Alps in Liguria, Piedmont and Lombardy. The herbaceous layer is often dominated by *Festuca ovina (s.l.)* and the undergrowth includes, in addition to plants characteristic of the *Quercion*, transgressives of the *Fagion* and of the *Quercetalia pubescenti-petraeae*.

(Tomaselli, 1973; Richard, 1974; Tosco, 1975; Ozenda and Wagner, 1975; Ozenda *et al.*, 1979; Lardelli, 1983; Ozenda, 1985; Noirfalise, 1987; Ellenberg, 1988)

- 41.5A** PORTUGUESE PEDUNCULATE OAK FORESTS
Rusco-Quercetum roboris viburnetosum
 Relict forests of *Q. robur* of central Portugal, often mixed with *Q. suber*, *Q. pyrenaica* or *Castanea sativa* and with a luxuriant understorey rich in lauriphyllous and xerophyllous lustrous-leaved shrubs and small trees such as *Prunus lusitanica*, *Arbutus unedo*, *Viburnum tinus*, *Ilex aquifolium*, *Laurus nobilis*, *Myrtus communis* and *Ruscus aculeatus*, limited to the basins of the Mondego and the Zezere, reduced to a very few, extremely fragile stands of exceptional biological and aesthetic value.
 (Braun-Blanquet *et al.*, 1956; Delvosalle and Duvigneaud, 1962)
- 41.6** **QUERCUS PYRENAICA FORESTS**
Quercion robori-pyrenaicae
Q. pyrenaica-dominated forests of the Iberian peninsula and, locally, south-western France.
 (Braun-Blanquet *et al.*, 1956; Braun-Blanquet, 1967; Ortuno and Ceballos, 1977; Meson, 1982, 1983; Noirfalise, 1986, 1987; Loidi Arregui, 1987; Dias Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Peinado Lorca and Martinez Parras, 1987; Martinez Parras and Peinado Lorca, 1987; Costa, 1987; Bolos y Capdevila, 1987; Izco Sevillano, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987)
- 41.61** CENTRAL IBERIAN *QUERCUS PYRENAICA* FORESTS
 Supra- and sometimes meso-Mediterranean *Quercus pyrenaica* forests of western Iberia, the Leonese interior, the Cordillera Central, the Iberian Range, the Montes de Toledo and the Sierra Morena.
- 41.611** Sub-Atlantic Iberian *Quercus pyrenaica* forests
Quercus pyrenaica forests of the Orensano-Sanabrian and Leonese mountains and of the western Cordillera Central.
- 41.6111** Sub-Atlantic sub-humid *Quercus pyrenaica* forests
Genisto falcatae-Quercetum pyrenaicae
 Supra- and meso-Mediterranean sub-humid *Quercus pyrenaica* forests of the Orenso-Sanabrian mountains and the Sierra de Gata complex.
- 41.6112** Sub-Atlantic humid *Quercus pyrenaica* forests
Holco mollis-Quercetum pyrenaicae
 Supra-Mediterranean humid to hyper-humid *Quercus pyrenaica* forests of the Orensano-Sanabrian and Leonese mountains, the Serra da Estrela and the Sierra de Gata complex.
- 41.612** Iberian sub-continental *Quercus pyrenaica* forests
Quercus pyrenaica forests of the central and eastern Cordillera Central and of the northern and eastern Iberian Ranges.
- 41.6121** Sub-continental sub-humid *Quercus pyrenaica* forests
Luzulo forsteri-Quercetum pyrenaicae
 Supra-Mediterranean sub-humid *Quercus pyrenaica* forests of Bejar, Gredos, Guadarrama, Ayllon and of the northern and eastern Iberian Ranges.
- 41.6122** Sub-continental humid *Quercus pyrenaica* forests
Festuco heterophyllae-Quercetum pyrenaicae
 Supra-Mediterranean humid to hyper-humid *Quercus pyrenaica* forests of the Sierra de Ayllon, the northern Iberian Range and, very locally, the Castillian flank of the Cantabrian chain.
- 41.613** Mariano-Oretanian *Quercus pyrenaica* forests
Quercus pyrenaica forests of the southern Hercynian ranges, limited to enclaves of the Montes de Toledo system and Sierra Morena satellites.
- 41.6131** Lower Mariano-Oretanian *Quercus pyrenaica* forests
Arbutum unedonis-Quercetum pyrenaicae
Quercus pyrenaica forests of the meso-Mediterranean level of the Montes de Toledo and Sierra Morena systems.

41.6132

Upper Mariano-Oretanian *Quercus pyrenaica* forests*Sorbo torminalis-Quercetum pyrenaicae**Quercus pyrenaica* forests developed above 1 000 metres in the highest ranges of the Montes de Toledo (Villuercas, Rocigalgo) and in a few satellites of the Sierra Morena (Sierra Madrona, Sierra Palomera).

41.62

CANTABRIAN *QUERCUS PYRENAICA* FORESTS*Melampyro pratense-Quercetum pyrenaicae*, *Linario triornithophorae-Quercetum pyrenaicae**Quercus pyrenaica* formations of medio-European character, of the collinar and montane levels of the Cantabrian chain and its satellite ranges, west to the Sierra de Picos de Ancares in Galicia, characteristic of areas with comparatively low precipitation, in the rain shadow of the coastward ranges or the interior oro-Cantabrian hills.

41.63

MAESTRAZGAN *QUERCUS PYRENAICA* FORESTS*Cephalanthero rubrae-Quercetum pyrenaicae**Quercus pyrenaica* forests of the sub-Mediterranean siliceous enclaves of the Maestrazgo and eastern Catalanian ranges, reduced to a very few relicts in the Penagolosa and Prades massifs.

41.64

BAETIC *QUERCUS PYRENAICA* FORESTS*Adenocarpus decorticans-Quercetum pyrenaicae**Quercus pyrenaica* forests of siliceous supra-Mediterranean areas with sub-humid climate of the western Sierra Nevada, the Sierra de Alfacar, the northern flanks of the Sierra de Cazulas and the Sierra Tejada; in more humid locations *Fraxinus angustifolius* and *Acer granatense* accompany *Q. pyrenaica*.

41.65

FRENCH *QUERCUS PYRENAICA* FORESTS*Betulo-Quercetum pyrenaica i.a.**Quercus pyrenaica* forests of south-western France, north to the Sologne where they constitute relatively extensive formations on poor soils, with *Betula pendula*, *Lonicera periclymenum*, *Deschampsia flexuosa*, *Holcus mollis*, *Molinia caerulea*, *Teucrium scorodonia*.

41.7

THERMOPHILOUS AND SUPRA-MEDITERRANEAN OAK WOODS*Quercetalia pubescenti-petraeae*

Forests or woods of sub-Mediterranean climate regions and supra-Mediterranean altitudinal levels, dominated by deciduous or semi-deciduous thermophilous oak species; they may, under local microclimatic or edaphic conditions, replace the evergreen oak forests in meso-Mediterranean or thermo-Mediterranean areas, and irradiate far north into medio-European or sub-Atlantic regions.

(Duvigneaud, 1953; Rey *et al.*, 1963; Vanden Berghen, 1963; Oberdorfer, 1967, 1990; Archiloque *et al.*, 1970; Fenaroli, 1970; Debazac and Mavrommatis, 1971; Barbero *et al.*, 1971; Tomaselli, 1973, 1981a; Tombal, 1974; Horvat *et al.*, 1974; Tosco, 1975; Ozenda and Wagner, 1975; Ozenda, 1975; Ortuno and Ceballos, 1977; Ozenda *et al.*, 1979; Noirfalise, 1984, 1986, 1987; Peinado-Lorca and Rivas-Martinez, 1987; Ellenberg, 1988)

41.71

WESTERN WHITE OAK WOODS AND RELATED COMMUNITIES*Quercion pubescenti-petraeae: Buxo-Quercetum*, *Lithospermo-Quercetum petraeae*, *Potentillo albae-Quercetum*, *Pteridio-Quercetum pubescentis*, *Aceri-Quercetum petraeae*; *Quercion ilicis p.**Quercus pubescens* forests and woods of the supra-Mediterranean zone of France, west of the Alpine arc, and of north-eastern Spain, with irradiations to southern Germany and Belgium. Low medio-European forests of *Q. petraea* or *Q. robur* occupying warm exposures beyond the range of *Q. pubescens* and linked to the *Quercion pubescenti-petraeae* by the presence of *Buxus sempervirens* or other thermophile calcicolous plants (*Limodorum abortivum*, *Melittis melissophyllum*).(Duvigneaud, 1953; Rey *et al.*, 1963; Vanden Berghen, 1963; Oberdorfer, 1967, 1990; Archiloque *et al.*, 1970; Barbero *et al.*, 1971; Tomaselli, 1981a; Tombal, 1974; Ozenda and Wagner, 1975; Ozenda, 1975; Ortuno and Ceballos, 1977; Ozenda *et al.*, 1979; Noirfalise, 1984, 1986, 1987; Loidi Arregui, 1987; Bolos y Capdevila, 1987; Vigo and Ninot, 1987; Ellenberg, 1988)

- 41.711** **Western *Quercus pubescens* woods**
Quercus pubescens ssp. *pubescens* formations of sub- and supra-Mediterranean regions of France, and of thermal stations in more northerly locations.
- 41.712** **Sub-Mediterranean *Quercus petraea*-*Q. robur* woods**
 Continental thermophilous *Quercus petraea* or *Q. robur* woods, outside of the range of *Q. pubescens* but accompanied by the thermophile, calcicolous cortège of the *Quercion pubescenti-petraeae*.
- 41.713** ***Quercus palensis* woods**
Quercus pubescens ssp. *palensis* formations of the Pyrenees and north-eastern Spain.
- 41.714** **Eu-Mediterranean white oak woods**
Quercion ilicis p.
Q. pubescens forests occupying fresh stations within the meso-Mediterranean zone, usually on ubacs and relatively deep soils, accompanied by *Q. ilex* and an associated vegetation characteristic of the *Quercion ilicis*.
- 41.72** **CYRNO-SARDINIAN WHITE OAK WOODS**
Lathyrion veneti
Quercus pubescens (with *Q. virgiliana*, *Q. congesta*) woods of Sardinia and Corsica. (Fenaroli, 1970; Pignatti, 1982; Gamisans, 1985; Chiappini, 1985a, 1985b; Barneschi, 1988)
- 41.73** **EASTERN WHITE OAK WOODS**
Ostryo-Carpinion p., *Cyclamino-Quercion brachyphyllae* p., *Cyclamino-Quercion ilicis* p.
 Often varied forests of the supra-Mediterranean (mostly lower supra-Mediterranean), and occasionally meso- or thermo-Mediterranean, levels of Greece and Italy, in which *Quercus pubescens* or its allies are the dominant deciduous oaks, usually associated with *Ostrya carpinifolia*, *Carpinus orientalis*, *C. betulus*, *Fraxinus ornus* and other species. (Rechinger, 1951; Fenaroli, 1970, 1984; Debazac and Mavrommatis, 1971; Barbero *et al.*, 1971; Tomaselli, 1973; Horvat *et al.*, 1974; Tosco, 1975; Ozenda and Wagner, 1975; Ozenda, 1975; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987; Bassani, 1987; Ferioli, 1989)
- 41.731** **Northern Italian *Quercus pubescens* woods**
 Formations of *Quercus pubescens* ssp. *pubescens*, *Fraxinus ornus*, *Ostrya carpinifolia*, *Carpinus betulus*, and, locally, *Carpinus orientalis* occupying the lower supra-Mediterranean (100-500 m) level of the central and northern Apennines, the Ligurian ranges and the Alpine foothills of Italy, with local impoverished irradiations to the upper supra-Mediterranean level on calcareous soils.
- 41.732** **Southern Italian and Sicilian *Quercus pubescens* woods**
 Formations of *Quercus pubescens* ssp. *pubescens*, *Ostrya carpinifolia*, *Carpinus orientalis* of the supra-Mediterranean level of southern Italy and Sicily.
- 41.733** **Greek *Quercus pubescens* woods**
 Formations of *Quercus pubescens* ssp. *pubescens*, *Carpinus orientalis*, *C. betulus*, *Ostrya carpinifolia* of the lower supra-Mediterranean level of Thessaly, Macedonia, Thrace, and locally on calcareous soils, of western Greece.
- 41.734** ***Quercus anatolica* woods**
 Usually open woods formed by *Quercus pubescens* ssp. *anatolica*, often associated with *Quercus macrolepis*, of Lesbos and Samothrace.
- 41.735** ***Quercus brachyphylla* woods**
 Stands of *Quercus brachyphylla*, often associated with *Quercus macrolepis* or *Q. ilex*, of the Peloponnese and Crete.

- 41.74** NORTHERN ITALIAN *QUERCUS CERRIS* WOODS
Ostryo-Carpinion p.
Q. cerris forests of the upper supra-Mediterranean level of the northern and central Apennines and the Italian pre-Alps, with *Ostrya carpinifolia*, *Carpinus betulus*, *Fraxinus excelsior*, *Quercus petraea*, *Tilia platyphyllos*, *Corylus avellana*, *Laburnum anagyroides*; some central Apennine formations may be dominated by *Quercus petraea*.
(Fenaroli, 1970, 1984; Debazac and Mavrommatis, 1971; Barbero *et al.*, 1971; Tomaselli, 1973; Tosco, 1975; Ozenda and Wagner, 1975; Ozenda, 1975; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987; Bassani, 1987; Ferioli, 1989)
- 41.75** SOUTHERN *QUERCUS CERRIS-Q. FRAINETTO* WOODS
Melitto-Quercion frainetto
Quercus cerris, *Q. frainetto*, or, sometimes, *Q. petraea*, formations of the upper supra-Mediterranean level of southern Italy, southern continental Greece and the Peloponnese.
(Fenaroli, 1970, 1984; Debazac and Mavrommatis, 1971; Barbero *et al.*, 1971; Tomaselli, 1973; Horvat *et al.*, 1974; Ozenda, 1975; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987; Bassani, 1987; Ferioli, 1989)
- 41.751** Southern Italian *Quercus cerris-Q. frainetto* woods
Formations of *Quercus cerris*, *Q. frainetto* or, locally, *Q. petraea*, of the Campanian, Lucanian and Calabrian Apennines and of Monte Gargano.
- 41.7511** Southern Italian *Quercus cerris* woods
Q. cerris-dominated formations of the supra-Mediterranean, montane and, locally, meso-Mediterranean levels, on siliceous or calcareous substrates.
- 41.7512** Southern Italian *Quercus frainetto* woods
Q. frainetto-dominated formations, mostly on siliceous or decarbonated substrates of the supra-Mediterranean level.
- 41.7513** Southern Italian *Q. petraea* woods
Q. petraea-dominated formations.
- 41.752** Southern Greek *Quercus cerris-Q. frainetto* woods
Formations dominated by *Quercus cerris*, by *Q. frainetto*, or both, of the Peloponnese, Attica and Beotia.
- 41.7521** Southern Greek *Q. cerris* woods
Q. cerris-dominated formations.
- 41.7522** Southern Greek *Q. frainetto* woods
Q. frainetto-dominated formations.
- 41.76** BALKANIC THERMOPHILOUS OAK WOODS
Quercion frainetto
Q. frainetto, *Q. cerris* and other deciduous oak forests of the supra-Mediterranean level of continental Greece except the extreme south.
(Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Ozenda *et al.*, 1979; Noirfalise, 1986, 1987)
- 41.761** Greek *Quercus cerris* woods
Quercus cerris-dominated formations.
- 41.762** Greek *Quercus frainetto* woods
Quercus frainetto-dominated formations.
- 41.763** Greek *Quercus dalechampii* woods
Quercus dalechampii-dominated formations.
- 41.764** Greek *Quercus petraea* woods
Quercus petraea-dominated formations.
- 41.765** Greek *Quercus virgiliana* woods
Quercus virgiliana-dominated formations.

- 41.766 **Greek *Quercus pedunculiflora* woods**
Quercus pedunculiflora-dominated formations.
- 41.767 **Greek *Quercus polycarpa* woods**
Quercus polycarpa-dominated formations.
- 41.77 **IBERIAN *QUERCUS FAGINEA* AND *Q. CANARIENSIS* FORESTS**
Aceri-Quercion fagineae p., *Quercion fagineae*, *Quercion fagineo-suberis*
Iberian forests and woods dominated by *Quercus faginea* or *Q. canariensis*. The humid formations of south-western Iberia (41.772 and 41.773) are forest types of unique character in Europe and of extreme biological importance; also highly distinctive and vulnerable are the Baetic formations listed under 41.7714 and 41.7715.
(Braun-Blanquet *et al.*, 1956; Bolos and Molinier, 1960; Rivas-Martinez, 1974; Loidi Arregui, 1987; Dias Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Peinado Lorca and Martinez Parras, 1987; Martinez Parras and Peinado Lorca, 1987; Costa, 1987; Bolos y Capdevila, 1987; Izco Sevillano, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987)
- 41.771 **Spanish *Quercus faginea* forests**
Spiraeo obovatae-Quercetum fagineae, *Cephalanthero longifoliae-Quercetum fagineae*, *Violo wilkommii-Quercetum fagineae*, *Daphno latifoliae-Aceretum granatensis*, *Fraxino orni-Quercetum fagineae*
Xero-mesophile *Quercus faginea* formations of slopes and plateaux of middle elevations of the Spanish Meseta and associated ranges.
- 41.7711 **Western *Quercus faginea* forests**
Spiraeo obovatae-Quercetum fagineae
Quercus faginea forests of the supra-Mediterranean, sub-humid level of the Cantabrian periphery and upper Ebro basin.
- 41.7712 **Central *Quercus faginea* forests**
Cephalanthero longifoliae-Quercetum fagineae
Quercus faginea forests of the meso-supra-Mediterranean levels of the Iberian Range, upper Douro basin and neighbouring regions.
- 41.7713 **Eastern *Quercus faginea* forests**
Violo wilkommii-Quercetum fagineae
Quercus faginea forests of the meso-supra-Mediterranean levels of the Maestrazgo, interior Catalonia and adjacent Aragon.
- 41.7714 **Baetic *Quercus faginea* forests**
Daphno latifoliae-Aceretum granatensis
Southern forests of the sub-humid to humid supra-Mediterranean level of calcareous Baetic ranges, limited to a few enclaves in the Serrania de Ronda and the ranges of the upper Guadalquivir basin, dominated by *Quercus faginea* associated with *Acer granatense*, *A. monspessulanum*, *Sorbus aria*, *S. torminalis*, *Taxus baccata* and sometimes *Quercus pyrenaica*.
- 41.7715 **Valencian *Quercus faginea* forests**
Fraxino orni-Quercetum fagineae
Quercus faginea forests of ubacs of the southern Valencian mountains (Aitana, Montcabrer, Benicadell), with *Acer granatense*, *Fraxinus ornus* and *Taxus baccata*.
- 41.772 **Portuguese *Quercus faginea* forests**
Arisaro-Quercetum fagineae
Humid, epiphyte-clad, dense, relict *Quercus faginea* forests of Portugal, restricted to a very few isolated localities.
- 41.773 **Andalusian *Quercus canariensis* forests**
Rusco hypophylli-Quercetum canariensis
Humid and hyper-humid, luxuriant *Quercus canariensis* forests of the sierras of extreme southern Spain, limited to the Aljibe and a very few localities in the Serrania de Ronda.

- 41.774** **Catalonian *Quercus canariensis* stands**
Carici depressae-Quercetum canariensis
 Formations of Catalonia rich in *Quercus canariensis*.
- 41.775** **Balearic *Quercus faginea* woods**
Aceri-Quercetum fagineae p.
 Relict formations of Majorca dominated by, or rich in, *Quercus faginea*.
- 41.78** **MACEDONIAN-OAK WOODLAND**
Ostryo-Carpinion p.: Quercetum trojanae i.a.
 Woods dominated by the semi-deciduous *Quercus trojana*.
 (Fenaroli, 1970, 1984; Horvat *et al.*, 1974; Groppali *et al.*, 1983; Ferioli, 1989)
- 41.781** ***Quercus trojana* woods of Greece**
 Usually low formations dominated by *Quercus trojana*, often with junipers or maples, of Macedonia, Thrace and Thessaly.
- 41.782** ***Quercus trojana* woods of Puglia**
 Relict woods, sometimes of considerable height, of *Q. trojana* and *Q. pubescens*, often with an admixture of *Q. ilex* and its associated vegetation (Murge: e.g. bosco delle Pianelle, foresta Gaglione).
- 41.79** **VALONIA OAK WOODLAND**
 Woods dominated by the semi-deciduous *Quercus macrolepis*, often fairly open, of the mostly meso-Mediterranean zone of Greece and, very locally, southern Italy.
 (Rechinger, 1951; Horvat *et al.*, 1974; Noirfalise, 1986, 1987; Fenaroli, 1987; Ferioli, 1989)
- 41.791** ***Quercus macrolepis* woods of Greece**
 Formations of continental Greece and its archipelagoes; well-developed forests exist, in particular, in the Ionian islands and on Lesbos.
- 41.792** ***Quercus macrolepis* woods of Puglia**
 Relict formations of Salento (Tricase).
- 41.8** **HOP-HORNBEAM, ORIENTAL HORNBEAM AND MIXED THERMOPHILOUS FORESTS**
Ostryo-Carpinion p., Aceri-Quercion fagineae p., Quercion frainetto p. i.a.
 Non-alluvial formations of the meso- and supra-Mediterranean zones dominated by *Ostrya carpinifolia*, *Carpinus orientalis*, *Acer spp.*, *Fraxinus spp.*, *Tilia spp.* or *Celtis australis*.
 (Tüxen and Oberdorfer, 1958; Bolos and Molinier, 1960; Fenaroli, 1970; Barbero *et al.*, 1971; Horvat *et al.*, 1974; Lapraz, 1975; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987; Martinez Parras and Peinado Lorca, 1987; Peinado Lorca and Martinez Parras, 1987; Asensi Marfil and Diez Garretas, 1987)
- 41.81** **HOP-HORNBEAM WOODS**
 Formations dominated by *Ostrya carpinifolia*.
- 41.811** **Meso-Mediterranean hop-hornbeam woods**
 Ravine forests of the meso-Mediterranean *Quercus ilex* zone.
- 41.812** **Supra-Mediterranean hop-hornbeam woods**
 Formations of the supra-Mediterranean level belonging to the *Ostryo-Carpinion*.
- 41.813** **Montane hop-hornbeam woods**
 Formations with an accompanying flora of the *Ostryo-Fagion*.
- 41.82** **ORIENTAL HORNBEAM WOODS**
 Low formations dominated by *Carpinus orientalis*, particularly abundant in Greece.
- 41.83** **THERMOPHILOUS MAPLE WOODS**
 Formations dominated by *Acer spp.*

- 41.831 Andalusian *Acer granatense* woods**
Daphno latifoliae-Aceretum granatensis p.
 Supra-Mediterranean formations of the mountains of the upper Guadalquivir, with *Acer granatense*, *A. monspessulanum*, *Quercus faginea*, *Q. pyrenaica*, *Sorbus aria*, *S. torminalis*, *Taxus baccata*, *Daphne laureola*, *Paeonia officinalis* ssp. *humilis*. Vestiges of this type of vegetation also survive in the Serrania de Ronda.
- 41.832 Balearic *Acer granatense* woods**
Aceri-Quercetum fagineae p.
 Formations, extremely rare if not extinct, of the mountains of Majorca (Puig de Maçanella, Puig Major), dominated by *Acer granatense*, with *Quercus faginea*, *Amelanchier ovalis* ssp. *comafredensis*, *Ilex aquifolium* var. *balearica*, *Helleborus foetidus* var. *balearicus*, *Sorbus aria*, *Primula acaulis* var. *balearica*, *Rubus ulmifolius*, *Tamus communis*, *Taxus baccata*, *Hedera helix*, *Smilax aspera* var. *balearica*, *Paeonia cambessedesii*, several of which are relict endemic taxa of very limited distribution and low numbers.
- 41.84 MEDITERRANEAN LIME WOODS**
 Supra- or meso-Mediterranean formations dominated by *Tilia spp.*
- 41.85 NETTLE-TREE WOODS**
 Formations rich in *Celtis australis*.
- 41.86 THERMOPHILOUS ASH WOODS**
 Non-alluvial, non-ravine formations dominated by *Fraxinus angustifolia* or *F. ornus*, often mixed with *Quercus pubescens* or *Q. pyrenaica*.
- 41.861 Sicilian narrow-leaved ash woods**
Fraxinus angustifolia woods of western Sicily.
- 41.862 Iberian narrow-leaved ash woods**
Fraxinus angustifolia woods of the Iberian peninsula.
- 41.863 Manna tree woods**
 Formations dominated by *Fraxinus ornus*.
- 41.87 OTHER OR VERY MIXED WOODS**
- 41.9 CHESTNUT WOODS**
Castanea sativa-dominated formations.
- 41.A HORNBEAM WOODS**
 Pure or almost pure formations of *Carpinus betulus*.
- 41.B BIRCH WOODS**
 Formations dominated by *Betula pendula*, *B. pubescens*, or their allies, on non-marshy terrain.
- 41.B1 LOWLAND AND COLLINAR BIRCH WOODS**
Quercion robori-petraeae p., i.a.
 Pioneer and sub-climax birch formations of the North Sea-Baltic plains, the lower Hercynian slopes, the periphery of the Paris Basin, south-western France, north-western Iberia and Insubria, within the range of Atlantic and sub-Atlantic acidophilous oak woods.
 (Simms, 1971; Westhoff and den Held, 1975; Groppali *et al.*, 1980; Condry, 1981; Nordiska ministerradet, 1984; Bournérias, 1984; Izco Sevillano, 1987; Noirfalise, 1987; Ellenberg, 1988; Ferioli, 1989; Oberdorfer, 1990; Rodwell, 1991)
- 41.B11 Humid birch woods**
 Formations usually formed by *Betula pubescens*, with *Molinia caerulea* and sometimes *Deschampsia flexuosa*, developed on podzolized and hydromorphic soils, as substitution facies of oak and birch woods, or colonization stages of *Molinion* grasslands or humid heaths.

- 41.B111** **Northern humid birch woods**
Quercus-Betuletum p.
 Widespread birch-dominated formations characteristic of the North Sea-Baltic plain.
- 41.B112** **Aquitano-Ligerian humid birch woods**
Peucedano-Quercetum p.
 Southern formations common, in particular, in the Sologne and neighbouring areas.
- 41.B12** **Medio-European dry acidophilous birch woods**
 Formations usually formed by *Betula pendula*, or, in the British Isles, *B. pubescens*, with *Deschampsia flexuosa*, *Agrostis tenuis*, *Festuca ovina*, *Vaccinium myrtillus*, developed notably on sands, gravels, moraines and decalcified alluvions of northern and middle European plains and hills, as substitution facies of acidophilous oak woods (*Fago-Quercetum*, *Blechno-Quercetum petraeae*, *Rusco-Quercetum*, *Luzulo-Quercetum*), occasionally of oak-hornbeam woods (particularly mixed Atlantic bluebell oak forests, *Endymio-Carpinetum*) or colonization stages of dry heaths and decalcified dunes.
- 41.B13** **Iberian acidophilous birch woods**
Holco mollis-Betuletum celtibericae i.a.
 Medio-European acidophilous birch woods of the collinar and lower montane levels of north-western Iberia, formed by *Betula pendula* or *B. celtiberica* as substitution stages of acidophilous oak woods.
- 41.B14** **Insubrian acidophilous birch woods**
 Birch woods of the collinar and lower montane levels of northern Italy, dispersed in the Alpine foothills where they constitute substitution stages of the Insubrian acidophilous oak woods (*Castaneo-Quercetum p.*), on the fluvio-glacial terraces of the Po system, as facies of the acidophilous pine-birch-oak woods, and in the Euganean hills.
- 41.B15** **Heavy-metal birch woods**
 Sub-climax birch woods occupying soils intoxicated by heavy metals, with an herb layer that may include metallophytes and habitually calciphile species.
- 41.B16** **Dune birch woods**
Crataego-Betuletum
 Birch woods formed by *Betula pubescens*, *B. pendula* and *Populus canescens* with *Viola hirta*, *Ligustrum vulgare*, *Polygonatum odoratum*, in calcareous North Sea and Baltic dunes.
- 41.B2** **SUB-BOREAL BIRCH WOODS**
 Birch woods, often extensive and pure, formed by *Betula pubescens* (*B. odorata*, *B. carpatica*) or *B. pendula*, beyond and above the present range of oak woods in Scotland and northern England.
 (Turrill, 1948; Simms, 1971; Clapham *et al.*, 1985; Noifalaise, 1987; Rodwell, 1991)
- 41.B3** **MONTANE AND SUBALPINE BIRCH WOODS**
 Birch stands of the montane and subalpine levels of the Alps, the Apennines, the Pyrenees, the Jura and the Hercynian ranges, mostly sub-climax formations of stations with anomalous edaphic and microclimatic conditions.
 (Sfikas, 1984; Ozenda, 1985; Ellenberg, 1988; Ferioli, 1989; Oberdorfer, 1990)
- 41.B31** **Alpine treeline birch woods**
 Tree-limit birch stands, of local distribution in the Alps.
- 41.B32** **Birch block forests**
Betulo-Sorbetum aucuparia i.a.
 Birch stands, mostly of *Betula pubescens* (*B. carpatica*, *B. tortuosa*), occupying, in the Alps, the Jura and the Hercynian ranges, cold stations on cliff-base rocky screes and boulder-falls through which cold air flows.
- 41.B33** **Pyrenean birch woods**
 Birch-dominated formations of the Pyrenees, locally frequent in all vegetation levels.

- 41.B34** **Apennine birch woods**
Isolated birch stations of the Apennines, in the Abruzzi, bosco di Manziana (Latium), monti Alburni, monti Picentini.
- 41.B35** **Greek birch woods**
Southern outposts of *Betula pendula* in the Rhodopi mountains of northern Greece.
- 41.B4** **CORSICAN BIRCH WOODS**
Betula pendula formations of the upper montane level of Corsica, forming extensive sub-climax belts on rocky, rapidly eroding soils at the upper forest limit, as well as transition communities in the evolution of laricio pine or beech forests.
(Gamisans, 1985)
- 41.B5** **MONTANE *BETULA CELTIBERICA* WOODLANDS**
Formations of the upper montane and supra-Mediterranean levels of Iberia dominated by the endemic *Betula celtiberica*.
(Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987; Izco Sevillano, 1987; Rivas-Martinez *et al.*, 1987)
- 41.B51** **Cantabrian *Betula celtiberica* woodlands**
Luzulo henriquezii-Betuletum celtibericae
Oro-Cantabrian tree-limit climax formations.
- 41.B52** **Estrelan and Orensano-Sanabrian *Betula celtiberica* woodlands**
Saxifrago spathularis-Betuletum celtibericae
Upper montane and supra-Mediterranean climax formations of the western Cordillera Central (Serra da Estrela) and the Orensano-Sanabrian mountains, limited to tree-limit situations and humid ravines.
- 41.B53** **Sorian and Guadarraman *Betula celtiberica* woodlands**
Melico uniflorae-Betuletum celtibericae
Humid supra-Mediterranean climax formations of the eastern Cordillera Central (Guadarrama) and of the northern Iberian Range (Sorian mountains), restricted to relict stations on rainy ubacs and humid ravines.
- 41.B6** **MOUNT ETNA BIRCH STANDS**
Endemic *Betula aetnensis* formations of Mount Etna lavas, limited to the 1 200-2 000 metre level.
(Fenaroli, 1970; Pignatti, 1982; Ferioli, 1989)
- 41.C** **ALDER WOODS**
Non-riparian, non-marshy formations dominated by *Alnus spp.*.
(Fenaroli, 1970; Simms, 1971; Gamisans, 1985; Noirfalise, 1986; Ferioli, 1989; Rodwell, 1991)
- 41.C1** **ALNUS CORDATA WOODS**
Alnus cordata-dominated formations of slopes with deep, loose, moist soils, endemic to the Campanian, Lucanian and Calabrian Apennines and the Castaniccia and San Petrone ranges of Corsica.
- 41.C2** **ALNUS GLUTINOSA WOODS**
Non-riparian, non-marshy formations dominated by *Alnus glutinosa*, including *Sambucus nigra* sub-community of Atlantic *Alnus glutinosa-Urtica dioica* woodland.
- 41.D** **ASPEN WOODS**
Formations dominated by *Populus tremula*.
(Braun-Blanquet, 1975; Nordiska ministerradet, 1984; Ellenberg, 1988; Ferioli, 1989)
- 41.D1** **INNER ALPINE ASPEN WOODS**
Corylo-Populetum tremulae
Woods of *Populus tremula* and *Corylus avellana*, accompanied by a xerophile flora, of dry inner Alpine valleys.

41 Broad-leaved deciduous forests

- 41.D2** **LOWLAND ASPEN WOODS**
Quercion robori-petraeae p.
 Pioneer and sub-climax *Populus tremula* formations of plains and hills, in particular the North Sea-Baltic plain and lower Hercynian slopes, within the range of Atlantic and sub-Atlantic acidophilous oak woods, and the large alluvial systems such as that of the Po.
- 41.D3** **MONTANE ASPEN STANDS**
Populus tremula formations of mountainous areas, in particular, within the beech belt of high southern mountains.
- 41.D4** **SUPRA-MEDITERRANEAN ASPEN STANDS**
Populus tremula formations occurring within the supra-Mediterranean environment of the mixed deciduous broad-leaved forests.
- 41.E** **ROWAN WOODS**
Sorbus aucuparia-dominated formations, characteristic in particular of the Scottish Highlands.
 (Noirfalise, 1987)
- 41.F** **ELM WOODS**
 Non-riparian, non-ravine *Ulmus spp.*-dominated formations.
- 41.F1** **SMALL-LEAVED ELM WOODS**
Ulmus minor (*U. carpinifolia* or *U. procera*) woods of base- and nutrient-rich, often ruderal, terrain, dispersed along the western seaboard of Europe, usually rich in species of southern affinities.
- 41.F11** **Sweet violet elm woods**
Viola odoratae-Ulmetum i.a.
 Formations of the Low Countries, in particular of dunal regions, and of the Paris Basin.
 (Westhoff and den Held, 1975; Bournérias, 1984; Noirfalise *et al.*, 1985)
- 41.F12** **Thermo-Atlantic elm woods**
Aro neglecti-Ulmetum minoris
 Formations of the coasts of Normandy, Brittany and Vendée.
 (Géhu and Géhu-Franck, 1985)
- 41.F13** **British suckering elm woods**
 Woods of the British Isles, mostly of *Fraxinus-Acer-Mercurialis* type, invaded and dominated by suckering elms of the *Ulmus minor* group (*U. carpinifolia*, *U. procera*); postcultural small-leaved elm groves are included.
 (Rodwell, 1991)
- 41.F2** **WYCH ELM AND FLUTTERING ELM WOODS**
 Non-riparian, non-ravine *Ulmus glabra* or *U. laevis*-dominated formations of northern and central Europe.
 (Nordiska ministerradet, 1984; Oberdorfer, 1990)
- 41.G** **LIME WOODS**
 Non-riparian, non-ravine *Tilia spp.*-dominated formations.
 (Nordiska ministerradet, 1984; Oberdorfer, 1990; Rodwell, 1991)
- 41.H** **OTHER DECIDUOUS WOODS**

42 Coniferous woodland

Forests and woodland of native coniferous trees other than floodplain and mire woods; formations dominated by coniferous trees, but comprising broad-leaved evergreen trees, are included.

- 42.1 FIR FORESTS**
Conifer forests dominated by firs (*Abies spp.*).
- 42.11 NEUTROPHILOUS SILVER FIR FORESTS**
Fir (*Abies alba*) and fir-spruce forests developed on neutral or near-neutral soils of the Alps, the Pyrenees, the Jura, the Hercynian ranges and the northern Apennines. (Ellenberg, 1963, 1988; Meyer, 1970; Gruber, 1978; Ozenda, 1981, 1985; Fenaroli, 1984; Durin, 1985; Noirfalise, 1986, 1987; Bassani, 1987; Ferioli, 1989; Oberdorfer, 1990)
- 42.111 Inner Alpine neutrophilous fir forests**
Galio rotundifolii-Abietenion (Abietetum albae) p.: Oxali-Abietetum i.a.
Neutrophilous fir and fir-spruce forests developed on brown soils of the intermediate Alps, outside of the climatic range of the beech.
- 42.1111 Sorrel fir forests**
Typical inner Alpine formations with a predominance of mull-moder species such as *Veronica latifolia*, *Melampyrum sylvaticum*, *Prenanthes purpurea*, *Oxalis acetosella*, *Luzula nivea*; all fir forests of the intermediate and inner Alps can be included in this category with the exception of those that present clearly acidophilous or calciphilous facies and of the well-characterized local types listed immediately below.
- 42.1112 Tall herb fir forests**
High altitude, upper montane, tall-herb rich formations with *Adenostyles alliariae*, *Geranium sylvaticum*, *Cicerbita alpina*, *Chaerophyllum villarsii*, *Peucedanum ostruthium*, *Alnus viridis* and *Sorbus aucuparia*.
- 42.1113 Trochiscanthes fir forests**
Formations of the Maritime Alps with *Trochiscanthes nodiflorus*, *Galium sylvaticum*, *Luzula pedemontana*, *Aquilegia atrata*, *Phyteuma halleri*.
- 42.112 Neutrophilous beech-zone fir forests**
Fir or fir-spruce facies of the montane beech-fir neutrophilous forests (41.13, 41.14, 41.17 p.) of the outer Alps, the Pyrenees, the northern Apennines, the Jura and the Hercynian arc, with rich herb and moss layers and a flora similar to that of the beech or beech-fir facies.
- 42.113 Inner Pyrenean fir forests**
More acidophilous formations of the inner Pyrenees, with *Vaccinium myrtillus*, *Goodyera repens*, *Galium rotundifolium* and a good representation of species of the neutrophilous beech forests, intermediate between this unit and 42.13.
- 42.12 CALCIPHILOUS SILVER FIR FORESTS**
Fir (*Abies alba*) and fir-spruce forests developed on calcareous soils of the Alps, the Pyrenees, the Jura and the Hercynian ranges. (Tüxen and Oberdorfer, 1958; Ellenberg, 1963; Ozenda, 1981, 1985; Noirfalise, 1986, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 42.121 Inner Alpine calcicolous fir forests**
Galio rotundifolii-Abietenion (Abietetum albae) p.: Calamagrostido variae-Abietetum, Carici albae-Abietetum, Adenostylo glabrae-Abietetum
Calcicolous fir or fir-spruce forests of the intermediate Alps with *Carex alba*, *Polygala chamaebuxus*, *Hepatica triloba*, *Calamagrostis varia*.

- 42.122** **Calcicolous beech-zone fir forests**
Fir facies of calcicolous beech-fir forests in the outer Alps, the Pyrenees, the Jura.
- 42.123** **Black Forest calcicolous fir-spruce woods**
Piceo-Abietetum
Fir-spruce woods of calcareous soils of the Baar Plateau in the eastern Black Forest foothills, rich in sedges and orchids.
- 42.13** **ACIDOPHILOUS SILVER FIR FORESTS**
Fir (*Abies alba*) and fir-spruce forests developed on acid soils of the Alps, the Pyrenees, the Jura, the Hercynian ranges and the northern Apennines.
(Ellenberg, 1963, 1988; Gruber, 1978; Ozenda, 1981, 1985; Dupias, 1985; Noirfalise, 1986, 1987; Oberdorfer, 1990)
- 42.131** **Inner Alpine acidophilous silver fir forests**
Galio rotundifolii-Abietenion (Abietetum albae) p.: Calamagrostido villosae-Abietetum, Vaccinio-Abietetum, Luzulo-Abietetum
Oligotrophic fir and fir-spruce forests of the intermediate Alps, with *Luzula nivea*, *Vaccinium myrtillus*, *Calamagrostis villosa*, *Festuca flavescens*, *Saxifraga cuneifolia*.
- 42.132** **Acidophilous beech-zone fir forests**
Fir or fir-spruce facies of acidophilous beech-fir formations, in the outer Alps, the Pyrenees, the Apennines, the Hercynian arc.
- 42.133** **Fir forests with alpenrose**
Rhodoreto-Abietetum, Homogyne-Abietetum
High-altitude fir forests characteristic of ubacs of high mountains outside of the range of spruce, with *Rhododendron ferrugineum*, *Vaccinium myrtillus*, *Homogyne alpina*, *Festuca flavescens*.
- 42.1331** **Pyrenean alpenrose fir forest**
Fir forests of the lower subalpine level of the Pyrenees, with *Rhododendron ferrugineum*, *Homogyne alpina*, *Lonicera nigra*, *Polystichum lonchitis*, *Rosa pendulina* (*R. alpina*), *Huperzia selago*.
- 42.1332** **Alpine alpenrose fir forests**
Fir forests of the lower subalpine level of the western Alps, with *Rhododendron ferrugineum*, *Vaccinium myrtillus*, *Homogyne alpina*, *Lonicera caerulea*, *Festuca flavescens*, *Huperzia selago*.
- 42.1333** **Block alpenrose fir forests**
Block fir forests of the montane level.
- 42.14** **CORSICAN SILVER FIR FORESTS**
Poo-Fagetum abietetosum
Fir woods and forests locally replacing, mostly in cool stations, the acidophilous beech forests of the montane level of Corsica.
(Gamisans, 1975, 1985; Noirfalise, 1986, 1987)
- 42.15** **SOUTHERN APENNINE SILVER FIR FORESTS**
Geranio versicolori-Fagion p.
Relict fir woods associated with the beech forests of the *Geranio versicolori-Fagion* of the Lucano-Calabrian Apennines (Pollino, Sila, Aspromonte).
(Fenaroli, 1970, 1984; Bonin, 1971; Noirfalise, 1986, 1987; Bassani, 1987; Ferioli, 1989)
- 42.16** **GREEK SILVER FIR FORESTS**
Fagion moesiacum p.
Very local, calciphilous, *Abies alba* forests of extreme northern Greece.
(Horvat *et al.*, 1974; Sfikas, 1978; Mavrommatis, 1978; Kassioumis, 1988)

- 42.17** FORESTS OF KING BORIS'S FIR
Fagion hellenicum p.
 Fir forests of the Pindus with *Abies borisii-regis*, adjacent to beech and beech-fir forests of the *Fagion hellenicum*.
 (Horvat *et al.*, 1974; Ozenda, 1975; Sfikas, 1978; Mavrommatis, 1978; Gamisans and Hebrard, 1979; Noirfalise, 1986, 1987)
- 42.18** FORESTS OF GRECIAN FIR
Abietion cephalonicae
 Endemic *Abies cephalonica* or mixed forests of the southern Pindus, the Parnassus, Cephalonia and the Peloponnese, outside of the range of beeches, *Fagus spp.*
 (Horvat *et al.*, 1974; Ozenda, 1975; Sfikas, 1978; Mavrommatis, 1978; Noirfalise, 1986, 1987)
- 42.19** PINSAPO FIR FORESTS
 Forests and stands of the endemic *Abies pinsapo* of the supra-meso-Mediterranean level of Andalusia.
 (Polunin and Smythies, 1973; Rigueiro Rodriguez, 1976; Ortuno and Ceballos, 1977; Ozenda *et al.*, 1979; Lopez Gonzalez, 1982; Asensi and Diez Garretas, 1987)
- 42.191** Ronda pinsapo fir forests
Paeonio coriaceae-Abietetum pinsapi
 Calcicolous formations of the Serrania de Ronda and associated ranges.
- 42.192** Bermeja pinsapo fir forests
Bunio macucae-Abietetum pinsapi
 Formations occupying ultra-basic serpentine outcroppings of the Sierra Bermeja and isolated stands of associated ranges.
- 42.1A** RELICT NEBRODI FIR STANDS
 Surviving stands of the endangered *Abies nebrodensis* in the Madonie mountains of Sicily.
 (Fenaroli, 1970; Pignatti, 1982; Groppali *et al.*, 1983; Ferioli, 1989)
- 42.1B** FIR REFORESTATION
 Plantations of European firs within or near their area of present or recent natural occurrence. Other plantations of these species and plantations of non-European firs should be noted as 83.
- 42.1B1** *Abies alba* reforestation
 Plantations of *Abies alba* within its area of occurrence or north and west of it.
- 42.1B2** *Abies borisii-regis* reforestation
 Plantations of *A. borisii-regis* in Greece.
- 42.1B3** *Abies cephalonica* reforestation
 Plantations of *A. cephalonica* in Greece.
- 42.1B4** *Abies pinsapo* reforestation
 Plantations of *A. pinsapo* in Andalusia.
- 42.1B5** *Abies nebrodensis* reforestation
 Plantations of *A. nebrodensis* in the mountains of northern Sicily.
- 42.2** SPRUCE FORESTS
Vaccinio-Piceion i.a.
 Conifer forests dominated by *Picea abies*.
 (Ellenberg, 1963, 1988; Ozenda, 1985; Noirfalise, 1987; Ferioli, 1989; Oberdorfer, 1990)

- 42.21 SUB-ALPINE SPRUCE FORESTS OF THE ALPS**
Piceetum subalpinum
Picea abies forests of the lower subalpine level, and of anomalous stations in the montane level, of the outer, intermediate and inner Alps; in the latter, they are often in continuity with the montane spruce forests of 42.22. The spruces are often stunted or columnar; they are accompanied by an undergrowth of decidedly subalpine affinities.
 (Ellenberg, 1963, 1988; Ozenda, 1981, 1985; Noirfalise, 1986, 1987; Oberdorfer, 1990)
- 42.211 Bilberry spruce forests**
Homogyne-Piceetum, *Vaccinio-Piceetum*
 Mostly acidophilous, mesophile, subalpine *Picea abies* forests with *Oxalis acetosella*, *Vaccinium vitis-idaea*, *V. myrtillus*, *Calamagrostis villosa*, *Hylocomium splendens*.
- 42.212 Tall herb subalpine spruce forests**
Adenostylo hirsutae-Piceetum, *Adenostylo alliariae-Piceetum*
 Tall herb rich, hygrophile or meso-hygrophile, *Picea abies* forests of high altitude stations subjected to prolonged snow cover and frequent fogs, with *Adenostyles* spp., *Chaerophyllum hirsutum*, *Peucedanum ostruthium*, *Ranunculus aconitifolius*, *Aconitum vulparia*, *A. paniculatum*, *Stellaria nemorum*, *Geranium sylvaticum*, *Cicerbita alpina*.
- 42.2121 Calcicolous tall herb subalpine spruce forests**
 Tall herb subalpine *Picea abies* forests on calcareous substrates, with *Adenostyles hirsuta*.
- 42.2122 Silicicolous tall herb subalpine spruce forests**
 Tall herb subalpine *Picea abies* forests on siliceous substrates, with *Adenostyles alliaria*.
- 42.213 Peatmoss subalpine spruce forests**
Sphagno-Piceetum
 Sphagnum-rich *Picea abies* forests of more or less peaty, humid substrates with *Listera cordata*, *Sphagnum acutifolium*, *S. quinquefarium*, *S. girgensohnii*.
- 42.214 Xerophile subalpine spruce forests**
Picea abies forests on dry adrets, with *Vaccinium vitis-idaea* or with *Arctostaphylos uva-ursi*, *Polygala chamaebuxus*, *Carex humilis*.
- 42.215 Cold station spruce forests**
Asplenio-Piceetum i.a.
Picea abies woods of anomalous stations at the montane or subalpine level, in particular block forests of 'ice cellars' (shaded rocky screes through which cold air flows), woods developed in valleys and depressions where cold air accumulates on clear nights, woods colonizing stabilized screes and narrow bands of rocks, woods on moist sites.
- 42.22 MONTANE SPRUCE FORESTS OF THE INNER ALPS**
Piceetum montanum
Picea abies forests of the montane level of the inner Alps, characteristic of regions climatically unfavourable to both beech and fir.
 (Ellenberg, 1963, 1988; Ozenda, 1981, 1985; Noirfalise, 1986, 1987)
- 42.221 Acidophile montane inner Alpine spruce forests**
Calamagrostio villosae-Piceetum, *Luzulo-Piceetum*, *Veronico-Piceetum*, *Oxali-Piceetum*
 Inner Alpine *Picea abies* forests of siliceous crystalline or schistous substrates, with *Calamagrostis villosa* and woodrushes.
- 42.222 Calciphile montane inner Alpine spruce forests**
Calamagrostio variae-Piceetum
 Calcicolous inner Alpine *Picea abies* forests with *Calamagrostis varia*, *Carex flacca*, *Sesleria caerulea*, *Hieracium trifidum*, *Aster bellidiastrum*.
- 42.223 Xerophile montane inner Alpine spruce forests**
Melico-Piceetum and related communities
 Xerophile, more or less mesotrophic inner Alpine *Picea abies* forests with *Carex montana* and *Melica nutans*.

- 42.224 Tall herb montane inner Alpine spruce forests**
Adenostylo glabrae-Piceetum
Upper montane inner Alpine *Picea abies* forests with tall herb communities.
- 42.225 Peatmoss montane inner Alpine spruce forests**
Sphagnum-rich inner Alpine *Picea abies* forests of peaty soils with *Listera cordata*, *Equisetum sylvaticum* and *Dryopteris dilatata*.
- 42.23 SUBALPINE HERCYNIAN FORESTS**
Subalpine *Picea abies* forests of high Hercynian ranges.
- 42.231 Subalpine spruce forests of the Bayerischer Wald**
Soldanello-Piceetum
Acidophilous *Picea abies* forest of the granitic domes of the Bayerischer Wald, with fir, *Sorbus aucuparia*, *Vaccinium myrtillus*, *Homogyne alpina*, *Soldanella montana*, *Calamagrostis villosa*.
(Ellenberg, 1963, 1988; Petermann and Seibert, 1979; Ozenda, 1985; Noirfalise, 1986, 1987; Oberdorfer, 1990)
- 42.232 Subalpine spruce forests of the Harz and Erzgebirge**
Calamagrostio villosae-Piceetum
Spruce forests of the higher elevations of the Harz (above 750 m) and Erzgebirge.
(Noirfalise, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 42.24 SOUTHERN SPRUCE FORESTS**
Outlying *Picea abies* formations of the Apennines and Rhodope, at the southern limit of the range of the species.
- 42.241 Greek spruce forests**
Very local *Picea abies* formations of the Rhodope mountains of extreme northern Greece (Kara-Dere Forest).
(Sfikas, 1978; Mavrommatis, 1978)
- 42.242 Apennine spruce forests**
Relict woods of spontaneous *Picea abies* of the northern Apennines (Passo del Cerreto, Emilia-Romagna; Foce del Campolino sull'Abetone, Tuscany).
(Bassani, 1987; Ferioli, 1989)
- 42.25 ENCLAVE SPRUCE FORESTS**
Other spontaneous *Picea abies* formations occupying outlying altitudinal or edaphic enclaves within the range of more predominant vegetation types.
(Noirfalise, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 42.251 Subalpine Jura spruce forests**
Subalpine *Picea abies* forests of the Jura, similar to those of the northern outer Alps.
- 42.252 Subalpine Black Forest spruce forests**
Subalpine *Picea abies* forests of the Black Forest, with *Listera cordata*, *Lycopodium annotinum*.
- 42.253 Montane edaphic spruce forests**
Asplenio-Piceetum p., *Bazzanio-Piceetum p.*, *i.a.*
Edaphic *Picea abies* enclaves of the montane and sub-montane levels of the Jura and Hercynian ranges and their vicinity, and of the pre-Alpine plateaux, in particular, block forests, boulder field forests, frost-pocket forests and woods on moist soils.
- 42.254 Montane beech-zone spruce forests**
Spruce facies of montane beech-fir forests in the outer Alps, the Jura system and the Hercynian arc.

- 42.26** **SPRUCE REFORESTATION**
Plantations of *Picea abies* in or near the present or recent natural range of the species, including all Hercynian and peri-Hercynian formations accompanied by semi-natural undergrowth. Intensive, very dense and out-of-station plantations of *Picea abies* and plantations of other *Picea* spp. should be listed as 83.
- 42.3** **LARCH-AROLLA FORESTS**
Laricio-Cembrion
Forests of the subalpine and sometimes montane levels of the Alps, dominated by *Larix decidua* or *Pinus cembra*; the two species may form either pure or mixed stands, and may be associated with *Picea abies* or, in the western Alps, *Pinus uncinata*.
(Ellenberg, 1963, 1988; Ozenda, 1985; Noifalaise, 1986, 1987; Oberdorfer, 1990)
- 42.31** **EASTERN SILICEOUS LARCH AND AROLLA FORESTS**
Larici-Cembretum
Subalpine *Larix decidua*, *Pinus cembra*, or *Larix decidua*-*Pinus cembra* forests of the eastern and central Alps, mostly of the inner ranges, usually on siliceous substrates, with an often species-poor undergrowth comprising *Vaccinium myrtillus*, *Rhododendron ferrugineum*, *Calamagrostis villosa*, *Luzula albida*.
(Ellenberg, 1963; Ozenda, 1985; Noifalaise, 1986, 1987)
- 42.311** **Bilberry arolla forests**
Larici-Cembretum myrtilletosum
Forests limited to ubacs, formed by vigorous *Pinus cembra* in often pure, dense, shady stands, with rarer *Larix decidua* and sporadic *Picea abies*; the ground layer may include *Linnaea borealis*, *Listera cordata*.
- 42.312** **Woodrush arolla forests**
Larici-Cembretum luzuletosum albidae
Forests characteristic of steep adrets in the lower subalpine level of the eastern intermediate Alps, usually dominated by *Pinus cembra*, often in dense stands.
- 42.313** **Rusty alpenrose arolla-larch forests**
Larici-Cembretum rhododendretosum
More open forests than those of 42.311 and 42.312, with *Pinus cembra* usually dominant, but *Larix decidua* more abundant and a more extensive heath element.
- 42.314** **Small-reed larch-arolla forests**
Larici-Cembretum calamagrostietosum villosae
Forests of adrets, usually open, with *Larix decidua* dominant, *Pinus cembra* and *Picea abies* in enclaves, and an undergrowth less rich in heaths but more in gramineous stands with *Calamagrostis villosa* and woodrushes.
- 42.315** **Dwarf pine larch-arolla forests**
Larici-Cembretum mugetosum
Xerophile forests of adrets with *Pinus mugo*.
- 42.316** **Dwarf juniper larch-arolla forests**
Larici-Cembretum juniperetosum
Xerophile forests of adrets with *Juniperus nana* and *Arctostaphylos uva-ursi*.
- 42.317** **Green alder and tall herb arolla-larch forests**
Larici-Cembretum alnetosum viridis
Hygrophile forests of stations with prolonged snow cover on lime-poor or lime-rich oligotrophic substrates, usually dominated by *Pinus cembra*.
- 42.318** **Lichen larch-arolla forests**
Larici-Cembretum cladonietosum
Forests of stabilized block screes, dominated by *Larix decidua* or *Larix decidua* and *Pinus cembra*, often with *Betula* spp. and *Pinus mugo*.

- 42.319 Peatmoss arolla forests**
Larici-Cembretum sphagnetosum
Forests of the edge of peatbogs, generally with *Pinus cembra* and no *Larix decidua*, accompanied by *Pinus mugo*, *Eriophorum* spp. and *Andromeda polifolia*.
- 42.32 EASTERN CALCICOLOUS LARCH AND AROLLA FORESTS**
Laricetum, *Larici-Cembretum rhododendretosum hirsuti*
Subalpine and montane *Larix decidua*, *Larix decidua-Picea abies*, *Pinus cembra* or *Larix decidua-Pinus cembra* forests of the eastern and central Alps, mostly of the outer ranges, on calcareous substrates, with a usually species-rich undergrowth including *Erica herbacea*, *Polygala chamaebuxus*, *Rhododendron hirsutum* or *Pinus mugo*. (Ozenda, 1985; Ellenberg, 1988)
- 42.321 Hairy alpenrose arolla and larch-arolla forests**
Larici-Cembretum rhododendretosum hirsuti
Forests of the intermediate Alps and the north-eastern outer Alps, developed in particular on hard limestone plateaux.
- 42.3211 Hairy alpenrose larch-arolla forests**
Forests of limestone plateaux with *Pinus cembra* and *Larix decidua*.
- 42.32111 Dwarf pine-hairy alpenrose larch-arolla forests**
Forests of *Pinus cembra* and *Larix decidua* with an undergrowth of *Pinus mugo* and *Rhododendron hirsutum*.
- 42.32112 Green alder-hairy alpenrose larch-arolla forests**
Forests of *Pinus cembra* and *Larix decidua* with an undergrowth of *Alnus viridis*, tall herbs and *Rhododendron hirsutum*.
- 42.32113 Other hairy alpenrose larch-arolla forests**
- 42.3212 Hairy alpenrose arolla forests**
Forests of limestone plateaux with *Pinus cembra* and no or little *Larix decidua*.
- 42.322 Limestone larch forests**
Laricetum
Calcicolous *Larix decidua* or *Larix decidua-Picea abies* forests, mostly of the outer Alps, in which *Pinus cembra* is rare or absent.
- 42.3221 Limestone alpenrose larch forests**
Laricetum rhododendretosum hirsuti
Larix decidua forests of limestone plateaux, with *Rhododendron hirsutum* dominating the ground layer.
- 42.3222 Limestone larch meadow forests**
Laricetum luzuletosum sylvaticae
Calcicolous forests of ubacs, often with very tall, vigorous trees and a rich grassy undergrowth in which, together with *Luzula sylvatica* and *L. luzulina*, *Calamagrostis villosa*, *Sesleria albicans*, *Festuca rubra*, *Carex ferruginea* or *C. firma* can all locally dominate; acidophilous species, including *Vaccinium vitis-idaea*, *V. myrtillus* and *Lycopodium annotinum*, are confined to the foot of the larches.
- 42.3223 Limestone rockfall larch forests**
Laricetum asplenietosum
Larix decidua forest developed on shady limestone screes.
- 42.3224 Limestone steep slope larch-spruce forests**
Laricetum rhodothamnetosum
Larix decidua and *Larix decidua-Picea abies* forests, usually of steep slopes in the montane and locally subalpine levels of the northern and southern eastern outer Alps, with *Erica herbacea*, *Buphthalmum salicifolium*, *Polygala chamaebuxus*.

- 42.33 WESTERN LARCH, MOUNTAIN PINE AND AROLLA FORESTS**
Subalpine *Larix decidua*, *Larix decidua-Pinus cembra*, *Larix decidua*-mountain pine, *Pinus cembra* and *Pinus cembra*-mountain pine forests of the western, and mostly south-western Alps, in regions where *Pinus uncinata* usually associates with *Larix decidua* and/or *Pinus cembra*. Characteristically xeric, open formations, they are best characterized by their understorey.
(Ozenda, 1985; Salomez *in litt.*, 1990)
- 42.331 Western larch and larch-mountain pine forests**
Forests of the western inner and intermediate Alps dominated by *Larix decidua* or by mixed *Larix decidua* and *Pinus uncinata*, with an occasional admixture of *Pinus cembra* or other conifers.
(Ozenda, 1985; Salomez *in litt.*, 1990)
- 42.3311 Western larch and larch-mountain pine heath forests**
Larix decidua and *Larix decidua-Pinus uncinata* forests with heath understorey formed by *Rhododendron ferrugineum*, *Vaccinium myrtillus*, *V. vitis-idaea*, *V. uliginosum*.
- 42.3312 Western larch and larch-mountain pine meadow forests**
Larix decidua and *Larix decidua-Pinus uncinata* forests with grass-rich understorey.
- 42.3313 Western larch and larch-mountain pine tall herb forests**
Larix decidua and *Larix decidua-Pinus uncinata* forests with tall herb understorey.
- 42.332 Western arolla forests**
Rare forests of the western Alps, dominated by *Pinus cembra* or mixed *Pinus cembra* and *Pinus uncinata*.
(Richard and Pautou, 1983; Ozenda, 1985; Apège, 1985; Gensac, 1987; Maurin *in litt.*, 1989; Salomez *in litt.*, 1990)
- 42.3321 Western silicolous arolla forests**
Silicolous *Pinus cembra* forests of ubacs and mesic stations in the inner and intermediate western Alps (Belledonne, Chamrousse; Briançonnais).
- 42.3322 Western dwarf juniper arolla forests**
Pinus cembra forests of adrets of the western inner Alps, in which *Pinus cembra* may be accompanied by *P. uncinata* and *P. sylvestris* over a heath of *Juniperus nana* and *Arctostaphylos uva-ursi*.
- 42.3323 Western calcicolous arolla forests**
Limestone and gypsum *Pinus cembra* forests, developed on raw humus accumulated over calcic or hyper-calcic substrates, with an exceptional juxtaposition of acidophilous and basiphilous companion species, occasional in the inner and intermediate Alps (Maurienne; Tarentaise, La Plagne, Mont Charvet; Flaine) and very locally the outer Alps (Haut Giffre, Les Bornes) of France.
- 42.34 SECONDARY LARCH FORMATIONS**
Formations of *Larix decidua* colonizing abandoned fields and pastures in lower levels of the Alps. Alpine *Larix decidua* plantations; plantations of *Larix decidua* out of range and of other *Larix spp.* or hybrids should be listed under 83.
(Ozenda, 1983, 1985)
- 42.4 MOUNTAIN PINE FORESTS**
Mostly subalpine forests of the Alps, the Jura, the Pyrenees and the Iberian Range, dominated by *Pinus uncinata*, usually open and with a very developed shrubby understorey.
(Ellenberg, 1963, 1988; Gruber, 1978; Ozenda, 1981, 1985; Lopez Gonzalez, 1982; Dupias, 1985; Fernandes Gonzalez, 1986; Noirfalise, 1986, 1987; Ferioli, 1989; Maurin *in litt.*, 1989; Oberdorfer, 1990)

- 42.41 RUSTY ALPENROSE MOUNTAIN PINE FORESTS**
Rhododendro-Vaccinion p.
Pinus uncinata forests of the western outer Alps, the Jura and Pyrenean ubacs, developed on siliceous or decalcified soils of the subalpine level with a predominately ericaceous undergrowth comprising *Rhododendron ferrugineum* (dominant), *Vaccinium myrtillus*, *V. uliginosum*, *Calluna vulgaris*, *Homogyne alpina*, *Deschampsia flexuosa*, *Lycopodium annotinum*.
 (Gruber, 1978; Ozenda, 1981, 1985; Richard and Pautou, 1982; Dupias, 1985; Noirfalise, 1986, 1987; Vigo and Ninot, 1987; Bolos y Capdevilla, 1987)
- 42.411 Outer Alpine alpenrose mountain pine forests**
Rhododendro ferruginei-Pinetum uncinatae
Pinus uncinata forests occupying hard limestone plateaux of the outer Alps, in the Chablais, the Aravis, the Bauges, the Chartreuse, the Vercors, the Dévoluy in which the almost pure calcareous bedrock is covered by a thick layer of raw humus supporting an acidophilous undergrowth dominated by *Rhododendron ferrugineum*, *Vaccinium myrtillus*, *V. vitis-idaea*, *V. uliginosum* accompanied by *Empetrum hermaphroditum*, *Huperzia selago*, *Selaginella spinosa*, *Cladonia rangiferina*, *Homogyne alpina*, *Bartsia alpina*, *Astrantia minor*.
- 42.412 Jura alpenrose mountain pine forests**
Lycopodio-Pinetum uncinatae
 Subalpine *Pinus uncinata* forests of the western Jura, similar to the Alpine formations of 42.411.
- 42.413 Pyrenean alpenrose mountain pine forests**
Rhododendro ferruginei-Pinetum uncinatae (Saxifrago-Rhododendretum pinetosum)
Pinus uncinata forests of ubacs of the Pyrenees developed on siliceous soils, or on decalcified soils in the calcareous ranges, in the more humid and snowy parts of the subalpine level, with a ground layer dominated by *Rhododendron ferrugineum* accompanied by *Vaccinium myrtillus*, *Homogyne alpina*, *Rosa pendulina*, *Deschampsia flexuosa*, *Oxalis acetosella*, *Juniperus nana*, *Calluna vulgaris*, *Gymnocarpium dryopteris*, *Dryopteris carthusiana*, *spinulosum*, *Solidago virgaurea*.
- 42.42 XEROCLINE MOUNTAIN PINE FORESTS**
Junipero-Pinion p., *Erico-Pinion p.*
Pinus uncinata forests of the inner Alps, of the western outer Alps and the Jura, and of Pyrenean adrets, accompanied by a shrubby undergrowth in which *Rhododendron ferrugineum* is absent or rare, while *Juniperus nana*, *J. hemisphaerica*, *Arctostaphylos uva-ursi*, *A. alpina*, *Erica herbacea*, *Rhododendron hirsutum*, *Cotoneaster integerrimus*, *Daphne striata*, *Dryas octopetala* or *Polygala chamaebuxus* may be prominent.
 (Gruber, 1978; Ozenda, 1981, 1985; Richard and Pautou, 1982; Dupias, 1985; Noirfalise, 1986, 1987; Vigo and Ninot, 1987; Bolos y Capdevilla, 1987)
- 42.421 Inner Alpine mountain pine forests**
 Subalpine or montane *Pinus uncinata*-dominated formations of the inner and intermediate Alps.
- 42.4211 Dwarf sedge mountain pine forests**
 Xerophile adret *Pinus uncinata* forests of limestones and gypsums in the subalpine level of the inner Alps, with *Carex humilis*, *Arctostaphylos uva-ursi*.
- 42.4212 Spring heath mountain pine forests**
 Meso-xerophile ubac *Pinus uncinata* forests of limestones and gypsums in the subalpine level of the inner Alps, with *Erica herbacea*, *Amelanchier ovalis*, *Arctostaphylos uva-ursi*, *Carduus defloratus*, *Sesleria caerulea*.
- 42.4213 Rock campion mountain pine forests**
Pinus uncinata formations of dry, sunny siliceous slopes in the subalpine level of the inner Alps, with *Silene rupestris*, *Vaccinium vitis-idaea*, *Juniperus nana*, *Sempervivum arachnoideum*, *Arctostaphylos uva-ursi*.

- 42.4214** **Amphibolite mountain pine forests**
Dry *Pinus uncinata* facies of pine woods developed on amphibolites in the Belledonne and Taillefer ranges.
- 42.4215** **Restharrow mountain pine forests**
Ononido-Pinetum uncinatae
Pinus uncinata facies of montane *Pinus sylvestris* woods of inner Alpine valleys, developed, in particular, on gypsum in Haute Maurienne and Tarentaise, and on stony calcareous slopes, screes, debris cones in Briançonnais.
- 42.42151** **Adret restharrow mountain pine forests**
Ononido-Pinetum uncinatae s.s.
Dryer, sunny slope formations.
- 42.42152** **Ubac restharrow mountain pine forests**
Ononido-Pinetum uncinatae ericetosum
Heather-rich shady slope formations.
- 42.422** **Outer Alpine juniper-bearberry mountain pine forests**
Pinus uncinata forests of the calcareous ranges of the western pre-Alps (see 42.411) and the Jura, on less evolved soils than those of 42.411, which do not allow the development of *Rhododendron ferrugineum* heaths.
- 42.4221** **Xerophile outer Alpine mountain pine forests**
Subalpine xerophile, often pioneer or sub-climax formations of steep slopes and very drained soils, with *Arctostaphylos uva-ursi*, *Juniperus nana*, *Amelanchier ovalis*, *Rhamnus alpinus*, *Cotoneaster integerrimus*, *Dryas octopetala*, *Globularia cordifolia*, *Alchemilla hoppeana*, *Sesleria caerulea*, *Teucrium montanum*, *Biscutella laevigata*, *Saxifraga paniculata* (*S. aizoon*).
- 42.4222** **Vaccinium mountain pine forests**
More mesophile subalpine formations of gentler slopes, with *Vaccinium spp.*
- 42.4223** **Abyssal mountain pine forests**
Pinus uncinata forests of the montane level of the Grande Chartreuse, the Vercors, the Jura and the Devoluy, developed mostly on screes of massive limestone blocks with trapped ice (block forests).
- 42.423** **Ventoux mountain pine woods**
Spontaneous sub-summital *Pinus uncinata* woods of the Ventoux, with *Juniperus nana*, *J. hemisphaerica* and *Arctostaphylos uva-ursi*.
- 42.424** **Pyrenean adret mountain pine forests**
Pinus uncinata-dominated forests of adrets in the subalpine level of the Pyrenees, developed on both siliceous and calcareous substrates.
- 42.4241** **Speedwell mountain pine forests**
Veronico-Pinetum pinetosum uncinatae
Pinus uncinata forests of siliceous Pyrenean adrets, on schist, granite or gneiss, with *Arctostaphylos uva-ursi*, *Juniperus nana*, *J. hemisphaerica*, *Calluna vulgaris*, *Genista pilosa*, *Cytisus purgans*, *Cotoneaster integerrimus* and a predominantly acidophilous herb layer comprising *Deschampsia flexuosa*, *Cruciata glabra*, *Festuca eskia*, *Veronica officinalis*, *Silene rupestris*, *Potentilla erecta*, *Antennaria dioica*.
- 42.4242** **Pyrenean bearberry mountain pine forests**
Arctostaphylo-Pinetum uncinatae
Pinus uncinata forests of calcareous Pyrenean adrets with *Arctostaphylos uva-ursi*, *Juniperus nana*, *J. hemisphaerica*, *Cotoneaster integerrimus*, *Rhamnus alpinus*, *Amelanchier vulgaris*, *Dryas octopetala* and a predominantly calciphilous herb layer comprising *Festuca gautieri*, *Valeriana montana*, *Teucrium pyrenaicum*, *Hepatica nobilis*, *Hippocrepis comosa*, *Polygala calcarea*, *Sesleria caerulea*, *Helectotrichon sedenense*, *Primula suaveolens*.

- 42.425 **Pasqueflower mountain pine forests**
Pulsatillo-Pinetum uncinatae
Pinus uncinata forests of steep calcareous ubacs of the Pyrenees with very superficial soil and a mostly grassy herb layer comprising *Sesleria caerulea*, *Festuca gautieri*, *Pulsatilla alpina*, *Valeriana montana*, *Salix pyrenaica*, *Hepatica nobilis*, *Deschampsia flexuosa*, *Pyrola uniflora*, *Listera cordata*.
- 42.426 **Mountain pine forests of the Iberian Range**
 Isolated outposts of *Pinus uncinata*-dominated formations in the northern and southern Iberian Ranges.
 (Lopez Gonzalez, 1982; Fernandes Gonzalez, 1986; Navarro Andres and Valle Gutierrez, 1987)
- 42.4261 **Urbion mountain pine forests**
Vaccinio myrtilli-Juniperetum nanae p.
Pinus uncinata forests of the Sierra de Urbion, usually associated with heaths of *Vaccinium myrtillus* and *Juniperus nana*.
- 42.4262 **Gudar mountain pine forests**
Pinus uncinata forests of the Sierra de Gudar, in the southern Iberian Range.
- 42.43 **MOUNTAIN PINE REFORESTATION**
Pinus uncinata plantations in, or near, the natural range of the species.
- 42.5 **SCOTS PINE FORESTS**
 Forests dominated by *Pinus sylvestris*.
- 42.51 **CALEDONIAN FOREST**
 Relict, indigenous Scots pine forests of endemic *Pinus sylvestris* var. *scotica*, limited to the central and north-eastern Grampians of Scotland. They are mostly open and have a ground layer usually rich in ericaceous species and mosses, in particular, *Hylocomium splendens*, and often harbouring, together with abundant *Deschampsia flexuosa*, *Goodyera repens*, *Listera cordata*, *Corallorhiza trifida*, *Linnaea borealis*, *Trientalis europaea*, *Pyrola minor*, *Moneses uniflora*, *Orthilia secunda*. Accompanying, dominated, tree species include *Juniperus communis*, *Sorbus aucuparia*, *Betula pubescens*, *B. pendula*, *Ilex aquifolium*, *Populus tremula*.
 (Simms, 1971; Pearsall, 1971; Ratcliffe, 1977; Noirfalise, 1986, 1987; Rodwell, 1991)
- 42.511 **Heather Caledonian forest**
Pinus sylvestris var. *scotica* forests with a heath-like ground cover of *Erica cinerea* and *Calluna vulgaris*.
- 42.512 **Bilberry Caledonian forest**
Pinus sylvestris var. *scotica* forests with a heath-like ground cover of *Vaccinium myrtillus* and *V. vitis-idaea*.
- 42.513 **Moss Caledonian forest**
Pinus sylvestris var. *scotica* forests with a closed canopy and an understorey formed mostly by mosses, in particular *Scapania gracilis*, *Diplophyllum albicans*, *Thuidium tamariscinum* and the hepatic *Anastrepta orcadensis*.
- 42.514 **Woodrush Caledonian forest**
Pinus sylvestris var. *scotica* forests with a ground cover rich in grass-like species, in particular *Luzula pilosa*, *Anthoxanthum odoratum*, *Agrostis capillaris*, *A. canina*, *Festuca ovina*, together with *Vaccinium spp.* and bryophytes.
- 42.515 **Peatmoss Caledonian forest**
Pinus sylvestris var. *scotica* forests of damp hollows, with carpets of *Sphagnum spp.*, *Molinia caerulea* and *Erica tetralix*.
- 42.52 **MIDDLE EUROPEAN SCOTS PINE FORESTS**
 Indigenous *Pinus sylvestris* forests of the lowlands of northern and middle Europe and of the montane level of the central European Hercynian ranges.

- 42.521 Subcontinental Scots pine forests**
Dicrano-Pinion: Leucobryo-Pinetum (Dicrano-Pinetum, Cladonio-Pinetum)
 Forests dominated by *Pinus sylvestris* of acid, often podsolized, sands of the plains and hills of middle Europe. Associated trees include *Quercus robur*, *Q. petraea*, *Betula pendula*, *Fagus sylvatica*; *Vaccinium myrtillus*, *Calluna vulgaris*, *Dicranum undulatum* are usually prominent in the ground layer, *Molinia caerulea* may be abundant in humid stands. (Oberdorfer, 1967, 1990; Ozenda *et al.*, 1979; Polunin and Walters, 1985; Ozenda, 1985; Noirfalise, 1986, 1987; Ellenberg, 1988)
- 42.5211 North-eastern Scots pine forests**
Pinus sylvestris forests of sands of the north-eastern plains and hills of middle Europe, south-west to the High Palatinate. (Oberdorfer, 1967, 1990; Polunin and Walters, 1985; Ozenda, 1985; Noirfalise, 1987; Ellenberg, 1988)
- 42.5212 Western lowland Scots pine forests**
 Relict woods of indigenous *Pinus sylvestris* of coarse sands in enclaves of cold subcontinental climate west of the main range of the subcontinental pine and pine-oak woodland, as in the Pays de Bitche basin. (S. Muller, 1984, 1985; Y. Muller, 1985)
- 42.522 Hercynian Scots pine forests**
 Montane acidophilous woods of indigenous *Pinus sylvestris* forming local, edaphic or microclimatic enclaves in the beech belt of the Hercynian ranges and their periphery, usually with *Vaccinium myrtillus* or lichens. (Becker *et al.*, 1981; Jacamon, 1983; S. Muller, 1985; Ozenda, 1985)
- 42.5221 Eastern Hercynian Scots pine forests**
 Indigenous *Pinus sylvestris* formations of the Erz, Fichtelgebirge, Riesengebirge, Bayerischer Wald, Thüringer Wald.
- 42.5222 Black Forest Scots pine forests**
 Indigenous *Pinus sylvestris* formations of the Black Forest.
- 42.5223 Vosges Scots pine forests**
 Indigenous *Pinus sylvestris* formations of the mostly dry, acid sandstones of the Vosges, and of sandstone slabs capping rocky outcrops of the Pays de Bitche and adjacent Rhine Palatinate.
- 42.5224 Luxembourg sandstone Scots pine forests**
 Indigenous *Pinus sylvestris* formations of Luxembourg sandstone outcrops.
- 42.523 Lowland steppe Scots pine forests**
Cytiso ruthenici-Pinion: Pyrolo-Pinetum
Pinus sylvestris woods of areas with extreme continental local climates of middle Europe outside of the Alps, in particular formations with *Pinus sylvestris* var. *haguenensis* of the Rhine Valley. (Oberdorfer, 1990)
- 42.53 INNER-ALPINE RESTHARROW STEPPE FORESTS**
Ononido-Pinion
 Xerophile, often calcicolous, open *Pinus sylvestris* or *P. sylvestris* and *P. uncinata* forests of the montane level of inner Alpine valleys submitted to extreme continental climate (upper Durance, Ubaye, upper Tinée, Val di Susa, Maurienne, Val d'Aoste, Alto Adige (Val Venosta)), rich in leguminous plants such as *Ononis rotundifolia*, *O. cenisia*, *Astragalus austriacus*, *A. purpurea*, *Coronilla minima*, *Onobrychis saxatilis* and with a shrub layer comprising *Juniperus communis*, *J. sabina*, *Berberis vulgaris*, *Amelanchier ovalis*. (Braun-Blanquet, 1959; Ellenberg, 1963, 1988; Ozenda, 1981, 1985; Guinochet and Vilmo-rin, 1973; Noirfalise, 1986, 1987; Oberdorfer, 1990)

- 42.54** **SPRING HEATH SCOTS PINE FORESTS**
Erico-Pinion
 Mesophile, mostly calcicolous, *Pinus sylvestris* forests of the intermediate Alps, and, locally, of the inner Alps, the northern outer Alps, the south-eastern outer Alps, the Bavarian plateau, the serpentines of northern Bavaria, the Lake Constance area, the Baar plateau and the Jura, characterized by the presence of *Erica herbacea* and accompanied by *Juniperus communis*, *Berberis vulgaris*, *Sorbus aria*, *Amelanchier ovalis*, *Chamaecytisus nigricans*, *Polygala chamaebuxus*, *Goodyera repens*, *Pyrola chlorantha*, *Epipactis atrorubens*, *Melampyrum pratense*, *M. sylvaticum*, *Carex alba*, *C. ornithopoda*, *C. humilis*, *C. flacca*, *Molinia caerulea*, *Calamagrostis varia*, *Sesleria caerulea*.
 (Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Ozenda, 1985; Noirfalise, 1986, 1987; Oberdorfer, 1990)
- 42.55** **INNER ALPINE SANDWORT STEPPE FORESTS**
Deschampsio-Pinion
 Xerophile, acidophilous, *Pinus sylvestris* forests of the montane level of south-western inner Alpine valleys (Maurienne, Guisane, Dora-Riparia, Chisone) where they replace the formations of the *Ononido-Pinion* on strongly siliceous adrets, with *Deschampsia flexuosa* and *Minuartia laricifolia* dominant.
 (Ozenda, 1985; Noirfalise, 1986, 1987)
- 42.56** **PYRENEAN MESOPHILE SCOTS PINE FORESTS**
Hepatico-Pinetum, *Hylocomio-Pinetum*, *Polygalo-Pinetum*
 Montane, mossy *Pinus sylvestris* forests of the Pyrenees; characteristic of regions with a moderately dry, sunny climate, they occur, at all exposures but mostly on ubacs, in a wide belt on the south flank of the range, with limited outposts on the north flank. Characteristic is the abundance of wintergreens (*Pyrola chlorantha*, *P. minor*, *Moneses uniflora*, *Orthilia secunda*) and of mosses (*Hylocomium splendens*, *Rhytidiadelphus triquetrus*, *Pleurozium schreberi*); *Vaccinium myrtillus*, *Luzula nivea*, *Hepatica nobilis* are usually present.
 (Gruber, 1978; Ozenda, 1985; Dupias, 1985; Noirfalise, 1986, 1987; Vigo and Ninot, 1987; Bolos y Capdevila, 1987)
- 42.561** **Pyrenean calcicolous mesophile Scots pine forests**
Polygalo-Pinetum
 Calcicolous formations of *Pinus sylvestris* with *Sorbus aria*, *Amelanchier ovalis*, *Ribes alpinum*, *Prunus mahaleb*, *Cotoneaster integerrimus*, *Polygala calcarea*, *Helleborus foetidus*, *Valeriana montana*, *Festuca gautieri*.
- 42.562** **Pyrenean siliceous mesophile Scots pine forests**
Hylocomio-Pinetum
 Silicicolous formations of *Pinus sylvestris* with *Sorbus aucuparia*, *Salix caprea*, *Calluna vulgaris*, *Galium rotundifolium*, *Melampyrum sylvaticum*, *M. pratense*, *Lathyrus linifolius* (*L. montanus*), *Potentilla erecta*, *Helleborus viridis*, *Deschampsia flexuosa*.
- 42.57** **CENTRAL MASSIF SCOTS PINE FORESTS**
 Montane *Pinus sylvestris* forests of interior, relatively dry, regions of the Central Massif in the upper Loire basin (Velay and neighbouring regions) and the Causse Méjean.
 (Ozenda, 1985)
- 42.58** **SOUTH-WESTERN ALPINE MESOPHILE SCOTS PINE FORESTS**
 Mesophile montane forests with wintergreens occupying a broad belt on the south-western flank of the Alps from Dauphiné to the Maritime Alps, differentiated from 42.54 by the absence of *Erica herbacea*; the undergrowth usually comprises *Arctostaphylos uva-ursi*, *Centaurea scabiosa*, *Tolpis staticifolia*, *Calluna vulgaris*, *Polygala chamaebuxus*, *Monotropa hypopitys*, *Goodyera repens*, *Epipactis atrorubens*, *Neottia nidus-avis*.
 (Archiloque *et al.*, 1969; Ozenda, 1981, 1985; Noirfalise, 1986, 1987)

- 42.59** SUPRA-MEDITERRANEAN SCOTS PINE FORESTS
Pinetum sylvestris, *Buxo-Quercetum hylacomio-pinetosum*
Pinus sylvestris-dominated facies of the thermophilous, supra-Mediterranean oak woods (41.7), alternated, mixed or imbricated with *Quercus pubescens* or *Q. faginea* woods in the south-western Alpine foothills, on the periphery of the Central Massif, along the southern flank of the Pyrenees and, locally, in the Ligurian and Insubrian Alps, in the western Alps of northern Dauphiné and Savoie, in the northern Apennines and on the northern flank of the Pyrenees. *Buxus sempervirens* is usually abundant in the undergrowth; other components of the shrub layer include *Corylus avellana*, *Sorbus aria*, *S. torminalis*, *Acer opalus*, *A. campestre*, *A. monspessulanum*, *Euonymus latifolius*, *Genista cinerea*, *Juniperus communis*.
(Archiloque *et al.*, 1969; Tosco, 1975; Ozenda, 1985; Dupias, 1985; Vigo and Ninot, 1987; Bassani, 1987; Bolos y Capdevila, 1987)
- 42.591** Peri-Alpine box Scots pine forests
Supra-Mediterranean *Pinus sylvestris* forests of the western, south-western and Insubrian Alps and their foothills, and of the Central Massif periphery.
- 42.592** Pre-Pyrenean box Scots pine forests
Supra-Mediterranean *Pinus sylvestris* forests, with abundant box, forming a broad belt on the southern flank of the Pyrenees, with outposts on the northern flank, in the eastern Pyrenees and the east of the Pays de Sault.
- 42.593** Emilian Scots pine woods
Isolated *Pinus sylvestris* woods of the base of the Emilian Apennines, mostly on limestones and serpentines, comprising *Quercus cerris* and *Q. pubescens* or *Carpinus betula*, *Corylus avellana*, *Acer campestre*, *Fraxinus ornus*.
- 42.5A** IBERIAN CALCAREOUS SCOTS PINE WOODS
Pino-Juniperion sabinæ i.a.
Montane and oro-Mediterranean, xerocline, calcicolous *Pinus sylvestris* forests of the Iberian Range, the Baetic ranges and the southern flank of the Pyrenees.
(Ozenda *et al.*, 1979; Noirfalise, 1986, 1987)
- 42.5A1** Pyrenean hedgehog-heath Scots pine woods
Woods or prewoods of adrets in the montane level of calcareous ranges of the southern flank of the central Pyrenees, with usually low and contorted *Pinus sylvestris* accompanied by a hedgehog-heath (see 31.71) of *Echinospartum horridum*, *Buxus sempervirens*, *Juniperus hemisphaerica*.
(Dupias, 1985; Vigo and Ninot, 1987)
- 42.5A2** Savin Scots pine forests
Pino-Juniperion sabinæ
Oro-Mediterranean, calcicolous *Pinus sylvestris* forests of the Iberian Range and the Baetic ranges, often fairly open, and with a shrub layer that includes the prostrate *Juniperus sabina*.
- 42.5A21** Iberian Range calcicolous Scots pine forests
Junipero sabinæ-Pinetum sylvestris
Oro-Mediterranean, calcicolous forests of *Pinus sylvestris* var. *iberica* of the southern Iberian Range (Maestrazgo: Gudar, Jabalambre, Penyagolosa; Serrania de Cuenca: Sierra de San Felipe, Montes Universales), with a shrub layer constituted mainly by *Juniperus sabina*; secondary calcicolous Scots pine formations of lower altitude in the Iberian Range.
(Lopez, 1976; Costa, 1987; Peinado Lorca and Martinez-Parras, 1987)

42.5A22

Baetic calcicolous Scots pine forests*Daphno oleoidis-Pinetum sylvestris pinetosum sylvestris*

Oro-Mediterranean forests of *Pinus sylvestris* var. *nevadensis* of the Baetic ranges, Sierra Magina, Sierra de Baza, Sierra Tejada, Sierra del Trevenque (calcareous periphery of the Sierra Nevada), with a shrub layer of *Juniperus sabina* and *J. nana* accompanied by *Ononis aragonensis*, *Genista lobelii* ssp. *longipes*, *Daphne oleoides* and *Prunus prostrata*, on limestones and dolomites.

(Ciaran and Blanco, 1984; Peinado Lorca and Martinez-Parras, 1987; Martinez-Parras and Peinado Lorca, 1987; Molero-Mesa and Perez-Raya, 1987)

42.5B

IBERIAN SILICICOLOUS SCOTS PINE FORESTS*Pino-Cytisium purgantis* i.a.

Montane and oro-Mediterranean, xerocline, silicicolous *Pinus sylvestris* forests of the Iberian Range, the Cordillera Central and the southern flank of the Pyrenees.

(Ozenda, *et al.*, 1979; Noirfalise, 1986, 1987)

42.5B1

Pyrenean xerophile Scots pine forests*Veronico-Pinetum sylvestris*

Montane and lower subalpine *Pinus sylvestris* or *P. sylvestris* and *P. uncinata* forests of dry adrets of the southern flanks of the Pyrenees and of the Val d'Aran, with a shrub layer comprising *Juniperus hemisphaerica*, *Cytisium purgans*, *Buxus sempervirens* and a herb layer dominated by *Deschampsia flexuosa*, accompanied by, among others, *Veronica officinalis*.

(Dupias, 1985; Vigo and Ninot, 1987)

42.5B2

Iberian Range silicicolous Scots pine forests

Pinus sylvestris forests of siliceous ground in the oro- and supra-Mediterranean levels of the northern and southern Iberian Ranges.

(Lopez, 1976; Ciaran and Blanco, 1984; Navarro Andres and Valle Gutierrez, 1987)

42.5B21

Upper Sorian silicicolous Scots pine forests*Vaccinio myrtilli-Juniperetum nanae pinetosum p.*

Oro-Mediterranean, acidophilous forests of *Pinus sylvestris* var. *iberica* of the northern Iberian Range (Soria), with *Juniperus nana*, *Cytisium purgans*, *Deschampsia flexuosa* ssp. *iberica*, and abundant *Vaccinium myrtillus*.

42.5B22

Lower Iberian Range silicicolous Scots pine forests*Luzulo-Quercetum pyrenaicae deschampsio-pinetosum sylvestris p. i.a.*

Supra-Mediterranean, acidophilous *Pinus sylvestris* var. *iberica* woods of the Iberian Range, forming in particular as a substitution stage of *Quercus pyrenaica* woodland of which they largely retain the accompanying flora.

42.5B3

Cordilleran silicicolous Scots pine forests

Pinus sylvestris forests of siliceous ground in the oro- and supra-Mediterranean levels of the Cordillera Central.

(Rivas-Martinez, 1963; Ciaran and Blanco, 1984; Peinado Lorca and Martinez-Parras, 1987; Rivas-Martinez *et al.*, 1987)

42.5B31

Summital Guadarraman silicicolous Scots pine forests*Junipero nanae-Cytisetum purgantis pinetosum*

Oro-Mediterranean, summital, silicicolous forests of *Pinus sylvestris* var. *iberica* of the Sierra de Guadarrama, with *Juniperus nana*.

42.5B32

Lower Cordilleran silicicolous Scots pine forests*Luzulo-Quercetum pyrenaicae deschampsio-pinetosum sylvestris p. i.a.*

Supra-Mediterranean *Pinus sylvestris* var. *iberica* woods of the Cordillera Central (Guadarrama, Gredos), forming in particular as a substitution stage of *Quercus pyrenaica* woodland of which they largely retain the accompanying flora.

42.5B4

Cantabrian Scots pine forests

Isolated *Pinus sylvestris* forests of the Cantabrian mountain system, in the Cordillera Cantabrica, the Montes de Leon and the Serra do Geres.

(Lopez Gonzalez, 1982; Ciaran and Blanco, 1984; Da Costa, 1985)

42.5C

GREEK SCOTS PINE FORESTS

Pinus sylvestris forests of the mountains of northern Greece (Pieria, Olympus, Vermion, Voras, Laila, Elatia range), often with *Acer pseudoplatanus*, *Sorbus aucuparia*, and sometimes *Fagus sylvestris* or *Picea abies* in the tree layer and with *Vaccinium myrtillus* and *Rubus idaeus* in the shrub layer.

(Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974)

42.5D

PO TERRACE SCOTS PINE FORESTS

Forests of *Pinus sylvestris* of the fluvio-glacial terraces that constitute the high plains of the Po river system, with *Betula pendula*, *Quercus pubescens*, *Castanea sativa* and a ground layer with *Cytisus scoparia*, *Calluna vulgaris*, *Pteridium aquilinum*, *Deschampsia caespitosa*, *Molinia caerulea*.

(Fenaroli, 1970, 1984; Groppali *et al.*, 1980; Bassilana, 1984; Noirfalise, 1986; Ardito, 1989)

42.5E

SCOTS PINE REFORESTATION

Pinus sylvestris plantations inside or near the present or recent natural range of the species. Other and very artificial *P. sylvestris* plantations should be listed under 83.

42.6

BLACK PINE FORESTS

Forests dominated by pines of the *Pinus nigra* group.

42.61

ITALIAN *PINUS NIGRA* FORESTS

Pinus nigra s.s. forests of the eastern Italian Alps and the Apennines.

(Fenaroli, 1970, 1984; Bonin, 1971; Pignatti, 1982; Ozenda, 1985; Bassani, 1987; Ferioli, 1989)

42.611

Alpine *Pinus nigra* forests

Pinus nigra ssp. austriaca forests of dry, sunny, rocky steep slopes and cliffs of the south-eastern pre-Alps (Carnian pre-Alps, Julian pre-Alps, Carso), between 200 and 1 200 m altitude, with *Cyclamen purpurascens* and *Aquilegia einseleana*.

42.612

Apennine *Pinus nigra* forests

Relict 'Villetta Barrea pine' (*Pinus nigra ssp. italica*) stations of the Abruzzi (Costa Camosciara, Villetta Barrea), the Campanian Apennines (Monti Picentini), the Pollino system (Orsomarso).

42.62

GREEK *PINUS NIGRA* FORESTS

Pinus nigra s.s. pine woods of north-western Greece.

(Mavrommatis, 1968; Horvat *et al.*, 1974)

42.63

SALZMANN'S PINE FORESTS

Pinus salzmannii forests of Spain and the Causses.

(Ortuno and Ceballos, 1977; Ozenda *et al.*, 1979; Lopez-Gonzalez, 1982; Noirfalise, 1986, 1987)

42.631

Causses Salzmann's pine forests

Isolated *P. salzmannii* var. *cebennensis* woods of the southern edge of the Causses, with an undergrowth typical of supra-Mediterranean white oak forests at the upper limit and of evergreen oak forests at lower altitudes; *Buxus sempervirens* is usually abundant.

(Braun-Blanquet, 1955b; Vanden Berghen, 1963)

42.632

Pre-Pyrenean Salzmann's pine forests

Meso- and supra-Mediterranean *P. salzmannii* var. *pyrenaica* forests of Pyrenean foothills; they are extensive in the south-eastern foothills, with outposts in the central foothills, in Catalanian ranges and, very locally, on the north side of the range (Valley of the Têt, Conflent). The understorey is formed by the cortège of *Quercus ilex* (*Juniperus oxycedrus*, *Rosmarinus officinalis*, *Quercus ilex*) at low altitudes, and by that of *Q. pubescens* (*Buxus sempervirens*, *Juniperus communis*, *Amelanchier ovalis*, *Cornus sanguinea*, *Lonicera etrusca*) at higher altitudes.

(Ortuno and Ceballos, 1977; Dupias, 1985; Vigo and Ninot, 1987)

- 42.633 Northern-Iberian Salzmänn's pine forests**
Isolated *Pinus salzmannii* var. *pyrenaica* woods of the northern Iberian Range (Soria). (Ortuno and Ceballos, 1977)
- 42.634 Cordilleran Salzmänn's pine forests**
Isolated silicolous *Pinus salzmannii* var. *iberica* woods of the Cordillera Central, limited to small enclaves in the Sierra de Gredos and associated ranges, in the Rio Tietar-Rio Alberche area. (Ortuno and Ceballos, 1977; Ciaran and Blanco, 1984)
- 42.635 Southern-Iberian Salzmänn's pine forests**
Supra- and, locally, oro-Mediterranean *Pinus salzmannii* var. *hispanica* forests of the southern Iberian Range, occupying extensive areas in the Serrania de Cuenca, the Maestrazgo and associated ranges, mostly on limestones. (Ortuno and Ceballos, 1977; Ciaran and Blanco, 1984)
- 42.636 Baetic Salzmänn's pine forests**
Supra- and, locally, oro-Mediterranean *Pinus salzmannii* var. *hispanica* forests of the Baetic and sub-Baetic ranges, covering vast expanses, mostly on limestones, in the Sierras de Cazorla, Segura and Alcaraz, with outposts in the Sierra de Baza, the Sierra de Filabres and the calcareous periphery of the Sierra Nevada. (Ortuno and Ceballos, 1977; Ciaran and Blanco, 1984; Herranz Sanz and Gomez Campo, 1986; Martinez Parras *et al.*, 1987; Peinado Lorca and Martinez-Parras, 1987; Martinez-Parras and Peinado Lorca, 1987)
- 42.6361 Supra-Mediterranean Baetic Salzmänn's pine forests**
Daphno latifoliae-Aceretum granatensis p., *Salvio-Lavanduletum lanatae p.*
Forests of *Pinus salzmannii* accompanied by a cortège similar to that of thermophilous oak forests, including *Quercus rotundifolia*, *Juniperus oxycedrus*, *Lavandula latifolia*, *Erinacea anthyllis*, *Rosmarinus officinalis*, *Genista scorpius*, *Crataegus monogyna*, *Berberis hispanica*, *Rosa pouzinii*, *Daphne laureola*, *Acer granatense*, *Paeonia officinalis*, of the Sierras de Cazorla, Segura and Alcaraz, the Sierra de Baza, the Sierra de Filabres and the calcareous periphery of the Sierra Nevada.
- 42.6362 Oro-Mediterranean Baetic Salzmänn's pine forests**
Daphno oleoidis-Pinetum sylvestris pinetosum salzmannii
Oro-Mediterranean woods of *Pinus salzmannii*, more open than those of 42.6361 and occupying very limited areas in the Sierras de Cazorla, Segura and Alcaraz, with a shrub layer of *Juniperus sabina* and *J. nana*, accompanied by *Ononis aragonensis*, *Genista lobelii* ssp. *longipes*, *Daphne oleoides* and *Prunus prostrata*.
- 42.64 CORSICAN LARICIO PINE FORESTS**
Pinus laricio forests of the mountains of Corsica. The nuthatch *Sitta whiteheadi* is endemic to these forests. (Lambinon *et al.*, 1978; Ozenda, *et al.*, 1979; Gamisans, 1985; Noifalisse, 1986)
- 42.641 Dense montane laricio forests**
Galio-Pinetum luzuletosum
Pinus laricio forests of the montane level of Corsica, where they replace beech forests, either entirely in some ranges or mostly on adrets and as subclimax communities elsewhere. The undergrowth, fairly similar to that of beech forests, includes *Ilex aquifolium*, *Daphne laureola*, *Pteridium aquilinum*, *Allium pendulinum*, *Helleborus lividus* ssp. *corsicus*, *Galium odoratum*. Epiphytic lichens are often abundant, including *Cetraria glauca*, *Hypogymnia bitteriana*.
- 42.642 Open montane laricio forests**
Galio-Pinetum anthyllidetosum
Open *Pinus laricio* forests of Corsica, growing at the upper forest limit or on steep rocky slopes, often with birches, *Betula pendula*.
- 42.643 Supra-Mediterranean laricio forests**
Galio-Pinetum ericetosum
Pinus laricio forests of the supra-Mediterranean level of Corsica, with an often dense understorey of *Erica arborea* and *E. scoparia*.

- 42.65 CALABRIAN LARICIO PINE FORESTS**
Pinus laricio var. *calabrica* forests of the Sila, the Aspromonte and Etna.
 (Fenaroli, 1970, 1984; Bonin, 1971; Pignatti, 1982; Groppali *et al.*, 1983; Noirfalise, 1986; Bassani, 1987; Ferioli, 1989)
- 42.651 Sila and Aspromonte laricio forests**
Pinus laricio forests of the Sila Greca, the Sila Grande, the Sila Piccola and the Aspromonte, where they replace beech forests in drier areas within the montane zone, forming at times, particularly in the Sila Grande, imposing expanses.
- 42.652 Etna laricio forests**
Pinus laricio forests of the north flank of Mount Etna.
- 42.66 PALLAS'S PINE FORESTS**
 'Pino-Chamaecytision'
 Montane forests of *Pinus pallasiana* of Greece.
 (Horvat *et al.*, 1974; Mavrommatis, 1978; Gamisans and Hebrard, 1979)
- 42.67 BLACK PINE REFORESTATION**
 Plantations of pines of the *P. nigra* group, accompanied by semi-natural undergrowth formations. These are usually calciphilous communities when accompanying *P. nigra*, acidophilous ones when with *P. laricio*. In all cases they can be specified by codes borrowed from other units, used in conjunction with 42.67.
- 42.7 HIGH ORO-MEDITERRANEAN PINE FORESTS**
 Woods of *Pinus heldreichii*, *P. leucodermis* or *P. peuce*.
- 42.71 WHITE-BARKED PINE FORESTS**
 Local treeline formations of *Pinus heldreichii* or *P. leucodermis* restricted to northern Greece and southern Italy, usually open and with an undergrowth formed by stripped grasslands on dry, often stony or rocky soils.
 (Fenaroli, 1970, 1984; Bonin, 1971; Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Strid, 1980; Pignatti, 1982; Polunin and Walters, 1985; Bassani, 1987; Ferioli, 1989)
- 42.711 Italian white-barked pine forests**
 Rare white-barked pine formations of high southern Italian mountains, limited to the Abruzzian Apennines (Maiella), the Campanian Apennines (Monti Picentini) and the Lucano-Calabrian Apennines (Pollino, Monti Alpi di Latronico, Monte la Spina, Monti di Orsomarso, Monte Montea, Sierra delle Ciavole).
- 42.712 Pindus white-barked pine forests**
 White-barked pine formations of high elevations of the Pindus, mostly on ophiolites, at altitudes above 1 600 metres.
- 42.713 Olympus white-barked pine forests**
 White-barked pine formations of Mount Olympus, mostly on jurassic and triassic limestones at altitudes above 1 350 metres, with an undergrowth including *Juniperus nana*, *Daphne laureola*, *D. mezereum*, *D. oleoides*, *Genista radiata*, *Buxus sempervirens*, *Cotoneaster integerrimus*.
- 42.72 MACEDONIAN PINE WOODS**
Pinion peucis
Pinus peuce formations, restricted to the subalpine zone of the high mountains of extreme northern Greece (Voras, Varnous).
 (Horvat *et al.*, 1974; Mavrommatis, 1978; Kassioumis, 1988)
- 42.8 MEDITERRANEAN PINE WOODS**
 Mediterranean and thermo-Atlantic woods of thermophilous pines, mostly appearing as substitution or paraclimatic stages of forests of the *Quercetalia ilicis* or *Ceratonio-Rhamnetalia*. Long-established plantations of these pines, within their natural area of occurrence, and with an undergrowth basically similar to that of paraclimatic formations, are included.

- 42.81** **MARITIME PINE FORESTS**
Woods and plantations of *Pinus pinaster* ssp. *atlantica* of south-western France and the western Iberian peninsula.
(Becker *et al.*, 1981; Géhu and Géhu-Franck, 1984c; Ciaran and Blanco, 1984; Silveira da Costa, 1984, 1985)
- 42.811** **Charente pine-holm oak forests**
Pino pinastri-Quercetum ilicis
Pinus pinaster ssp. *atlantica* forests with a subcanopy of *Quercus ilex*, *Arbutus unedo* and sometimes *Quercus pubescens* or *Q. robur* and an undergrowth of *Rubia peregrina*, *Cistus salvifolius*, *Daphne gnidium* and, in the more acid stands, *Ulex europaeus*, *Cytisus scoparius*, *Erica scoparia* or, in more calcareous ones, *Hedera helix*, *Ruscus aculeatus*, developed on mostly calcareous inner dunes of the low-rainfall coasts of Vendée, Charente-maritime and northern Gironde, including the islands of Noirmoutier, Yeu, Ré and Oléron.
- 42.812** **Aquitanian pine-cork oak forests**
Pino pinastri-Quercetum suberis
Pinus pinaster ssp. *atlantica* forests with a subcanopy of *Quercus suber*, *Arbutus unedo* and sometimes *Quercus robur* and an undergrowth of *Erica cinerea*, *Pteridium aquilinum*, *Frangula alnus*, *Rubia peregrina* and, in the more open stands, *Cistus salvifolius*, *Cytisus scoparius*, *Erica scoparia*, *Calluna vulgaris* or, in more closed ones, *Hedera helix*, *Ruscus aculeatus*, *Ilex aquifolium*, developed on acidocline inner dunes of the warmer, more humid coasts of the Marensin, between the Eyre and the Adour river mouths.
- 42.813** **Landes maritime pine plantations**
Pinus pinaster ssp. *atlantica* woodland of south-western France other than the dunal formations listed in 42.811 and 42.812.
- 42.814** **Iberian maritime pine forests**
Pinus pinaster ssp. *atlantica* forests of Galicia, Portugal and neighbouring areas.
- 42.82** **MESOGEEAN PINE FORESTS**
Forests of *Pinus pinaster* ssp. *pinaster* (*Pinus mesogeensis*) of the western Mediterranean, mostly in siliceous meso-Mediterranean, upper meso-Mediterranean and supra-Mediterranean situations of Spain, Corsica, south-eastern France, north-western Italy, Sardinia and Pantelleria.
(Braun-Blanquet, 1964; Archiloque *et al.*, 1969; Fenaroli, 1970; Ortuno and Ceballos, 1977; Lavagne and Moutte, 1977; Brullo, 1977; Ozenda, 1981, 1985; Pignatti, 1982; Guittonneau and Huon, 1983; Ciaran and Blanco, 1984; Gamisans, 1985; Herranz Sanz and Gomez Campo, 1986; Peinado Lorca and Martinez-Parras, 1987)
- 42.821** **Iberian mesogean pine forests**
Pinus pinaster forests of the Iberian peninsula, appearing mostly as substitution communities of *Quercus rotundifolia*, *Q. pyrenaica* or, locally, *Q. suber*, *Q. faginea* woodlands.
- 42.8211** **Northern-Iberian mesogean pine forests**
Very extensive *Pinus pinaster* forests of the northern Iberian Range and neighbouring areas, occupying siliceous, often sandy substrates.
- 42.8212** **Cordilleran mesogean pine forests**
Extensive *Pinus pinaster* forests of the Cordillera Central and neighbouring areas, particularly developed on the southern slope of the range, occupying siliceous substrates, mostly gneiss and granite.
- 42.8213** **Southern-Iberian mesogean pine forests**
Pinus pinaster forests of the southern Iberian Range and plateaux of eastern New Castile.
- 42.82131** **Siliceous southern-Iberian mesogean pine forests**
Widespread and extensive silicolous *Pinus pinaster* forests, mostly occupying reddish sandy soils (rodnales).

- 42.832 Balearic stone pine woods**
Pinus pinea formations of the Balearic Islands, native only on Ibiza and Formentera.
- 42.833 Provence stone pine woods**
Pinus pinea formations of Provence, possibly spontaneous on coastal sands and in the Maures area.
- 42.8331 Coastal Provence stone pine forests**
Pinus pinea woods of coastal sands, particularly of the Camargue, where it is associated with *Juniperus phoenicea* ssp. *lycia*.
- 42.8332 Permian Provence stone pine forests**
Pinus pinea woods of the Permian depression encircling the Maures, and a few neighbouring localities, associated mostly with maquis of *Cistus monspeliensis*, *C. salvifolius*, *C. ladanifer*, *Erica scoparia*.
- 42.834 Corsican stone pine woods**
Pinus pinea formations of the littoral of Corsica, some of which may be of natural origin, in particular on old dunes of the east coast.
- 42.835 Sardinian stone pine forests**
Pinus pinea formations of Sardinia.
- 42.8351 Iglesiasiente near-natural stone pine forests**
Pinus pinea forest of coastal dunes of Iglesiasiente, west of Monte Linas, comprising plurisecular trees and of undoubted indigenous origin.
- 42.8352 Sardinian semi-natural stone pine forests**
Other *Pinus pinea* woods of Sardinia, some, particularly in the vicinity of Monte Linas, of possible native origin.
- 42.836 Sicilian stone pine forests**
Pinus pinea formations of the Monti Peloritani, north-western Sicily, of probable native origin.
- 42.837 Peninsular Italian stone pine forests**
Large, ancient, *Pinus pinea* plantations of the Tyrennian, and locally, Adriatic coasts of the Italian peninsula, in Liguria, Tuscany, Latium, Campania, Emilia-Romagna (Ravenna) and Friuli-Venetia Giulia (Grado).
- 42.838 Greek stone pine forests**
Pinus pinea woods of the littoral and coastal hills of the Peloponnese, Chalcidice, Crete and Aegean islands, rather local but probably in part, at least, spontaneous; a splendid example exists, in particular, on Skiathos.
- 42.84 ALEPPO PINE FORESTS**
Woods of *Pinus halepensis*, a frequent colonist of thermo- and calcicolous meso-Mediterranean scrubs. The distinction between spontaneous forests and long-established formations of artificial origin is often difficult. The latter are thus included here, while recent, obviously artificial groves are not.
(Rechinger, 1943, 1951; Loisel, 1971; Ortuno and Ceballos, 1977; Lavagne and Moutte, 1977; Sfikas, 1978; Molinier and Martin, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Lopez Gonzalez, 1982; Ciaran and Blanco, 1984; Fenaroli, 1984; Polunin and Walters, 1985; Tassi, 1985; Dupias, 1985; Gamisans, 1985; Pratesi and Tassi, 1986; Herranz Sanz and Gomez Campo, 1986; Kassioumis, 1988; Ferioli, 1989; Bournérias *et al.*, 1990)
- 42.841 Iberian Aleppo pine forests**
Pinus halepensis forests of Spain, considered native for at least two-thirds of their considerable expanse; they are mostly restricted to eastern regions on the Mediterranean slope of the Catalanian mountains, the Maestrazgo, the pre-Baetic ranges of the upper Guadalquivir basin, the southern Andalusian mountains; they penetrate farther inland in the Ebro basin and around the headwaters of the Tagus and Guadalquivir systems.

- 42.842** **Balearic Aleppo pine forests**
Pinus halepensis formations of the Balearics, present and probably native on all the major islands.
- 42.843** **Provenço-Ligurian Aleppo pine forests**
Mostly lower meso-Mediterranean *Pinus halepensis* forests of Provence and of the lower slopes and coastlines of the Maritime and Ligurian Alps, extensive and undoubtedly native.
- 42.844** **Corsican Aleppo pine woods**
Rare and local *Pinus halepensis* woods of the Corsican coasts, some, at least, possibly natural.
- 42.845** **Sardinian Aleppo pine woods**
Pinus halepensis formations of Sardinia, where certainly native woods occur on Isola di San Pietro and the Sulcis coast of Iglesias.
- 42.846** **Sicilian Aleppo pine woods**
Pinus halepensis formations of Sicily and peripheral islands.
- 42.8461** **Mainland Sicilian Aleppo pine forests**
Pinus halepensis woods of mainland Sicily, where native formations occur on the south-western slope of the Iblei massif (Vittoria).
- 42.8462** **Egadi Aleppo pine forests**
Pinus halepensis woods of the Egadi islands (Marettimo, Isla Grande, San Pantaleo).
- 42.8463** **Lampedusa Aleppo pine forests**
Pinus halepensis woods of the Pelagie (Lampedusa).
- 42.8464** **Pantelleria Aleppo pine forests**
Pino-Genistetum aspalathoidis pinetosum halepensis
Uncommon *Pinus halepensis*-dominated facies of the pine woods of Pantelleria.
- 42.847** **Peninsular Italian Aleppo pine forests**
Pinus halepensis formations of the Italian peninsula; extensive, probably at least partially native ones are individualized in the subdivisions below.
- 42.8471** **Gargano Aleppo pine forests**
Pinus halepensis forests of Monte Gargano and the Tremiti islands.
- 42.8472** **Metapontine Aleppo pine forests**
Pinus halepensis forests of the Gulf of Taranto area, in particular of the Metapontine littoral.
- 42.8473** **Umbrian Aleppo pine forests**
Pinus halepensis forests of southern Umbria, in the Narni and Spoleto-Terni areas.
- 42.8474** **Italian Aleppo pine reforestation**
Other *Pinus halepensis* formations of peninsular Italy.
- 42.844** **Greek Aleppo pine forests**
Pinus halepensis formations of Greece, where the species is relatively widespread, particularly in Attica, Thessaly, the coasts of the Peloponnese and of central continental Greece, the Ionian islands, Chalcidici, the northern Sporades, Euboea and Skiros.
- 42.85** **AEGEAN PINE FORESTS**
Pinus brutia forests of Crete and eastern Aegean islands. Eastern vicariants of Aleppo pine forests (42.84), they comprise, however, taller, more luxuriant, and often extensive, formations.
(Rechinger, 1943, 1951; Horvat *et al.*, 1974; Sfikas, 1987; Latridis, 1988)

- 42.851** **Aegean pine forests of Crete**
Pinus brutia-dominated forests of Crete and its satellite islands Gavdos and Gaidaronisi, pure or mixed with *Cupressus sempervirens*; they are widespread in particular in the White Mountains, the Psiloriti range, the Dikti range and, locally, in the Sitia mountains and the Asterousia mountains.
- 42.8511** **Cretan lentisc Aegean pine forests**
Pinus brutia forests with garrigue undergrowth of *Pistacia lentiscus*, *Cistus creticus*.
- 42.8512** **Cretan phrygana Aegean pine forests**
Pinus brutia forests with a phrygana undergrowth of *Sarcopoterium spinosum* or *Thymus capitatus*.
- 42.8513** **Cretan grassy Aegean pine forests**
Pinus brutia forests with sparse grassy undergrowth on stony ground.
- 42.852** **Aegean pine forests of Lesbos**
Extensive *Pinus brutia* forests of Lesbos, occupying Mount Olympus and surrounding hills in the south-eastern quadrant of the island, as well as parts of the Kuratsonas range in the north-west; these forests harbour the only European population of the nuthatch *Sitta krueperi* and the most significant one of the orchid *Comperia comperiana*.
- 42.8521** **Lesbian humid montane Aegean pine forests**
Humid montane *Pinus brutia* forests of Lesbos, with a high, fairly dense *Quercus coccifera*-dominated understorey and abundant lichen growth.
- 42.8522** **Lesbian cistus Aegean pine forests**
Dry collinar *Pinus brutia* forests of Lesbos, with low, sparse undergrowth formed mostly by *Cistus salvifolius*.
- 42.8523** **Lesbian heath Aegean pine forests**
Dry collinar *Pinus brutia* forests of Lesbos, with continuous ericaceous undergrowth.
- 42.853** **Aegean pine forests of Samos**
Pinus brutia forests covering large expanses of Samos, in particular in the Ambelos range, the Kerki mountains, the southern hills and the north-eastern peninsula.
- 42.8531** **Samian collinar Aegean pine forests**
Lower altitude *Pinus brutia* forests of Samos, with *Pistacia lentiscus*, *Cistus salvifolius*, *C. parviflorus*, *Sarcopoterium spinosum*, *Quercus coccifera*.
- 42.8532** **Samian montane Aegean pine forests**
Higher altitude *Pinus brutia* forests of Samos, sometimes including *Pinus pallasiana*, and with an undergrowth comprising *Quercus coccifera*, *Prunus cocomilia* (*P. pseudarmeniaca*), *Crataegus* spp.
- 42.854** **Aegean pine woods of Chios**
Remnant forests of Chios with a composition and stratification similar to those of the forests of Samos.
- 42.855** **Aegean pine forests of Thasos**
Broad *Pinus brutia* belt on the lower reaches of Thasos, up to about 400 to 500 m, mixed with *Pinus pallasiana* in the higher areas.
- 42.8551** **Thasian kermes Aegean pine forests**
Thasos *Pinus brutia* forests with a dense *Quercus coccifera* undergrowth.
- 42.8552** **Thasian bracken Aegean pine forests**
Thasos *Pinus brutia* forests with sparse undergrowth.
- 42.8553** **Thasian heath Aegean pine forests**
Thasos *Pinus brutia* forests with dense ericaceous undergrowth.

- 42.856 **Aegean pine woods of Samothrace**
Mostly sparse *Pinus brutia* formations of the lowlands of Samothrace.
- 42.857 **Aegean pine forests of Rhodes**
Remnant *Pinus brutia* forests of Rhodes, still represented by some relatively natural formations with rich scrub undergrowth.
- 42.858 **Aegean pine forests of Karpathos**
Fairly extensive *Pinus brutia* forests of Karpathos, distributed, in particular, in the northern coastal area, the southern interior and the middle elevation of Kali Limni.
- 42.859 **Aegean pine forests of the Dodecanese**
Pinus brutia formations of the islands of Simi, Kos, Leros and Ikaria.
- 42.9 **CANARY ISLAND PINE FORESTS**
Cytiso-Pinetea canariensis: Cisto-Pinion canariensis
Forests of endemic *Pinus canariensis*, of the dry montane level at around 800 to 2 000 m (locally down to 500 and up to 2 500 m) in Tenerife, La Palma, Gran Canaria and Hierro, with *Chamaecytisus proliferus*, *Adenocarpus foliolosus*, *Cistus symphytifolius*, *Lotus campylocladus*, *L. hillebrandii*, *L. spartioides*, *Daphne gnidium*, *Juniperus cedrus*, *Micromeria spp.*; these forests, of which well-preserved examples have become rare, are the only habitat of *Fringilla teydea*, *Dendrocopos major canariensis* and *D. m. thanneri*. (Bannerman, 1963; Ortuno and Ceballos, 1977; White, 1983; Bramwell and Bramwell, 1983; Ciaran and Blanco, 1984; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Machado, *in litt.*, 1989)
- 42.91 **CANARY PINE-ROCKROSE FORESTS**
Climax *Pinus canariensis* forests within the main zone of altitudinal occurrence, with an undergrowth characterized and often dominated by *Cistus symphytifolius* and comprising *Chamaecytisus proliferus*, *Lotus campylocladus*, *L. hillebrandii*, *L. spartioides*, *Juniperus cedrus*, *Bystropogon origanifolius*, *Argyranthemum adauctum*.
- 42.911 **Tenerife pine-rockrose forests**
Pine forests of Tenerife, with *Lotus campylocladus*, *Chamaecytisus proliferus* (*Cytiso proliferi-Pinetum canariensis cistetosum symphytifolii*); they are the main habitat of the endangered *Dendrocopos major canariensis* and of *Fringilla teydea teydea*.
- 42.912 **La Palma pine-rockrose forests**
Pine forests of La Palma, with *Lotus hillebrandii* (*Loto hillebrandii-Pinetum canariensis cistetosum*).
- 42.913 **Gran Canaria pine-rockrose forests**
Pine forests of Gran Canaria, with *Cistus symphytifolius* var. *leucophyllus* and *Lotus spartioides*; they are the main habitat of the threatened *Dendrocopos major thanneri* and *Fringilla teydea polatzeki*.
- 42.914 **Hierro pine-rockrose forests**
Pine forests of Hierro, with *Lotus hillebrandii*.
- 42.92 **CANARY PINE-DRY SCRUB FORESTS**
Formations of dry, south-facing slopes in the lower part of the *Pinus canariensis* belt, transitional towards juniper formations and their degradation scrubs, with an undergrowth often formed by *Cistus monspeliensis*, *Euphorbia obtusifolia* ssp. *regis-jubae*, *Salvia canariensis*, *Micromeria hyssopifolia*, *Echium aculeatum*.
- 42.921 **Tenerife pine-dry scrub woods**
- 42.922 **La Palma pine-dry scrub woods**
- 42.923 **Gran Canaria pine-dry scrub woods**
- 42.924 **Hierro pine-dry scrub woods**

- 42.93** CANARY PINE-HEATH FORESTS
Formations of humid, fogbound north- and north-west-facing slopes in the lower reaches of the *Pinus canariensis* belt, with an abundance of *Erica arborea* and *Myrica faya*, and occasionally with *Ilex canariensis* and *Arbutus canariensis*; epiphytic lichens are abundant, as are dense carpets of mosses, in particular, *Hypnum cupressiforme*. These woods are the main habitat of *Regulus teneriffae*.
- 42.931** Tenerife pine-heath forests
- 42.932** La Palma pine-heath forests
- 42.933** Gran Canaria pine-heath forests
Formations of Gran Canaria, harbouring the endemic *Micromeria pineolens*.
- 42.934** Hierro pine-heath forests
Formations of Hierro, harbouring the almost extinct *Adenocarpus ombriosus*.
- 42.94** CANARY PINE-BROOM WOODS
Formations of the highest altitudes of the *Pinus canariensis* belt, invaded by species of the supra-Canarian level, in particular *Adenocarpus viscosus*.
- 42.941** Tenerife pine-broom woods
Formations of Tenerife, with *Adenocarpus viscosus* var. *viscosus*.
- 42.942** La Palma pine-broom woods
Formations of La Palma, with *Adenocarpus viscosus* var. *spartioides*.
- 42.95** CANARY PINE-JUNIPER WOODS
Junipero cedri-Pinetum canariensis
Pinus canariensis and *Juniperus cedrus* formations of steep, rocky slopes of high altitudes of Tenerife and La Palma.
- 42.951** Tenerife pine-juniper woods
Formations of the edges of Las Canadas del Teide.
- 42.952** La Palma pine-juniper woods
Formations of the summits of La Palma.
- 42.A** CYPRESS, JUNIPER AND YEW FORESTS
Woods dominated by *Cupressus sempervirens*, *Juniperus* spp. or *Taxus baccata*.
- 42.A1** CYPRESS FORESTS
Acero-Cupression
Montane forests of Crete and a few eastern Aegean islands, dominated by *Cupressus sempervirens*.
(Rechinger, 1943, 1951; Ozenda *et al.*, 1979; Noifalisse, 1987; Sfikas, 1987; Yatridis, 1988; Kassioumis, 1988)
- 42.A11** Cypress forests of Crete
Cupressus sempervirens and *C. sempervirens-Pinus brutia* forests of Crete occupying a wide altitudinal range, but a restricted geographical area, in the White Mountains (notably Samaria) with outposts in the Idi and Dikti mountains. Tall, closed, luxuriant forests exist, with cypresses up to 30 metres, as well as more open stands. Accompanying the cypress and *Pinus brutia* may be *Quercus coccifera*, *Acer sempervirens*, *Zelkova abelicea*.
- 42.A12** Cypress forests of Rhodes
Cupressus sempervirens and *C. sempervirens-Pinus brutia* forests of Rhodes, represented on most mountain ranges and locally at lower altitudes.
- 42.A13** Cypress woodland of Syme
Cupressus sempervirens formations of Syme, rather open and with impoverished undergrowth.

- 42.A14** **Cypress woodland of Kos**
Cupressus sempervirens forest remnants of middle elevations of Kos.
- 42.A15** **Cypress woodland of Samothrace**
Cupressus sempervirens formations of steep slopes of the south-eastern side of Samothrace.
- 42.A2** **SPANISH JUNIPER WOODS**
Juniperion thuriferae
Forest formations dominated by *Juniperus thurifera* of Spain, southern France and Corsica. Many communities may be better described as arborescent matorrals, and listed under 32.136; geographical divisions can nevertheless be retained by appending the suffixes of 42.A2 to 32.136.
(Ozenda *et al.*, 1979; Ozenda, 1981, 1985; Dupias, 1985; Blanco Castro and Sainz Ollero, 1985; Gamisans, 1985; Noirfalise, 1986, 1987; Navarro Andres and Valle Gutierrez, 1987; Peinado Lorca and Martinez-Parras, 1987; Costa, 1987; Bolos and Capdevila, 1987; Rivas-Martinez *et al.*, 1987)
- 42.A21** **Iberian Spanish juniper forests**
Juniperetum hemisphaerico-thuriferae, *Junipero thuriferae-Quercetum rotundifoliae p.*
Juniperus thurifera forests on calcareous substrates in the supra-Mediterranean levels of the Iberian Range and neighbouring plateaux, dispersed throughout the entire system, in an arc extending from the province of Burgos to the Serrania de Cuenca and the mountains of Teruel; these constitute the main range of the species. *Pinus sylvestris* and *P. Salzmannii* may accompany the juniper; *Juniperus hemisphaerica* and *Berberis hispanica* may be common in the undergrowth.
- 42.A22** **Guadarraman Spanish juniper woods**
Juniperetum hemisphaerico-thuriferae p.
Relict *Juniperus thurifera* woods of enclaves on the periphery of and within the Sierra de Guadarrama, occurring both on rare local limestone deposits and in a few siliceous stations.
- 42.A221** **Guadarraman calciphilous Spanish juniper woods**
Formations of *Juniperus thurifera* linked to local limestone deposits of the Sierra de Guadarrama area.
- 42.A222** **Guadarraman silicicolous Spanish juniper woods**
Juniperetum hemisphaerico-thuriferae juniperetosum oxycedri
Anomalous silicicolous *Juniperus thurifera* formations, with *J. oxycedrus*.
- 42.A23** **Cantabrian Spanish juniper woods**
Juniperetum sabino-thuriferae
Relict, open *Juniperus thurifera* woodlands of dry, warm, rocky, calcareous southern slopes of the Cordillera Cantabrica, between the Rio Pisuerga and the Rio Luna, with *Juniperus nana*, *J. sabina*, *Berberis vulgaris* ssp. *cantabrica*, *Rhamnus alpinus*, *Viburnum lantana*.
- 42.A24** **Monegros Spanish juniper woods**
Juniperus thurifera woodlands on gypsiferous soils of the Ebro basin, with *Rhamnus lycioides*.
- 42.A25** **Manchegan Spanish juniper woods**
Junipero thuriferae-Quercetum rotundifoliae p.
Juniperus thurifera woods on La Mancha clay soils of the Campo de Montiel.
- 42.A26** **Baetic Spanish juniper woods**
Relict, open *Juniperus thurifera* formations of the pre-Baetic system in the Sierra Taibilla (Albacete, Murcia).
- 42.A27** **Pyrenean Spanish juniper woods**
Relict *Juniperus thurifera* wood of the supra-Mediterranean level of the Montagne de Rie, on the northern flank of the central Pyrenees.

- 42.A28** **Southern Alpine Spanish juniper woods**
Juniperus thurifera formations of warm calcareous supra-Mediterranean slopes of the south-western Alps, in Drôme, Hautes-Alpes and Alpes-de-Haute-Provence, between 700 and 1 200, occasionally 1 400, m.
- 42.A29** **Isère Spanish juniper woods**
Juniperus thurifera formations of warm calcareous supra-Mediterranean slopes of the Isère valley, in the western Alps, between 300 and 500 m.
- 42.A2A** **Corsican Spanish juniper woods**
 Open montane forests of *Juniperus thurifera*, sometimes mixed with *Pinus laricio*, restricted to a few valleys in the interior of Corsica with extreme temperature ranges (Pinnera, Ruddy, Pruniccia).
- 42.A3** **GRECIAN JUNIPER WOODS**
Juniperetum excelsae
 Forest formations dominated by *Juniperus excelsa*, of the *Ostryo-Carpinion* zone of the mountains of northern Greece (up to 900-1 000 m, around Lake Prespa). Arborescent matorrals, somewhat more widespread in Greece, have been listed under 32.1331. (Horvat *et al.*, 1974)
- 42.A4** **STINKING JUNIPER WOODS**
 Forest formations dominated by *Juniperus foetidissima* on adrets of the upper supra-Mediterranean level in Greece. Arborescent matorrals, somewhat more widespread in Greece, including the Aegean archipelagoes (Samos), have been listed under 32.1332. (Rechinger, 1951; Noirfalise, 1986, 1987)
- 42.A5** **SYRIAN JUNIPER WOODS**
Juniperus drupacea woods of the northern slopes of Mount Parnon, Greece. Part of the formation takes the appearance of an arborescent matorral, listed under 32.135. (Polunin, 1980; Kassioumis, 1988)
- 42.A6** **ARBOR-VITAE FORESTS**
 Xero-thermophile forests of *Tetraclinis articulata*, restricted to extreme south-eastern Spain, are extinct in forest form. The relict formations dominated by this species, of exceptional bio-geographical and historical importance, constitute arborescent matorrals and have been listed under 32.15. (Templado, 1974; Tomaselli, 1981b)
- 42.A7** **YEW WOODS**
 Woods dominated by *Taxus baccata*, often with *Ilex aquifolium*, of very local occurrence. (Fenaroli, 1970; Brun *et al.*, 1975; Groppali, *et al.*, 1983; Sobron Garcia, 1984; Gamisans, 1985; Pratesi and Tassi, 1986; Noirfalise, 1986, 1987; Ferioli, 1989; Rodwell 1991)
- 42.A71** **British yew woods**
Taxus baccata woods with *Sorbus aria* or *Mercurialis perennis* of dry valleys and scarps of the chalk of south-east England and, very locally, of the Durham magnesium limestone.
- 42.A72** **Corsican yew woods**
 Formations of *Taxus baccata*, *Ilex aquifolium*, *Buxus sempervirens*, restricted to cool, montane areas in the Tenda range, the San Pedrone range and the Cap Corse mountains.
- 42.A73** **Sardinian yew woods**
Taxus baccata and *Ilex aquifolium* woods of the Catena del Marghine and the Mount Limbara system.
- 42.A74** **Peninsular Italian yew woods**
Taxus baccata and *Ilex aquifolium* of the Macerata region.
- 42.A75** **Iberian yew woods**
 Occasional pure *Taxus baccata* formations of Spanish mountains, most often on steep shady slopes.

- 42.A76** **Provence yew woods**
Taxus baccata formations of southern France, similar to 42.A75.
- 42.A8** **MACARONESIAN JUNIPER WOODS**
 Juniper-dominated formations of the Atlantic islands. All such formations are listed here whether wood-like or scrub-like in physiognomy; ericoid-dominated facies of the same formations have been listed under 31.3.
 (Géhu, 1984; Blanco Castro and Sainz Ollero, 1985; Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988; Machado *in litt.*, 1989)
- 42.A81** **Canarian juniper woods**
Juniperus cedrus formations of the high altitudes of Tenerife, La Palma, Gomera, Gran Canaria, restricted to steep rocky slopes.
- 42.A82** **Azorean juniper woods**
Juniperion brevifoliae p.
 Endemic *Juniperus brevifolia* formations of the Azores.
- 42.A83** **Macaronesian Phoenician juniper woods**
Maytenio-Juniperion phoeniceae p.
Juniperus phoenicea formations of Tenerife, La Palma, Hierro, Gran Canaria, Gomera.
- 42.A9** **PRICKLY JUNIPER WOODS**
 Woods dominated by *Juniperus oxycedrus*. Most *J. oxycedrus* formations are at most arborescent matorral listed under 32.131. A few may, however, qualify as woodland, as, for instance, those of the Limbara in Sardinia.
 (Veri and Pacioni, 1985)
- 42.AA** **PHOENICIAN JUNIPER WOODS**
 Mediterranean formations dominated by *Juniperus phoenicea* are mostly arborescent matorrals and have been covered under 32.132. Exceptional, tall and dense formations, however, may be more appropriately characterized as woodland and listed in this unit.

43 Mixed woodland

Forest and woodland of mixed deciduous and coniferous trees. Detailed habitats can be coded by transposing subdivisions of division 41, simply replacing prefix 41 by prefix 43. Mixed coniferous and broad-leaved evergreen woodland should not be listed under 43, but under 42 or 45, depending on dominance.

44 Alluvial and very wet forests and brush

Tree and shrub vegetation of flood plains, marshes, fens and bogs.

- 44.1 RIPARIAN WILLOW FORMATIONS**
Salicetea purpureae; Populetalia albae p.
Salix spp. brush or arborescent formations, lining flowing water and submitted to periodic flooding.
- 44.11 PRE-ALPINE WILLOW BRUSH**
Salicetea purpureae: Salicion elaeagni
 Willow brush of fast, pebbly, summer-high rivers in Alpine and peri-Alpine valleys with *Salix eleagnos*, *S. purpurea* ssp. *gracilis*, *S. daphnoides*, *S. nigricans*, *Myricaria germanica* and *Hippophae rhamnoides*.
 (Ellenberg, 1963, 1988; Guinochet and Vilmorin, 1973; Yon and Tendron, 1981; Ozenda, 1985; Oberdorfer, 1990)
- 44.111 Willow-tamarisk brush**
Salici-Myricarietum
 Low, prostrate *Myricaria germanica* and *Salix spp.* formations of low, silty shoals.
- 44.112 Willow and sea-buckthorn brush**
Salicetum elaeagno-daphnoidis
 Formations of *Salix spp.* and *Hippophae rhamnoides* of higher gravel shoals.
- 44.12 LOWLAND, COLLINAR AND MEDITERRANEO-MONTANE WILLOW BRUSH**
Salicion triandro-viminalis, Salicenion angustifolii, Salicion salvifoliae (Salicion albae p)
 Linear shrubby willow formations of river banks in plains, hills and low mountains of middle Europe and the Mediterranean region, with *Salix triandra*, *S. viminalis*, *S. purpurea*.
 (Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Yon and Tendron, 1981; Géhu, 1984; Noirfalise, 1984; Rivas-Martinez *et al.*, 1984; Oberdorfer, 1990)
- 44.121 Almond willow-osier scrub**
Salicetum triandro-viminalis
 Willow scrub, often dense, lining water courses of medio-European and Atlantic lowlands and hills, with *Salix purpurea* ssp. *lambertiana*, *S. triandra*, *S. viminalis*.
 (Noirfalise and Sougnez, 1961; Westhoff and den Held, 1975; Noirfalise, 1984; Bournérias, 1984; Ellenberg, 1988; Oberdorfer, 1990; Rodwell, 1991)
- 44.122 Mediterranean purple willow scrub**
Saponario officinalis-Salicetum pupureae
 Willow scrub dominated by *Salix purpurea* ssp. *lambertiana* and *S. eleagnos* ssp. *angustifolia* of water courses of southern France, Mediterranean eastern Spain south to the Rio Segura basin, Italy.
 (Archiloque *et al.*, 1969; Bolos, 1979; Perdigo, 1979; Folch i Guillen, 1979; Francalancia and Orsomando, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1984; Alcaraz Ariza and Peinado Lorca, 1987)
- 44.123 Balkanic purple willow scrub**
Tamarici-Salicetum purpureae, Nerio-Salicetum purpureae, Salicetum triandrae balcanicum, Alneto-Salicetum amplexicaulis i. a.
 Willow-dominated scrub of banks and shoals of Greek rivers, with *Salix purpurea*, *S. amplexicaulis*, *S. elaeagnos*, *S. triandra*, *S. viminalis*.
 (Oberdorfer, 1953; Horvat *et al.*, 1974; Strid, 1980; Sfikas, 1984)

- 44.124** **Ibero-montane willow scrub**
Salicetum triandro-elaegni
 Willow scrub, up to 2-3 m tall, lining water courses of the Pyrenees, the Iberian Range, the Sierra Nevada, formed by *Salix purpurea*, *S. elaeagnos* ssp. *angustifolia*, *S. triandra*. (Lopez, 1976; Rivas-Martinez *et al.*, 1984; Dupias, 1985; Martinez Parras *et al.*, 1987; Vigo and Ninot, 1987)
- 44.125** **Cantabrian willow scrub**
Salicetum cantabricae
 Willow scrub of montane rivers and arroyos of the Cordillera Cantabrica, with the endemic *Salix cantabrica* and with *S. elaeagnos* ssp. *angustifolia*, *S. purpurea* ssp. *lambertiana*, *S. triandra* ssp. *discolor*. (Rivas-Martinez *et al.*, 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987)
- 44.126** **Iberian sage-leaved willow scrub**
Salicetum purpureo-salvifoliae (*Salicetum lambertiano-salvifoliae*)
 Small or medium-sized willow scrub of meso-Mediterranean and, locally, supra-Mediterranean, zones of central Iberia (Castellano-Leonese sectors, Extremadura), characterized by the presence of the Iberian endemic *Salix salvifolia* and *S. x secalliana*, together with *S. atrocinerea*, *S. x matritensis*, *S. neotricha*, *S. purpurea* ssp. *lambertiana*, *S. triandra* ssp. *discolor*; they line, mostly on siliceous sandy soils, small oligotrophic rivers with strong seasonal amplitude, or form behind the taller curtain of the *Populo nigrae-Salicetum neotrichae* along large water courses of argilous base-rich soils. (Rivas-Martinez, 1975; Rivas-Martinez *et al.*, 1984; Navarro Andres and Valle Gutierrez, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987)
- 44.127** **Pedicellated willow scrub**
 Willow scrub of stream courses of extreme southern Europe, characterized by the presence of the south-western Mediterranean and North African *Salix pedicellata*. (Pignatti, 1982; Chiappini, 1985b; Rivas-Martinez *et al.*, 1987; Asensi Marfil and Diez Garretas, 1987)
- 44.1271** **Andalusian willow scrub**
Equiseto telmateiae-Salicetum pedicellatae (*Salicetum pedicellatae*)
 Willow scrub of south-western Iberian stream courses, fringing, in particular, humid *Quercus canariensis* forests in conjunction with rhododendron-alder galleries (44.52), dominated by *Salix pedicellata* and *Salix salvifolia* ssp. *australis*.
- 44.1272** **Sardinian pedicellated willow scrub**
- 44.1273** **Sicilian pedicellated willow scrub**
- 44.1274** **Calabrian pedicellated willow scrub**
- 44.13** **WHITE WILLOW GALLERY FORESTS**
Salicion albae: Salicetum albae, Salicetum fragilis
 Arborescent galleries of tall *Salix alba*, *S. fragilis* and *S. x rubens*, sometimes including *Populus nigra*, along medio-European lowland, hill or sub-montane rivers, submitted to a regular regime of inundation. (Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Bournérias, 1979; Yon and Tendron, 1981; Géhu, 1984; Oberdorfer, 1990; Rodwell, 1991)
- 44.14** **MEDITERRANEAN TALL WILLOW GALLERIES**
Populetalia albae p.
 Arborescent willow formations bordering Mediterranean watercourses, willow-dominated belt or facies of the poplar-ash-elm forests.
- 44.141** **Mediterranean white willow galleries**
 Riparian forests of Iberia and the Mediterranean basin dominated by *Salix alba* or its relatives.

44.1411

Iberian tall willow galleries*Populo nigrae-Salicetum neotrichae*

Arborescent willow galleries dominated by *Salix neotricha* accompanied by *Salix alba*, *S. fragilis*, *Populus nigra* and sometimes *P. alba*, *Fraxinus angustifolia*, *Frangula alnus*, *Sambucus nigra*, *Ulmus spp.*, forming as the ligneous vegetation closest to the water along the middle and lower course of large rivers of little seasonal amplitude in the meso- and supra-Mediterranean foothills of the Cantabrian Cordillera, the Iberian Range and neighbouring regions.

(Lopez, 1976; Navarro Andres and Valle Gutierrez, 1987)

44.1412

Mediterranean *Salix alba* galleries*Populion albae: Rubo caesi-Populetum albae i. a.*

Other Mediterranean riparian forests formed by white willows, *Salix alba*, *S. fragilis*- or *S. x rubens*-dominated facies of poplar-ash-elm forests developed along lowland Iberian, southern French, Italian, Greek rivers; the accompanying cortège does not differ from that of poplar or ash-dominated facies.

(Horvat *et al.*, 1974; Francalancia and Orsomando, 1980; Pedrotti, 1980; Pignatti, 1982; Diaz Gonzalez and Fernandez Prieto, 1987)

44.142

Olive-leaved and ashy willow riparian woods*Rubo corylifolii-Salicetum atrocineriae, Viti viniferae-Salicetum atrocineriae*

Woods of arborescent willows, physiognomically dominated by *Salix atrocineria* or *S. cinerea*, forming, in thermo-, meso- or supra-Mediterranean areas, on the banks of slow water courses; similar woods occupy soggy depressions (44.92).

(Rivas-Martinez, 1975; Sfikas, 1978; Bolos, 1979; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Chiappini, 1985b; Navarro Andres and Valle Gutierrez, 1987; Asensi Marfil and Diez Garretas, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Rallo and Pandolfi, 1988)

44.1421

Iberian olive-leaved willow woods*Rubo corylifolii-Salicetum atrocineriae*

Riparian woods of *Salix atrocineria* of central and eastern Iberia, with *Salix neotricha*, *S. salvifolia*, *Frangula alnus*, *Populus tremula*, *Fraxinus angustifolia* and many lianas and brambles (*Rubus spp.*).

44.1422

Andalusian olive-leaved willow woods*Viti viniferae-Salicetum atrocineriae*

Riparian woods formed almost exclusively by *Salix atrocineria*, with a few *Fraxinus angustifolia*, numerous lianas and brambles (*Rubus spp.*) and an abundance of *Thelypteris palustris* in the undergrowth, characteristic of the south-western Iberian peninsula.

44.1423

Sardinian olive-leaved willow woods

Riparian woods of *Salix atrocineria* of Sardinia.

44.1424

Ashy willow riparian woods*Frangulo-Salicetum cinerae i.a.*

Riparian woods of *Salix cinerea* of Italy and Greece.

44.15

CANARIAN WILLOW GALLERIES*Rubo-Salicetum canariensis*

Riparian communities forming mostly in ravines and gullies within the laurel forest belt of the Canary Islands and characterized by the presence of the tall endemic, *Salix canariensis*. The best preserved are found in the barranco de Los Cernicalos of Gran Canaria, in the caldera de Taburiente of La Palma and in the barranco del Infierno of Tenerife.

(Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988)

44.2

GREY ALDER GALLERIES*Alnion incanae (Alnetum incanae s.l)*

Riparian woods of *Alnus incana* of montane and sub-montane rivers of the Alps, the northern Apennines and neighbouring regions.

(Ellenberg, 1963, 1988; Braun-Blanquet, 1975; Ozenda, 1981; Yon and Tendron, 1981; Noirfalise, 1986; Ferioli, 1989; Oberdorfer, 1990)

- 44.21** MONTANE GREY ALDER GALLERIES
Calamagrosti variaae-Alnetum incanae
Alnus incanus formations of the upper reaches of Alpine, particularly inner Alpine, valleys, replacing, colonizing or fringing the pioneer willow scrubs of the *Salicion elaeagni* (44.11).
- 44.22** SUB-MONTANE GREY ALDER GALLERIES
Equiseto hyemalis-Alnetum incanae
Alder formations of the middle course of rivers flowing from the Alps, in particular on the Bavarian plateau, the Rhine and Rhône systems.
- 44.3** MEDIO-EUROPEAN STREAM ASH-ALDER WOODS
Alno-Padion p. (Fraxino-Alnion glutinosae)
Riparian forests of *Fraxinus excelsior* and *Alnus glutinosa*, sometimes *Alnus incana*, of middle European and northern Iberian lowland or hill watercourses, on soils periodically inundated by the annual rise of the river level, but otherwise well-drained and aerated during low-water; they differ from riparian alder woods within 44.9 by the strong representation in the dominated layers of forest species not able to grow in permanently waterlogged soils. (Oberdorfer, 1953, 1990; Noirfalise and Sougnez, 1961; Westhoff and den Held, 1975; Yon and Tendron, 1981; Bournérias, 1984; Noirfalise, 1984; Ellenberg, 1988)
- 44.31** ASH-ALDER WOODS OF RIVULETS AND SPRINGS
Carici remotae-Fraxinetum, *Equiseto telmateiae-Fraxinetum*, *Ribeso sylvestris-Fraxinetum*
Fraxinus excelsior-Alnus glutinosa formations of springs and small streams of Atlantic, sub-Atlantic and subcontinental middle Europe, usually dominated by ashes, with *Carex remota*, *C. pendula*, *C. strigosa*, *Equisetum telmateia*, *Rumex sanguineus*, *Lysimachia nemorum*, *Cardamine amara*, *Chrysosplenium oppositifolium*, *C. alternifolium*, *Impatiens noli-tangere*, *Ribes rubrum*.
(Noirfalise, 1952, 1984; Oberdorfer, 1953, 1990; Tüxen and Oberdorfer, 1958; Duvigneaud and Mullenders, 1961; Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Yon and Tendron, 1981; Rodwell, 1991)
- 44.311** Sedge ash-alder woods
Carici remotae-Fraxinetum caricetosum
Formations of *Fraxinus excelsior* and *Alnus glutinosa* with an abundance of *Carex remota*, *C. strigosa*, *C. pendula*, *C. sylvatica*.
- 44.312** Fontinal ash-alder woods
Carici remotae-Fraxinetum chrysosplenietosum
Fraxinus excelsior-Alnus glutinosa woods with a wetter soil occupied by *Cardamine amara* and *Chrysosplenium spp.*, and often by *Impatiens noli-tangere*.
- 44.313** Cabbage thistle ash-alder woods
Carici remotae-Fraxinetum cirsietosum
Fraxinus excelsior-Alnus glutinosa woods with the tall *Cirsium oleraceum* and *Eupatorium cannabinum* and usually *Carex acutiformis*; these constitute a transition towards 44.332.
- 44.314** Hillside spring ash-alder woods
Ribeso sylvestris-Fraxinetum
Fraxinus excelsior-Alnus glutinosa woods of seeping hillside depressions and of moist peaty ground, with *Ribes rubrum*.
- 44.315** Great horsetail ash-alder woods
Equiseto telmateiae-Fraxinetum
Fraxinus excelsior-Alnus glutinosa woods of calcareous tuffs.
- 44.32** ASH-ALDER WOODS OF FAST-FLOWING RIVERS
Stellario-Alnetum glutinosae
Alder or ash-alder galleries of the banks of fast-flowing rivers and large brooks replacing the peri-Alpine *Alnus incana* galleries in hills of northern and western Europe. They are usually co-dominated by *Alnus glutinosa*, *Fraxinus excelsior* and *Acer pseudoplatanus*, accompanied by *Acer platanoides*, *Ulmus glabra*, *U. laevis*. *Prunus padus* is frequent in the undergrowth, shrubs include *Ribes rubrum*, *R. uva-crispa*, *Corylus avellana*; the herb layer comprises *Stellaria nemorum*, *Impatiens noli-tangere*, *Aconitum vulparia*, *Allium ursinum*,

Geum rivale, *Athyrium filix-femina*, *Dryopteris carthusiana*, *Matteuccia struthiopteris*, *Ranunculus platanifolius*, *Urtica dioica*, *Ranunculus ficaria*, *Primula elatior*, *Lamium galeobdolon* or *Filipendula ulmaria*, *Luzula sylvatica*. The gallery may be enclosed within other forests or reduced to a thin line of alders along rivers traversing pastureland. (Oberdorfer, 1953, 1990; Noirfalise and Sougnez, 1961; Yon and Tendron, 1981; Noirfalise, 1984; Ellenberg, 1988)

44.33

ASH-ALDER WOODS OF SLOW RIVERS*Pruno-Fraxinetum*, *Ulmo-Fraxinetum*

Central, and locally western, European woods of large valleys of lowland slow and even-flowing rivers, with *Fraxinus excelsior*, *Alnus glutinosa*, *Prunus padus*, *Ulmus laevis*, *Quercus robur*, *Humulus lupulus*, *Rubus idaeus*, *R. caesius*, *Ribes nigrum*, *R. rubrum*, *Sambucus nigra*, *Aegopodium podagraria*, *Peucedanum palustre*, *Glyceria maxima*, *Iris pseudacorus*, *Carex acutiformis*, *C. riparia*, *Phalaris arundinacea*, *Filipendula ulmaria*, *Cirsium oleraceum*, *C. palustre*.

(Oberdorfer, 1953, 1990; Noirfalise and Sougnez, 1961; Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Yon and Tendron, 1981; Carbiener, 1983; Noirfalise, 1984; Noirfalise *et al.*, 1985; Rodwell, 1991)

44.331

Central European slow river ash-alder woods*Pruno-Fraxinetum*

Alnus glutinosa-*Fraxinus excelsior* forests with *Prunus padus*, often extensive, and capable of occupying floodplains well beyond the riparian gallery, progressively richer in *Quercus robur* and *Carpinion* species towards the exterior.

44.332

West European tall herb ash-alder woods*Macrophorbio-Alnetum* (*Ulmo-Fraxinetum* = *Aegopodio-Fraxinetum*, *Alno-Macrophorbietum*)

Alnus glutinosa or *Fraxinus excelsior*-*Alnus glutinosa*-*Ulmus* riparian woods on eutrophic, moist soils of alluvial terraces, levees and flood-plains of the lower courses of rivers of Atlantic and sub-Atlantic regions of the British Isles and the western seaboard of the European mainland, with *Salix cinerea* and *Urtica dioica*, often rich in tall herbs, in particular *Cirsium oleraceum*, *Eupatorium cannabinum*, *Epilobium hirsutum*, *Dipsacus pilosus*, *Symphytum officinale*, *Aconitum napellus*, and in creepers, *Humulus lupulus*, *Solanum dulcamara*, *Calystegia sepium*. *Ribes rubrum*, *Iris pseudacorus*, *Equisetum telmateia*, *E. fluviatile* are locally characteristic; tall sedges, in particular *Carex acutiformis* and *C. paniculata*, dominate some of the wettest communities. Typical sub-communities of British *Alnus glutinosa*-*Urtica dioica* woodland are included, as are drier *Sambucus nigra* sub-communities in situations where they are adjacent. Formations of this unit are now rare, having for the most part been replaced by poplar plantations.

44.34

NORTHERN IBERIAN ALDER GALLERIES*Hyperico androsaemi-Alnetum*, *Valeriano pyrenaicae-Alnetum*, *Scrophulario alpestris-Alnetum* (*Alnetum catalaunicum*), *Carici pendulae-Alnetum*, *Lamio flexuosi-Alnetum*

Riparian alder or ash-alder woods of collinar and montane streams of the northern Iberian peninsula, with a pronounced medio-European influence marked in particular by the presence of *Fraxinus excelsior* (and not *F. angustifolia*). They are characteristic of streams originating in the Pyrenees, the Cantabrian Cordillera, the northern Galician mountains and the Catalonian ranges. The canopy may include *Ulmus glabra*, *Quercus robur* and tall willows; the undergrowth contains *Sambucus nigra*, *Corylus avellana*, *Cornus sanguinea*, *Rubus caesius*, *Carex pendula*, *C. remota*, *Festuca gigantea*, *Bromus ramosus*, *Lathraea clandestina*, *Circaea lutetiana*, *Hypericum androsaemum*, *Solanum dulcamara*, *Valeriana pyrenaica*, *Lysimachia nemorum*, *Saxifraga hirsuta*, *Galanthus nivalis*, *Athyrium filix-femina*, *Dryopteris dilatata*, *Osmunda regalis*, *Equisetum telmateia*.

(Oberdorfer, 1953; Bolos, 1979, 1980; Dierschke, 1980; Rivas-Martinez *et al.*, 1984; Loidi Arregui, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Vigo and Ninot, 1987; Izco Sevillano, 1987)

44.341

Galicio-Cantabrian alder galleries*Valeriano pyrenaicae-Alnetum*

Northern Galician and western Cantabrian *Alnus glutinosa* galleries, with *Carex acuta* ssp. *broteriana*.

- 44.3411** **Eume near-natural alder galleries**
Relict near-natural-*Alnus glutinosa* galleries of the Eume basin, with the rare ferns *Trichomanes (Vandenboschia) speciosum* and *Calcita macrocarpa*.
- 44.3412** **Semi-natural Galicio-Cantabrian alder galleries**
Other formations.
- 44.342** **Pyreneo-Cantabrian alder galleries**
Hyperico androsaemi-Alnetum
Eastern Cantabrian and western Pyrenean *Alnus glutinosa* galleries.
- 44.343** **Pyreneo-Catalonian alder galleries**
Scrophulario alpestris-Alnetum (Alnetum catalaunicum), *Carici pendulae-Alnetum*, *Lamio flexuosi-Alnetum*
Eastern Pyrenean and Catalonian *Alnus glutinosa* galleries.
- 44.4** **MIXED OAK-ELM-ASH FORESTS OF GREAT RIVERS**
Ulmenion minoris
Diverse riparian forests of the middle courses of great rivers, inundated only by large floods.
(Ellenberg, 1963, 1988; Yon and Tendron, 1981; Oberdorfer, 1990)
- 44.41** **GREAT MEDIO-EUROPEAN FLUVIAL FORESTS**
Quercu-Ulmetum minoris
Fully developed, very tall, multilayered, highly diverse riparian forests of oaks, ashes, elms, limes, maples, alders, poplars, cherries, apple, willows of the middle and lower courses of large medio-European river systems, in particular, the Rhine, the Danube, the Emst, the Elbe, the Saale, the Weser, the Loire, the Rhône-Saône systems. Their highly complex structure is formed of eight strata to which participate up to 50 species of trees and shrubs. The upper arborescent stratum includes *Quercus robur*, *Fraxinus excelsior*, *Ulmus minor*, *U. laevis*, *U. glabra*, *Populus alba*, *P. tremula*, *P. canescens*, *P. nigra*, *Acer pseudoplatanus*, *A. platanoides*, *Salix alba*, *Alnus glutinosa*, *Prunus avium*, the lower arborescent stratum *Malus sylvestris*, *Tilia cordata*, the sub-arborescent shrub layer *Alnus incana*, *Prunus padus* and *Crataegus monogyna*. There are very varied high and low shrub layers and numerous lianas, *Clematis vitalba*, *Tamus communis*, *Humulus lupulus*, *Hedera helix* and *Vitis vinifera* ssp. *silvestris*. Most diverse, structurally, floristically and faunistically, of all European ecosystems, and closest in that respect to tropical communities and to the warm temperate forests of the Pleistocene, the great fluvial forests of Europe are reduced to a few highly vulnerable examples, located mainly within the Rhine, Danube and Elbe systems.
(Oberdorfer, 1953, 1990; Ellenberg, 1963, 1988; Carbiener, 1970, 1983; Yon and Tendron, 1981)
- 44.42** **RESIDUAL MEDIO-EUROPEAN FLUVIAL FORESTS**
Fragments of oak-elm-ash forests of large medio-European river systems, very altered and with greatly reduced species richness.
- 44.43** **BALKANIC ASH-OAK-ALDER FORESTS**
Quercus robur and *Fraxinus angustifolia* riparian forests of sub-Mediterranean regions of south-eastern Europe.
(Horvat *et al.*, 1974; Pedrotti, 1980; Dierschke, 1980; Yon and Tendron, 1981; Kassioumis, 1988)
- 44.431** **Illyrian ash-oak-alder forests**
Leucojo-Fraxinetum angustifoliae
Riparian forests of the karst region of north-eastern Italy, composed of *Fraxinus angustifolia*, *Quercus robur*, *Ulmus minor*, *Alnus glutinosa* and with an abundance of *Leucosium aestivum*.
- 44.432** **Hellenic ash-oak-alder forests**
Rare mixed riparian forests of northern Greece, dominated by *Quercus robur* and *Fraxinus angustifolia*, represented, in particular, by the remarkable Mouries forest in the Kilkis prefectorate.

44.44

PO OAK-ASH-ALDER FORESTS*Polygonato multiflorae-Quercetum roboris i.a.*

Relict forests of the alluvial plain of the Po and its main tributaries, remnants of the greatest fluvial system of Europe. They are formed by meso-hygrophile, mesotrophic, multi-layered, oak-ash-hornbeam-dominated communities (*Carpinion betuli: Polygonato multiflorae – Quercetum roboris*), with facies richer in ashes, willows and, mostly, alders, in the wettest areas (*Alno-Padion*). Constituent trees include *Quercus robur*, *Q. cerris*, *Fraxinus excelsior*, *F. ornus*, *Carpinus betulus*, *Ulmus minor*, *Populus alba*, *P. nigra*, *Acer campestre*, *A. pseudoplatanus*, *Prunus padus*, *P. avium*, *Alnus glutinosa*, *Salix alba*, *Corylus avellana*, *Sorbus torminalis*, *S. domestica*, the shrub layers are formed, in particular, by *Ruscus aculeatus*, *Cornus mas*, *C. sanguinea*, *Crataegus laevigata*, *C. monogyna*, *Pyracantha coccinea*, *Rubus fruticosus*, *R. ulmifolius*, *R. caesius*, *Ribes uva-crispi*, *Sambucus nigra*, *Daphne mezereum*, *Viburnum lantana*, *Mespilus germanica*, *Lonicera xylosteum*, *Ligustrum vulgare*, *Prunus spinosa*, *Rosa canina*, *Euonymus europaeus*, *Rhamnus catharticus*; lianas are abundant, in particular, *Hedera helix*, *Tamus communis*, *Rubia peregrina*, *Bryonia cretica*; in the herb layer occur, in particular, *Equisetum hyemale*, *Symphytum officinale*, *Polygonatum multiflorum*, *Pulmonaria officinalis*, *Lathyrus vernus*, *Mercurialis perennis*, *Primula acaulis*, *Asarum europaeum*, *Euphorbia dulcis*, *Melittis melisophyllum*, *Erythronium dens-canis*, *Leucojum vernum*, *Brachypodium sylvaticum*, *Carex pilosa*. These forests are the habitat of the endangered endemic frog *Rana latastei*.

(Fenaroli, 1970; Tomaselli, 1970; Tosco, 1975; Ozenda *et al.*, 1979; Ozenda, 1985; Noirfalise, 1986, 1987)

44.5

SOUTHERN ALDER AND BIRCH GALLERIES*Osmundo-Alnion*

Riparian formations of *Alnus glutinosa*, locally of *A. cordata* or *Betula spp.* of the Mediterranean basin and of western Iberia, often with *Fraxinus angustifolia* and *Osmunda regalis*.

(Bolos, 1979; Dierschke, 1980; Yon and Tendron, 1981; Rivas-Martinez *et al.*, 1984)

44.51

SOUTHERN BLACK ALDER GALLERIES

Riparian *Alnus glutinosa*-dominated multilayered formations of the meso- and supra-Mediterranean levels of Italy, the Cévennes, the Iberian peninsula and Greece.

44.511

Iberian meso-Mediterranean alder galleries*Senecio bayonensis-Alnetum glutinosae (Scrophularia scorodoniae-Alnetum, Alneto-Scrophularietum)*

Meso-Mediterranean *Alnus glutinosa* riparian galleries of southern Galicia, Portugal, Extremadura, the western Cordillera Central, western Castilla, with *Betula celtiberica*, *Salix atrocinerea*, *Frangula alnus*, *Fraxinus angustifolia*, *Celtis australis*, many lianas, *Clematis campaniflora*, *Humulus lupulus*, *Vitis vinifera ssp. sylvestris* and a herb layer comprising *Senecio bayonensis*, *Galium broterianum*, *Scrophularia scorodonia*, *Osmunda regalis*, *Carex acuta ssp. broteriana*.

(Braun-Blanquet *et al.*, 1956; Rivas-Martinez, 1975; Izco, 1987; Ladero, 1987; Rivas-Martinez *et al.*, 1987; Navarro Andres and Valle Gutierrez, 1987)

44.512

Iberian supra-Mediterranean alder galleries*Galio broteriani-Alnetum*

Supra-Mediterranean *Alnus glutinosa* riparian galleries of water courses with moderate seasonal fluctuations, of western Iberia, with *Betula celtiberica*, *Ilex aquifolium*, *Populus tremula* and *Luzula sylvatica ssp. henriquesii*, *Paris quadrifolia*, *Galium broterianum*, *Paradisea lusitanicum*, *Carex acuta ssp. broteriana*.

(Peinado Lorca *et al.*, 1984; Rivas-Martinez *et al.*, 1987; Ladero, 1987; Navarro Andres and Valle Gutierrez, 1987)

44.513

Western Mediterranean alder galleries*Alno-Fraxinetum oxycarpae*

Alnus glutinosa riparian galleries of southern France and northern Italy, in particular, the Cévennes, the coasts of Liguria and northern Tuscany, the Triestine karst, often with *Fraxinus angustifolia*.

(Ozenda, 1953; Dierschke, 1980; Pedrotti, 1980)

- 44.514 **Greek alder galleries**
Alnus glutinosa riparian galleries along permanent water courses of non-calcareous regions of Greece, in particular, of Thessaly, the sea-facing slopes of the Pelion, the Ossa, the Pierria, the Pindus, Macedonia, Thrace, northern Euboea and the northern Peloponnese. (Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974)
- 44.52 **RHODODENDRON-ALDER GALLERIES**
Frangulo baetici-Rhododentretum baetici
 Highly remarkable, relict thermo- and meso-Mediterranean alder galleries of deep, steep-sided valleys of the Sierras of the Campo de Gibraltar and of southern Portugal, with *Rhododendron ponticum* ssp. *baeticum*, *Frangula alnus* ssp. *baetica*, *Arisarum proboscideum* and a rich fern community including *Pteris incompleta*, *Diplazium caudatum*, *Culcita macrocarpa*. They are often in contact with humid to hyper-humid *Quercus canariensis* forests (41.773) and with *Salix pedicellata* formations (44.1271). (Yon and Tendron, 1981; Asensi and Diez Garretas, 1987)
- 44.53 **CORSICAN BLACK AND CORDATE ALDER GALLERIES**
Hyperico hircini-Alnenion
 Collinar and montane riparian alder galleries of Corsica, dominated by *Alnus cordata*, with *Alnus glutinosa*. (Yon and Tendon, 1981; Gamisans, 1985)
- 44.531 **Collinar Corsican alder galleries**
 Upper meso- and lower supra-Mediterranean alder galleries, with *Hypericum hircinum* and *Erica terminalis*.
- 44.532 **Montane Corsican alder galleries**
 Upper supra-Mediterranean and montane alder galleries, with *Athyrium filix-femina* and *Gentiana asclepiadea*.
- 44.54 **ORETANIAN BIRCH GALLERIES**
Galio broteriani-Betuletum parvibracteatae
 Relict *Betula parvibracteata* riparian galleries limited to two stations of the Montes de Toledo (Cordillera Oretana), one in the Sierra de Rio Frio where a unique gallery of about 20 km in length survives, the other at the spring of the Estena. The dominant species, an extremely narrow endemic, is accompanied by *Myrica gale*, *Frangula alnus*, *Salix atrocinerea*, *Galium broterianum*, *Scilla ramburei*. (Peinado *et al.*, 1983; Ladero, 1987)
- 44.6 **MEDITERRANEAN POPLAR-ELM-ASH FORESTS**
Populion albae
 Mediterranean multi-layered alluvial forests with *Populus alba*, *Fraxinus angustifolia*, *Ulmus minor*, *Salix alba*, *Salix spp.*, *Alnus spp.*, lianas and often species of the *Quercetalia ilicis*. *Populus alba*, usually dominant in height, may be absent or sparse in some associations which are then dominated by *Fraxinus angustifolia*, *Ulmus minor* and/or *Salix spp.* (Oberdorfer, 1953; Horvat *et al.*, 1974; Dierschke, 1980; Molinier and Martin, 1980; Yon and Tendron, 1981; Guinochet and Vilmorin, 1983)

44.61

MEDITERRANEAN RIPARIAN POPLAR FORESTS

Populenion albae

Riparian forests of base-rich soils submitted to seasonal, prolonged inundation with slow drainage, physiognomically dominated by tall *Populus alba* and/or *P. nigra*. *Fraxinus angustifolia* and *Salix alba* habitually accompany the poplars and may locally be quantitatively strongly dominant; such areas may, depending on their size, be treated as a local manifestation of a complex poplar ensemble, or listed under 44.63 or 44.141. The poplar forests are usually the tall ligneous vegetation belt closest to the water in riverside catenas. (Braun-Blanquet and de Bolos, 1957; Debazac and Mavrommatis, 1971; Gausсен, 1972; Horvat *et al.*, 1974; Rivas-Martinez, 1975; Molinier *et al.*, 1976; Lavagne and Moutte, 1977; Girerd, 1978; Dierschke, 1980; Molinier and Martin, 1980; Ozenda, 1981; Harant and Jarry, 1982; Devaux *et al.*, 1983; Peinado Lorca *et al.*, 1984; Darracq *et al.*, 1984; Gamisans, 1985; Dupias, 1985; Chiappini, 1985b; Fernandes Gonzalez, 1986; Asensi Marfil and Diez Garretas, 1987; Navarro Andres and Valle Gutierrez, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Vigo and Ninot, 1987; Martinez Parras *et al.*, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Baudière *et al.*, 1988; Rallo and Pandolfi, 1988)

44.611

Iberian poplar galleries

Rubio tinctori-Populetum albae, *Rubo caesi-Populetum albae*; *Salici atrocinereae-Populetum albae*, *Nerio oleandri-Populetum albae*

Riparian poplar galleries on inundatable eutrophic soils with permanent hydromorphy of the Iberian range, the Castilian plateau, the Ebro basin, the Mediterranean Iberian east, the great Baetic rivers, with *Populus alba*, *P. nigra*, arborescent willows (*Salix neotricha*, *S. alba*, *S. fragilis*, *S. atrocinerea*), *Fraxinus angustifolia*, *Ulmus minor* and *Celtis australis*. The naturalized madder, *Rubia tinctorum*, grows in the shade of the eastern and central formations, the Atlantic *Salix atrocinerea* is an important component of the formations of the central Meseta, the Montes de Toledo and western Andalusia, and *Nerium oleander* penetrates the most thermophilous western Andalusian formations.

44.612

Provenço-Languedocian poplar galleries

Populetum albae p.

Riparian gallery forests lining water courses and other water bodies of Provence and Languedoc, in particular the rivers of the Mediterranean periphery of the Pyrenees, the Languedocian rivers draining the Causses and the southern Central Massif, the Rhône and Durance systems, especially the Camargue, the Verdon, the Var, with *Populus alba*, *P. nigra*, *Ulmus minor*, *Fraxinus angustifolia* (locally accompanied by *F. excelsior*), *Acer negundo*, *A. campestre*, *A. platanoides*, *Celtis australis*, *Quercus pubescens*, *Alnus glutinosa*, and an undergrowth with *Cornus sanguinea*, *Rubus caesius*, *Sambucus nigra*, *Vitis vinifera*, *Bryonia cretica*, *Humulus lupulus*, *Rubia peregrina*, *Solanum dulcamara*, *Alliaria petiolata*, *Cucubalus baccifer*, *Saponaria officinalis*, *Iris foetidissima*, *Arum italicum*, *Brachypodium sylvaticum*, *Carex pendula*; *Celtis australis* may form facies locally (e.g. Estérel).

44.613

Cyrno-Sardian poplar galleries

Populetum albae p.

Riparian woods of lower water courses of Corsica and Sardinia, with *Populus alba*, *P. nigra*, *Fraxinus ornus*, *F. angustifolia*, *Alnus glutinosa*, *A. cordata* and arborescent willows.

44.614

Italian poplar galleries

Populetum albae p.

Riparian poplar galleries of Italian rivers and other water bodies, with *Populus alba*, *P. nigra*, *Alnus glutinosa*, *Ulmus minor*, *Acer campestre*, *Viburnum lantana*, *V. opulus*, *Rhamnus catharticus*, *Crataegus monogyna*, *Rubus caesius*, *Humulus lupulus*, *Clematis vitalba*.

44.615

Greek poplar galleries

Populetum albae balcanicum

Riparian poplar galleries of Greek rivers and other water bodies, with *Populus alba*, *P. nigra*, *Ulmus minor*, *Alnus glutinosa*, *Platanus orientalis*, *Salix spp.*, *Periploca graeca*, *Pyracantha coccinea*, *Vitex agnus-castus*, *Cornus sanguinea*, *Brachypodium sylvaticum*.

44.6151

Nestos riparian forests

Hodja Orman forest of the Nestos, dominated by *Populus alba*, formerly one of the most extensive riparian complexes in the Balkans.

- 44.6152** **Greek white poplar riparian forests**
Other *Populus alba* riparian galleries.
- 44.6153** **Northern Greek black poplar riparian forests**
Populus nigra s.s.-dominated riparian galleries of northern Greece, in particular, in the Vertiskos massifs and the regions north of Drama.
- 44.6154** **Greek downy poplar riparian forests**
Populus nigra var. *pubescens* of, notably, Epirus and Thessaly.
- 44.62** **MEDITERRANEAN RIPARIAN ELM FORESTS**
Fraxino angustifoliae-Ulmenion minoris p.: *Aro italici-Ulmetum*, *Acantho mollis-Ulmetum minoris*
Ulmus minor-dominated woodlands, usually forming, on eutrophic soils, at the outer, drier, edge of the Mediterranean riparian or lacustrine galleries. *Populus alba* and *Fraxinus angustifolia* often participate in the tree-layer; *Arum italicum*, *Ranunculus ficaria*, *Acanthus mollis*, *Brachypodium sylvaticum*, *Elymus caninus*, *Rubus ulmifolius* are characteristic of the undergrowth. Dense and dark in natural form, these woods have been extremely reduced and degraded by human action. The most characteristic examples to remain are probably those of the Iberian peninsula, although fragments are still recorded in France, Italy and Greece.
(Horvat *et al.*, 1974; Rivas-Martinez, 1975; Lopez, 1976; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Devaux *et al.*, 1983; Peinado Lorca *et al.*, 1984; Fernandes Gonzalez, 1986; Loidi Arregui, 1987; Asensi Marfil and Diez Garretas, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Ladero Alvarez, 1987; Martinez Parras *et al.*, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Baudière *et al.*, 1988; Kassioumis, 1988; Rallo and Pandolfi, 1988)
- 44.63** **MEDITERRANEAN RIPARIAN ASH WOODS**
Fraxino angustifoliae-Ulmetum minoris p., *Fraxinion angustifoliae*
Riparian galleries dominated by tall *Fraxinus angustifolia*, mostly characteristic of less eutrophic soils than the elm and poplar galleries, and of drier stations, with shorter inundation periods, than those occupied by poplar woods.
(Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Rivas-Martinez, 1975; Lopez, 1976; Rivas-Martinez *et al.*, 1980; Dierschke, 1980; Pedrotti, 1980; Peinado Lorca *et al.*, 1984; Fernandes Gonzalez, 1986; Asensi Marfil and Diez Garretas, 1987; Navarro Andres and Valle Gutierrez, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Martinez Parras *et al.*, 1987; Aparicio Martinez and Silvestre Domingo, 1987)
- 44.631** **Iberian supra-Mediterranean ash galleries**
Quercus pyrenaicae-Fraxinetum angustifoliae
Fraxinus angustifolia and *Quercus pyrenaica*-dominated galleries of supra-Mediterranean watercourses of the Cordillera Central, the Leonese mountains and the Iberian Range, developed on siliceous, sandy soils with temporary hydromorphy (pseudogleys).
- 44.632** **Iberian meso-Mediterranean ash galleries**
Ficario ranunculoidis-Fraxinetum angustifoliae
Fraxinus angustifolia-dominated galleries of western Iberia, developed in meso- and thermo-Mediterranean areas on siliceous sandy, rarely inundated soils; *Populus alba*, *P. nigra*, *Salix atrocinerea*, *Rubus ulmifolius*, *Osmunda regalis*, *Ranunculus ficaria*, *Arum italicum* frequently accompany the ashes.
- 44.633** **Baetic ash-maple galleries**
Aceri granatensis-Fraxinetum angustifoliae
Meso- and supra-Mediterranean riparian galleries of the siliceous Sierra Nevada formed by *Fraxinus angustifolia* and *Acer granatense*.
- 44.634** **Tyrrhenian ash-alder galleries**
Alno-Fraxinetum angustifoliae p.
Fraxinus angustifolia-dominated galleries, usually with *Alnus glutinosa*, of southern France and Tyrrhenian northern and central Italy.

44.635

Italian ash galleries*Carici-Fraxinetum angustifoliae*

Fraxinus angustifolia-dominated galleries of the Adriatic slope of the Italian peninsula, the lower Po basin, the plain of Foggia, the Gulf of Taranto and Sicily, with *Ulmus campestris*, *Salix alba*, *Populus nigra*, *Equisetum telmateia*, *Brachypodium sylvaticum*, *Carex pendula*, *Ligustrum vulgare*, *Rubus ulmifolius*.

44.636

Greek ash galleries

Uncommon *Fraxinus angustifolia*-dominated galleries of continental Greece, reported in particular from the lower Achelos and Pinios.

44.64

HOP-HORNBEAM GALLERIES*Melico uniflorae-Ostryetum*

Ostrya carpinifolia-dominated alluvial galleries of the Var, in south-eastern France, with *Ulmus minor*, *Populus alba*, *Salix elaeagnos*, *Alnus glutinosa*, *Fraxinus ornus*, *Acer campestre*, *A. opalus*, *Quercus pubescens*, *Cornus sanguinea*, *Ligustrum vulgare*, *Laurus nobilis*, *Tamus communis*, *Hedera helix*, *Viola reichenbachiana*, *Euphorbia dulcis*, *Brachypodium sylvaticum*, *Melica uniflora*, *Carex pendula*, *C. digitata* and the rare *Carex grioletii*.

(Lapraz, 1981)

44.7

ORIENTAL PLANE AND SWEET GUM WOODS

Forests and woods, for the most part riparian, dominated by *Platanus orientalis* or *Liquidambar orientalis*.

44.71

ORIENTAL PLANE WOODS*Platanion orientalis*Forests of *Platanus orientalis*.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Dierschke, 1980; Yon and Tendron, 1981; Groppali *et al.*, 1983; Pratesi and Tassi, 1985)

44.711

Greek riparian plane forests

Platanus orientalis gallery forests of Greek watercourses, temporary rivers and gorges; they are distributed throughout the mainland and archipelagoes, colonizing poorly stabilized alluvions of large rivers, gravel or boulder deposits of permanent or temporary torrents, spring basins, and particularly, the bottom of steep, shady gorges, where they constitute species-rich communities. The accompanying flora may include *Salix alba*, *S. elaeagnos*, *S. purpurea*, *Alnus glutinosa*, *Cercis siliquastrum*, *Celtis australis*, *Populus alba*, *P. nigra*, *Juglans regia*, *Fraxinus ornus*, *Alnus glutinosa*, *Crataegus monogyna*, *Cornus sanguinea*, *Ruscus aculeatus*, *Vitex agnus-castus*, *Nerium oleander*, *Rubus spp.*, *Rosa sempervirens*, *Hedera helix*, *Clematis vitalba*, *Vitis vinifera*, *Ranunculus ficaria*, *Anemone blanda*, *Aristolochia rotunda*, *Saponaria officinalis*, *Symphytum bulbosum*, *Hypericum hircinum*, *Calamintha grandiflora*, *Melissa officinalis*, *Helleborus cyclophyllus*, *Cyclamen hederifolium*, *C. repandum*, *C. creticum*, *Galanthus nivalis* ssp. *reginae-olgae*, *Dracunculus vulgaris*, *Arum italicum*, *Biarum tenuifolium*, *Brachypodium sylvaticum*, *Dactylis glomerata* and may be rich in mosses, lichens and ferns, among which *Pteridium aquilinum* is often abundant. Various associations have been described, reflecting regional and ecological variation in the composition of the undergrowth. The plane tree galleries are particularly well represented along the Ionian coast and in the Pindus; other important local complexes exist in Macedonia, in Thrace, around the Olympus massif, in the Pelion, in the Peloponnese, particularly in the Taygetos, where luxuriant gorge forests reach 1 300 m, in Euboea and in Crete; local, distinctive, representatives occur in other Aegean islands, such as Rhodes, Samos, Samothrace, Thasos. Restriction to gorges is increasingly pronounced towards the south.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Dierschke, 1980; Strid, 1980; Sfikas, 1984)

44.712

Greek slope plane woods

Platanus orientalis woods on colluvions, detritus cones, ravine sides or other poorly stabilized substrates.

(Debazac and Mavrommatis, 1971)

44.713 Sicilian plane tree canyons

Relict *Platanus orientalis*-dominated or -rich galleries of the Cassabile, the Anapo, the Irminio and the Carbo rivers, in the Iblei range of south-eastern Sicily, of the gorge of the Sirmeto, in the vicinity of the Nebrodi. Some of these formations, in particular, in the gorges of the Cassabile and of the Anapo, are true plane tree woods. Others, such as on the Sirmeto, are *Populus alba*, *Fraxinus angustifolia*, *Salix spp.* formations with *Platanus orientalis*; as they grade into each other, and because of the very isolated occurrence, and great biogeographical and historical interest of *Platanus orientalis* in Sicily, they are all listed here. Plane tree woods have had a much greater extension in Sicily and probably in Calabria. A large forest has, in particular, existed on the Alcantara, where the species is now extinct.

(Groppali *et al.*, 1983; Pratesi and Tassi, 1985)

44.72 SWEET GUM WOODS

Liquidambar orientalis gallery of the Petaloudhes Valley, on Rhodes.

(Rechinger, 1951; Sfikas, 1984)

44.8 SOUTHERN RIPARIAN GALLERIES AND THICKETS

Low ligneous formations of wetlands of the thermo-Mediterranean zone and of south-western Iberia.

44.81 OLEANDER, CHASTE TREE AND TAMARIX GALLERIES

Nerio-Tamaricetea

Thickets and galleries of *Nerium oleander*, *Vitex agnus-castus* or *Tamarix spp.*, mostly of the thermo-Mediterranean zone.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Horvat *et al.*, 1974; Yon and Tendron, 1981; Géhu, 1984; Izco *et al.*, 1984; Veri and Pacioni, 1985; Chiappini, 1985a, b)

44.811 Oleander galleries

Nerion oleandri p.

Nerium oleander cordons and screens, often with *Tamarix spp.*, *Vitex agnus-castus*, *Ditrichia viscosa*, *Saccharum ravennae*, *Arundo donax*, *Rubus ulmifolius*, most typical of temporary water courses, but also lining small and sometimes large rivers, marking springs and areas of high water table in southern and eastern Iberia, very locally in eastern Provence, Liguria and Corsica (Saint-Florent), in southern Italy, Sardinia and Sicily, in southern and western Greece, the Aegean and Ionian archipelagoes, and Crete. They are particularly abundant in the south and east of Iberia, in Sicily and in the Aegean region.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Horvat *et al.*, 1974; Pignatti, 1982; Lopez Gonzalez, 1982; Sfikas, 1984; Izco *et al.*, 1984; Fenaroli, 1984; Gamisans, 1985; Pratesi and Tassi, 1985; Veri and Pacioni, 1985; Chiappini, 1985a, b; Costa, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Ferioli, 1989)

44.812 Chaste tree thickets

Nerion oleandri p.: Vinco majoris-Viticetum agni-casti i.a.

Vitex agnus-castus formations of temporary water courses and other humid sites within, mostly, the thermo-Mediterranean zone. They occur, though uncommonly, in the Mediterranean south and east of Spain and in the Balearics; they are local and rare in eastern Provence, the Tyrrhenian coast of Italy, Puglia, the gulf of Taranto, Corsica, Sardinia and Sicily. They are frequent in Greece, particularly along the Ionian coasts, where they can constitute dense thickets, uncommon again in the Aegean archipelagoes and Crete.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Horvat *et al.*, 1974; Pignatti, 1982; Lopez Gonzalez, 1982; Izco *et al.*, 1984; Sfikas, 1984; Gamisans, 1985; Chiappini, 1985a, b)

44.813 Tamarisk thickets

Formations, mostly of Mediterranean and thermo-Atlantic coasts and lowlands, dominated by *Tamarix spp.*

44.8131

West Mediterranean tamarisk thickets

Tamaricion africanae: *Tamaricetum gallica*, *Polygono equisetiformis-Tamaricetum africanae*, *Glycirrhizo glabrae-Tamaricetum canariensis* i.a.

Tamarix gallica, *T. africana* or *T. canariensis* thickets of water-course galleries, humid depressions and slightly saline coastal flats in Iberia, southern and western France, peninsular Italy, the Balearics, Corsica, Sardinia and Sicily. The accompanying flora comprises *Scirpus holoschoenus*, *Saccharum ravennae*, *Arundo donax*, *Brachypodium phoenicoidis*, *Piptatherum miliaceum*, *Asparagus acutifolius*, *Equisetum ramosissimum*, *Rubia peregrina*, *R. longifolia*, *R. angustifolia*, *Dittrichia viscosa*.

(Pignatti, 1982; Lopez Gonzalez, 1982; Izco *et al.*, 1984; Fenaroli, 1984; Gamisans, 1985; Pratesi and Tassi, 1985; Veri and Pacioni, 1985; Chiappini, 1985a, b; Fernandez Gonzalez, 1986; Alcaraz Ariza and Peinado Lorca, 1987; Ferioli, 1989)

44.8132

Macaronesian tamarisk thickets

Tamarix spp.-dominated formations of the Canary Islands and Madeira.

44.81321

Canarian tamarisk thickets

Tamarix canariensis and *T. africana* galleries and thickets of the lower zone of the Canary Islands, lining the low part of barrancos and occupying the deltas of greater water courses. They are particularly abundant in the eastern desert islands, Lanzarote and, mostly, Fuerteventura, where they constitute one of the principal ligneous habitats for the fauna. They have also important representatives along the north coast of Tenerife and on Gran Canaria (Charca de Maspalomas, La Aldea).

(Wilpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988)

44.81322

Madeiran tamarisk thickets

Tamarix gallica thickets of the lowlands of Madeira.

(Duvigneaud, 1977)

44.8133

East Mediterranean tamarisk thickets

Tamaricetum parviflorae, *Tamaricetum tetrandrae* i.a.

Tamarix parviflora, *T. tetrandra*, *T. dalmatica*, *T. smyrnensis* and *T. hampeana* thickets of lowland water-course galleries, humid depressions and slightly saline coastal flats of Greece and its islands.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Sfikas, 1984; Izco *et al.*, 1984; Yatridis, 1988)

44.8134

Hyper-saline tamarisk stands

Tamaricion boveana-canariensis

Thickets of *Tamarix boveana*, *T. canariensis* or, sometimes, *T. gallica*, accompanied by typical salt marsh flora, in particular, *Arthrocnemum fruticosum*, *A. glaucum*, *Suaeda brevifolia*, *Halimione portulacoides*, *Atriplex halimus*, *A. hastata*, *Limonium lactibracteatum*, *L. eugeniae*, *L. cossonianum*, *L. angustibracteatum*, *L. sinuosum*, *Inula crithmoides*.

(Horvat *et al.*, 1974; Polunin, 1980; Izco *et al.*, 1984; Fernandez Gonzalez, 1986; Costa, 1987; Alcaraz Ariza and Peinado Lorca, 1987)

44.81341

***Tamarix boveana* stands**

Inulo crithmoidis-Tamaricetum boveanae

Rare and vulnerable formations of the Ibero-African *Tamarix boveana*, alone or associated with *T. canariensis*, characteristic of arid areas of eastern Iberia, limited to a few stations in the arid South-east (Murcia, Almeria, Alicante), the Ebro depression (Salada de Chiprana), the Ebro delta and Majorca (Alcudia).

44.81342

Saline *Tamarix canariensis* stands

Agrostu stoloniferae-Tamaricetum canariensis, *Lycio intricati-Tamaricetum canariensis*

Formations of *Tamarix canariensis*, sometimes with *T. gallica*, characteristic of strongly saline sites, in particular, of Iberian interior saline depressions (La Mancha) and of arid south-east coastal areas.

44.81343

Saline eastern tamarisk stands

Tamarix smyrnensis, *T. hampeana*, *T. dalmatica* stands of the strongly saline part of Greek coastal marshes.

44.82

SOUTH-WESTERN IBERIAN TAMUJARES

Securinegion tinctoriae: Pyro bourgaeanae-Securinegetum tinctoriae

Low, spiny, almost monospecific fringes formed by the Ibero-African shrubby spurge *Securinega tinctoria* on the outer edge of temporary or permanent water courses of great seasonal amplitude in the south-western quadrant of the Iberian peninsula (Montes de Toledo, Sierra Morena, Extremadura, south-western Andalusia, southern Portugal). Among the few associated plants, are the lianas *Bryonia cretica*, *Tamus communis* and the endemic *Clematis campaniflora*. *Pyrus bourgaeana* may transgress from neighbouring communities.

(Delvosalle and Duvigneaud, 1962; Rivas Martinez, 1974; Lopez Gonzalez, 1982; Géhu, 1984; Ladero, 1987)

44.83

ORETANIAN LAURIPHYLLOUS GALLERIES

Viburno tini-Prunetum lusitanicae

Supra- and upper meso-Mediterranean riparian galleries of the Montes de Toledo (Cordillera Oretana), constituted by the lauriphyllous *Prunus lusitanica* and *Viburnum tinus*; they line water courses on the inner edge of alder galleries of 44.551 and 44.552, which they sometimes entirely replace.

(Ladero, 1987)

44.84

ORETANIAN BOG-MYRTLE WILLOW SCRUB

Frangulo-Myricaetum galeae

Tall scrub of Montes de Toledo streams, with *Frangula alnus*, *Salix atrocinerea*, *S. salvifolia* and *Myrica gale*.

(Peinado *et al.*, 1983; Ladero, 1987)

44.9

ALDER, WILLOW AND BOG-MYRTLE SWAMP WOODS

Alnetea glutinosae

Woods and scrubs of marshy ground, waterlogged for most of the year, colonizing fens and marshy or permanently inundated alluvial terraces of rivers.

44.91

ALDER SWAMP WOODS

Alnion glutinosae

Marshy *Alnus glutinosa*-dominated formations, usually with shrubby willows in the undergrowth.

(Noirfalise and Sougnez, 1961; Ellenberg, 1963, 1988; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Yon and Tendron, 1981; Noirfalise, 1984; Noirfalise *et al.*, 1985; Izco Sevillano, 1987; Oberdorfer, 1990; Rodwell, 1991)

44.911

Meso-eutrophic swamp alder woods

Carici elongatae-Alnetum (Irido-Alnenion)

Mesotrophic and meso-eutrophic *Alnus glutinosa* swamp woods of marshy depressions, with *Carex elongata*, *Thelypteris palustris*, *Dryopteris cristata*, *Osmunda regalis*, *Solanum dulcamara*, *Calystegia sepium*, *Ribes nigrum*, and often, in acidocline variants, *Betula pubescens*. The constancy of *Carex elongata* is characteristic on the continent, less so in Britain. Tall sedges, *Carex paniculata*, *C. acutiformis*, *C. elata*, often dominate the herb layer in the most humid types.

44.9111

Atlantic greater tussock-sedge alder woods

Alnus glutinosa-Carex paniculata formations of the British Isles, poor in *Carex elongata*, and harbouring, in particular, *Oenanthe crocata* and abundant *Osmunda regalis*.

44.9112

Elongated-sedge swamp alder woods

Carici elongatae-Alnetum

Formations of sub-Atlantic and subcontinental regions of the continent characterized in particular by the constant presence of *Carex elongata*.

- 44.912** **Oligotrophic swamp alder woods**
Carici laevigatae-Alnetum (*Blechno-Alnenion: Blechno-Alnetum, Sphagno-Alnetum*)
 Oligotrophic or meso-oligotrophic, acidocline *Alnus glutinosa* woods of fens and poorly drained banks of brooks or small rivers, mostly characteristic of siliceous regions and Atlantic climates, south to Galicia. *Betula pubescens* and *Frangula alnus* often accompany the alders. The ground layer is usually rich in *Sphagnum* spp. and includes *Carex laevigata*, *Equisetum sylvaticum* and many ferns, including *Oreopteris limbosperma*, *Blechnum spicant*, *Athyrium filix-femina*, *Dryopteris cristata* and *D. carthusiana*.
- 44.913** **Mediterranean swamp alder woods**
 Rare swamp woods of the Mediterranean evergreen oak zone, such as the Athos peninsula swamp wood with *Arundo donax*, *Equisetum telmateia*, *Carex pendula*, *C. remota*, *Humulus lupulus*, *Osmunda regalis*.
- 44.92** **MIRE WILLOW SCRUB**
Salicion cinereae (*Frangulo-Salicion auritae*)
 Willow-dominated formations with *Salix aurita*, *S. cinerea*, *S. atrocinerea*, *S. pentandra*, *Frangula alnus*, *Betula humilis*, of fens, marshy floodplains and fringes of lakes and ponds.
 (Noirfalise, 1964; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Ellenberg, 1988; Oberdorfer, 1990; Rodwell, 1991)
- 44.921** **Grey willow scrub**
 Mesotrophic or eutrophic *Salix cinerea* or *S. aurita* and *Alnus glutinosa* scrubs of mires, fens, and water fringes.
- 44.922** **Sphagnum willow scrub**
 Oligotrophic *Salix aurita* or *B. carpatica* scrubs, rich in sphagnum, of bog edges and acid fens.
- 44.923** **Bay willow scrub**
 Tall *Salix pentandra* formations.
- 44.924** **Dwarf mire willow scrub**
 Dwarf *Salix repens*, *S. rosmarinifolia* and *Betula humilis* scrubs of bogs and fens.
- 44.93** **SWAMP BOG-MYRTLE SCRUB**
Salicion cinereae p.: *Myricetum gale*
Myrica gale thickets of fringes of fens, drying fens and nascent or regenerating bogs of middle Europe, mostly characteristic of the Atlantic sector.
 (Lebrun *et al.*, 1949; Westhoff and den Held, 1975; Ellenberg, 1988; Oberdorfer, 1990)
- 44.A** **BIRCH AND CONIFER SWAMP WOODS**
Vaccinio-Piceetea: Piceo-Vaccinienion uliginosi (*Betulion pubescentis, Ledo-Pinion*) i.a.
 Woods of *Betula pubescens*, *Pinus* spp. or *Picea abies* colonizing bogs and acid fens.
- 44.A1** **SPHAGNUM BIRCH WOODS**
Betuletum pubescentis (*Vaccinio uliginosi-Betuletum pubescentis*); *Sphagno palustris-Betuletum pubescentis* i.a.
 Forests of *Betula pubescens* or *B. carpatica* on peaty, humid and very acid soils, colonizing bogs of reduced peat building activity and acid fens, with *Molinia caerulea*, *Vaccinium uliginosum*, *V. myrtillus*, *Empetrum nigrum*, *Trientalis europaea* and many sphagnums, mosses and liverworts.
 (Ellenberg, 1963, 1988; Noirfalise *et al.*, 1971; Westhoff and den Held, 1975; Mériaux *et al.*, 1978; Bournérias, 1979, 1984; Noirfalise, 1984; Oberdorfer, 1990)
- 44.A11** **Cottongrass sphagnum birch woods**
Sphagno-Betuletum eriophoretosum vaginati, Erico-Sphagnetum betuletosum
 Sphagnum-rich *Betula pubescens* or *B. carpatica* woods in which bog species, in particular *Eriophorum vaginatum* and *Vaccinium oxycoccos*, are prominent.

44.A12

Sedge sphagnum birch woods*Sphagno-Betuletum agrostido-caricetosum nigrae*

Sphagnum-rich *Betula pubescens* or *B. carpatica* woods in which *Molinia caerulea* is accompanied by a cortège of acid fen species, in particular, *Carex rostrata*, *C. nigra*, *C. echinata*, *Juncus acutiflorus*, *Agrostis canina*, *Nartheceum ossifragum*, *Calamagrostis canescens*.

44.A13

Meso-acidophilous sphagnum birch woods

Sphagnum-rich *Betula pubescens* or *B. carpatica* woods in which the presence of species characteristic of sub-humid mineral soils indicate a transition towards acidophilous birch and oak woods; *Salix cinerea*, *Alnus glutinosa*, *Lysimachia vulgaris*, *Luzula sylvatica*, *Oxalis acetosella*, *Deschampsia flexuosa* may be prominent, next to *Molinia caerulea*.

44.A2

SCOTS PINE BOG WOODS*Ledo-Pinetum (Vaccinio uliginosae-Pinetum sylvestris) i.a.*

Pinus sylvestris formations of bogs and transition mires with *Eriophorum vaginatum*, *Ledum palustre*, *Vaccinium uliginosum*, *Calluna vulgaris*, *Andromeda polifolia* restricted to the plains of northern and eastern Germany and to isolated stations in the Hercynian arc. (Ellenberg, 1963, 1988; Petermann and Seibert, 1979; Muller, 1985; Oberdorfer, 1990)

44.A3

MOUNTAIN PINE BOG WOODS*Vaccinio uliginosae-Pinetum rotundatae (Sphagno-Mugetum, Pino rotundatae-Sphagnetum p)*

Pinus rotundata (P. uncinata s.l., P. mugo) woods (var. *arborea*) or scrubs (var. *pseudopumilio*) of bogs in the Alps and peri-Alpine areas, the Jura and the higher Hercynian ranges, with *Eriophorum vaginatum*, *Vaccinium oxycoccus*, *V. uliginosum*, *V. myrtillus*, *Sphagnum spp.* and sometimes *Betula nana*.

(Ellenberg, 1963, 1988; Oberdorfer, 1967, 1990; Ozenda, 1975; Delvosalle, 1977; Petermann and Seibert, 1979)

44.A4

SPHAGNUM SPRUCE WOODS*Picea abies* woods with a sphagnum-rich ground layer.

(Ellenberg, 1963, 1988; Oberdorfer, 1967, 1990; Ozenda, 1975; Delvosalle, 1977; Petermann and Seibert, 1979)

44.A41

Montane sphagnum spruce woods*Sphagno-Piceetum, Soldanello-Piceetum bazzanietosum i.a.*

Often dense *Picea abies* forests on peaty soils carpeted with sphagnum and mosses, accompanied by an understorey of *Maianthemum bifolium*, *Vaccinium myrtillus*, *V. vitis-idaea*, *Deschampsia flexuosa*, *Calamagrostis villosa*, *Blechnum spicant* and *Listera cordata*.

44.A42

Bog spruce woods

Picea abies formations colonizing raised bogs, with *Betula pubescens*, *B. carpatica*, *Vaccinium uliginosum*, *V. vitis-idaea*, *V. myrtillus*, *V. oxycoccus*, *Eriophorum vaginatum*, *Sphagnum magellanicum* and other sphagnums.

45 Broad-leaved evergreen woodland

Mediterranean forests dominated by broad-leaved evergreen trees. Laurel forests of the Atlantic islands. Holly woods.

45

45.1

OLIVE-CAROB FORESTS

Oleo-Ceratonion, *Ceratonio-Rhamnion*, *Kleinio-Euphorbietea canariensis p.*

Thermo-Mediterranean or thermo-Canarian woodland dominated by arborescent *Olea europaea* ssp. *sylvestris*, *Ceratonia siliqua*, *Pistacia lentiscus*, *Myrtus communis* or, in the Canary Islands, by *Olea europaea* ssp. *cerasiformis* and *Pistacia atlantica*. Most formations will be listed as arborescent matorral (35.12), but a few stands may have a sufficiently tall, closed canopy to qualify for this unit.

(Fenaroli, 1970; Lapraz, 1970; Horvat *et al.*, 1974; Ozenda *et al.*, 1979; Quézel, 1981; Tomaselli, 1981b; Groppali *et al.*, 1983; Noifalise, 1986; Fernandez Gonzalez, 1986; Asensi and Diez Garretas, 1987; Rivas-Martinez and Costa, 1987; Serrada *et al.*, 1988)

45.11

WILD OLIVE WOODLAND

Olea europaea ssp. *sylvestris*-dominated formations. The most developed examples are found in southern Andalusia (*Tamo communis-Oleetum sylvestris*: extinct?), in Menorca (*Prasio majoris-Oleetum sylvestris*), Sardinia, Sicily, Calabria, Crete.

45.12

CAROB WOODLAND

Ceratonia siliqua-dominated formations, often with *Olea europaea* ssp. *sylvestris* and *Pistacia lentiscus*. The most developed examples, some truly forest-like, are to be found in Majorca (*Cneoro tricocci-Ceratonietum siliquae*), eastern Sardinia, south-eastern Sicily, Puglia, Crete.

45.13

CANARIAN OLIVE WOODLAND

Olea europaea ssp. *cerasiformis* and *Pistacia atlantica* formations of the Canary Islands.

45.2

CORK-OAK FORESTS

West-Mediterranean silicicolous forests dominated by *Quercus suber*, usually more thermophile and hygrophile than 45.3.

(Fenaroli, 1970, 1985; Tomaselli, 1970; Rivas-Martinez, 1974; Ortuno and Ceballos, 1977; Lambinon *et al.*, 1978; Ozenda *et al.*, 1979; Rivas-Martinez *et al.*, 1980; Quézel, 1981; Groppali *et al.*, 1981, 1983; Ozenda, 1981; Géhu and Géhu-Franck, 1984c; Gamisans, 1985; Chiappini, 1985a, b; Pratesi and Tassi, 1985; Veri and Pacioni, 1985; Noifalise, 1986, 1987; Fernandez Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Barneschi, 1988)

45.21

TYRRHENIAN CORK-OAK FORESTS

Quercion suberis

Mostly meso-Mediterranean *Quercus suber* forests of Italy, Sicily, Sardinia, Corsica, France and north-eastern Spain. They are most often degraded to arborescent matorral (32.11).

45.211

Provençal cork-oak woodland

Formations of crystalline Provence (Maures, Esterel), no longer represented by fully developed, mature stands.

45.212

Corsican cork-oak woodland

Formations of the lower meso-Mediterranean level of Corsica, developed on deep siliceous soils, mostly of the south-eastern part of the island; better preserved than on the continent, they are nevertheless almost never represented by fully developed, extensive forest.

45.213

Sardinian cork-oak forests

Extensive, widespread and varied forests of Sardinia, extending from sea level to about 900 m in non-calcareous mountains. *Q. suber* is sometimes associated with *Q. ilex* or *Q. pubescens*. These forests include luxuriant, fully developed, mature formations, by far the best-preserved cork-oak forests in the central Mediterranean basin.

- 45.214 Central Italian cork-oak forests**
Very local, relict coastal forests of Tuscany and Latium in which *Q. ilex* often accompanies *Q. suber*.
- 45.215 Southern Italian cork-oak forests**
Very local formations of Calabria, Puglia and of northern and south-eastern Sicily (Monte Scorace; Bosco di San Pietro, western Iblei), for the most part very degraded.
- 45.216 Catalan cork-oak woodland**
Quercus suber-dominated facies appearing on the more oligotrophic soils within the meso-Mediterranean *Q. ilex* zone of Catalonia and the Pyrenean foothills.
- 45.217 Valencian cork-oak woodland**
Asplenio onopteridis-Quercetum suberis
Isolated, relict formations of the Sierra Espadan, Valencia.
- 45.218 Balearic cork-oak woodland**
Quercus suber-dominated facies appearing on deep siliceous soils of the thermo-Mediterranean *Q. rotundifolia* formations of Menorca.
- 45.22 SOUTH-WESTERN IBERIAN CORK-OAK FORESTS**
Quercion fagineo-suberis
Quercus suber forests, often with *Q. faginea* or *Q. canariensis*, of the south-western quadrant of the Iberian peninsula.
- 45.221 Thermo-Mediterranean cork-oak woodland**
Oleo sylvestris-Quercetum suberis
Subhumid thermo-Mediterranean forests and woodlands of the south-western Iberian peninsula, occurring in sandy coastal areas of western Andalusia and the Algarve, as well as at lower elevations of the Sierras of the Campo de Gibraltar, immediately below the following formation, and characterized by the presence of *Olea europaea* ssp. *sylvestris* and other thermo-Mediterranean elements.
- 45.222 Aljibian cork-oak forests**
Teucro baetici-Quercetum suberis
Luxuriant, fully developed, humid and hyperhumid meso- to thermo-Mediterranean forests occupying, with the more exiguous and even more umbrophilous *Q. canariensis* formations, the higher elevations of the Sierras of the Campo de Gibraltar and a few enclaves of the Sierra de Ronda, with elements of north African oak forests such as *Teucrium scorodonia* ssp. *baeticum* and *Ruscus hypophyllum*; they are best represented in the Sierra de Aljibe, and are, next to those of Sardinia, the best-preserved cork-oak forests of the Community.
- 45.223 Eastern Andalusian cork-oak woodland**
Adenocarpo-Quercetum suberis
Isolated, relict meso-Mediterranean forest of the Sierra de la Contraviesa, eastern Andalusia.
- 45.224 Extremaduran cork-oak woodland**
Sanguisorbo agrimonioidis-Quercetum suberis
Meso-Mediterranean forests of the Sierra Morena, the Montes de Toledo system and lower southern slopes of the Cordillera Central (Extremadura and surrounding regions), only locally well developed, with lauriphyllous undergrowth or mantle.
- 45.23 NORTH-WESTERN IBERIAN CORK-OAK WOODLAND**
Holco-Quercetum pyrenaicae p.
Very local, exiguous *Q. suber* enclaves in the *Q. pyrenaica* forest area of the valleys of the Sil and of the Mino (Galicia).
- 45.24 AQUITANIAN CORK-OAK WOODLAND**
Isolated *Q. suber*-dominated stands occurring either as a facies of dunal pine-cork oak forests or in a very limited area of the eastern Landes.

45.3

MESO- AND SUPRA-MEDITERRANEAN HOLM-OAK FORESTS*Quercion ilicis*

Forests dominated by *Quercus ilex* or *Q. rotundifolia*, often, but not necessarily, calcicolous.

(Rechinger, 1951; Ocana-Garcia, 1958; Kornas, 1959; Bolos and Molinier, 1960; Jasiewicz, 1963; Amaral Franco, 1965; Archiloque, *et al.*, 1969; Fenaroli, 1970; Tomaselli, 1970; Horvat *et al.*, 1974; Lapraz, 1975; Ozenda, 1975; Margot and Romain, 1976; Ortuno and Ceballos, 1977; Brullo *et al.*, 1977; Lambinon *et al.*, 1978; Sfikas, 1978; Ozenda *et al.*, 1979; Polunin, 1980; Groppali *et al.*, 1980, 1981, 1983; Ozenda, 1981; Quézel, 1981; Géhu and Géhu-Franck, 1984c; Chiappini, 1985a, b; Dupias, 1985; Veri and Pacioni, 1985; Fenaroli, 1985; Gamisans, 1985; Noirfalise, 1986, 1987; Fernandez Gonzalez, 1986; Peinado-Lorca and Rivas-Martinez, 1987; Barneschi, 1988; Baudière *et al.*, 1988)

45.31

MESO-MEDITERRANEAN HOLM-OAK FORESTS

Rich meso-Mediterranean formations, penetrating locally, mostly in ravines, into the thermo-Mediterranean zone. They are often degraded to arborescent matorral (32.11), and some of the types listed below no longer exist in the fully developed forest state relevant to category 45; they have nevertheless been included, both to provide appropriate codes for use in 32.11, and because restoration may be possible.

45.311

North-western Iberian holm-oak forests*Lauro nobilis-Quercetum ilicis*

Quercus ilex forests with exuberant undergrowth of Mediterranean, often lauriphyllous, small trees, shrubs, and lianas, including *Laurus nobilis*, *Rhamnus alaternus*, *Arbutus unedo*, *Phillyrea media*, *Rosa sempervirens*, *Rubia peregrina*, *Smilax aspera*, *Hedera helix*, often well-preserved on steep slopes of the calcareous mountains rising above the southern coast of the Bay of Biscay.

45.312

Catalo-Provençal lowland holm-oak woodland*Viburno tini-Quercetum ilicis* = *Quercetum galloprovinciale*

Lower meso-Mediterranean *Quercus ilex* formations of Catalonia, Languedoc and Provence rich in lauriphyllous and sclerophyllous shrubs and lianas, in particular *Viburnum tinus*, *Arbutus unedo*, *Smilax aspera*, *Phillyrea latifolia*, *Ruscus aculeatus*, *Rubia peregrina*; they are mostly degraded to arborescent matorral, the few remaining groves of holm oaks with a forest-like canopy being generally heavily modified by intensive human use.

45.313

Catalo-Provençal hill holm-oak forest*Asplenio onopteridis-Quercetum ilicis* = *Quercetum mediterraneo-montanum*

Humid upper meso-Mediterranean *Quercus ilex* formations of Montseny, Valles, Montserrat, Prades, Ports de Beseit, eastern Pyrenees, high Languedoc, Cévennes, upper Provence and south-western Alps with an undergrowth poorer in shrubs, especially those of eu-Mediterranean affinities, and richer in often acidocline herbaceous species characteristic of supra-Mediterranean deciduous oak woods. Well-developed stands with full forest characteristics exist in several locations on the slopes of well-watered hills, in particular the tall, dense canopy of Montseny. Sparser, lower formations colonize many rocky hillsides in the entire upper meso-Mediterranean arc of the Gulf of Lions basin, locally ascending into the supra-Mediterranean level.

45.314

Balearic holm-oak forests*Cyclamino balearici-Quercetum ilicis*

Humid *Quercus ilex* formations, often well developed, of the higher mountains of northern Majorca, in which the thermo-Mediterranean elements of the *Q. rotundifolia* formations of lower altitude have given way to more hygrophilous elements such as *Viburnum tinus*, *Viola dehnhardtii*, *Monotropa hypopitys*, *Neottia nidus-avis*, *Cephalanthera spp.*; they are rich in endemics, among which *Cyclamen balearicum*, *Smilax aspera* var. *balearica*, *Rhamnus ludovici-salvatoris*, *Paeonia cambessedesii*.

45.315

Corsican lowland holm-oak woodland

Quercus ilex formations of the lower meso-Mediterranean level of Corsica with *Viburnum tinus*, *Erica arborea*, *Lonicera implexa*, *Phillyrea angustifolia*, *Clematis flammula*, *Smilax aspera*, *Rubia peregrina*; generally degraded to arborescent matorral or dense coppice, they still include, mostly above 400 m of altitude, a few better-preserved woodland fragments.

45.316

Corsican hill holm-oak woodland

Quercus ilex formations of the upper meso-Mediterranean level (500-600 m to 1 100-1 200 m) of Corsica with *Arbutus unedo*, *Erica arborea*, *Viburnum tinus*, *Ilex aquifolium*, *Daphne laureola*, *Teucrium scorodonia*, *Helleborus lividus*, *Cyclamen repandum*, *Sanicula europaea*, *Melica uniflora*; often installed on steep slopes, they include rather more stands with forest characteristics than the lowland formations.

45.317

Sardinian holm-oak forests

Lower and upper meso-Mediterranean *Q. ilex* forests of Sardinia with *Viburnum tinus*, *Phillyrea angustifolia*, *P. latifolia*, *Rhamnus alaternus*, *Arbutus unedo*, *Erica arborea*, *Ruscus aculeatus*, *Crataegus monogyna*, *Rubia peregrina*, *Smilax aspera*, *Clematis flammula*, *C. cirrhosa*, *C. vitalba*, *Rosa sempervirens*, *Tamus communis*, *Rubus ulmifolius*, *Cyclamen repandum*, *Carex halleriana*, *C. distachya*, *Luzula forsteri*, *Hedera helix*, *Lonicera implexa* and *Pistacia lentiscus* in more thermo-Mediterranean areas. Extensive, fully developed, mature stands survive in particular in the hinterland of the Golfo di Orosei, around Mount Gennargentu, in the Barbagia, the Iglesiente, the Sarrabus, the Catena di Margine, on Monte Albo. They occupy a wide altitudinal range, grading at the upper limit into the more sub-Mediterranean formations of 45.32.

45.318

Northern and central Italian holm-oak forests

Quercus ilex-dominated formations of Tyrrhenian and Adriatic coastal areas of the northern half of the Italian peninsula with *Phillyrea media*, *P. angustifolia*, *Viburnum tinus*, *Ruscus aculeatus*, *Daphne gnidium*, *Fraxinus ornus*, *Rosa sempervirens*, *Lonicera implexa*, *Rubia peregrina*, *Smilax aspera*, *Myrtus communis*, *Clematis flammula*, *Tamus communis*, *Carex olbiensis*, *Luzula forsteri*, *Cyclamen repandum* and often an admixture of *Quercus suber* or of the deciduous *Q. pubescens* and *Q. cerris*; at higher altitude they take on a more montane character with a greater prevalence of sub-Mediterranean elements. Although these formations are, like most other continental holm-oak communities, mostly degraded to arborescent matorral or coppice, fully developed forests subsist very locally, in particular in Tuscany and Latium and, to a lesser extent, in Veneto and Emilia-Romagna.

45.319

Illyrian holm-oak woodland*Orno-Quercetum ilicis*

Quercus ilex-dominated formations, restricted in the Community to steep slopes of the Riviera Triestina, similar in composition to those of the eastern Adriatic coast, with *Pistacia terebinthus*, *Fraxinus ornus*, *Coronilla emerus*, *Ostrya carpinifolia*, *Carpinus orientalis*, *Laurus nobilis*, *Lonicera etrusca*, *Clematis flammula*, *Rubia peregrina*, *Smilax aspera*, *Vitis vinifera*, *Cyclamen purpurascens*, *Prunus mahaleb*.

45.31A

Southern Italian holm-oak forests*Querco-Teucrietum siculi*

Mostly upper meso-Mediterranean *Quercus ilex*-dominated formations of southern Italy and Sicily with *Viola alba* ssp. *dehnhardtii*, *Teucrium siculum*, *Carex distachya*, *Cyclamen repandum*, *Pyrus amygdaliformis*, *Ruscus aculeatus*, *Cytisus villosus*, *Asparagus acutifolius*, *Rubia peregrina*, *Asplenium onopteris*, *Luzula forsteri*, *Lonicera etrusca*, *Smilax aspera*, *Rosa sempervirens* and, in some facies, *Chamaerops humilis*, *Pistacia lentiscus*, *Phillyrea media*, *Arbutus unedo*; like the preceding formations, they are usually degraded to arborescent matorral or coppice, but fine stands survive locally, particularly in Sicily, Puglia (e.g. Bosco delle Pianelle) and Calabria (e.g. Boschi di Badolato).

45.31B

Pantellerian holm-oak woodland*Viburno-Quercetum ilicis* p., *Erico Quercetum ilicis* p.

Relictual, mostly degraded pockets of acidophilous *Q. ilex* woodland of Pantelleria.

45.31C

Greek holm-oak woodland*Andrachno-Quercetum ilicis*

Quercus ilex-dominated formations of peninsular Greece and the Ionian and Aegean archipelagoes, with the exception of those of Crete; associated with *Q. ilex* are *Quercus coccifera*, *Arbutus andrachne*, *A. unedo*, *Phillyrea latifolia*, *Pistacia terebinthus*, *P. lentiscus*, *Olea europaea*, *Juniperus oxycedrus*; arborescent matorrals (32.1) occur throughout the area, though much less commonly than in the western Mediterranean; reasonably extensive, fully developed, mature forest stands do not appear to remain.

- 45.31D** **Cretan holm-oak woodland**
Cyclamino-Quercetum ilicis
 Uncommon *Quercus ilex* formations of Crete; small stands of arborescent matorral (32.1), in which *Q. ilex* may be associated with *Q. coccifera* or *Q. brachyphylla*, occur sporadically, particularly on rocky slopes; orchard-like groves of old *Q. ilex*, *Q. brachyphylla* and cultivated *Olea europaea* exist in the extreme west of the island; heavily grazed, they may be more akin to dehesa (84.5) than to forest.
- 45.32** **SUPRA-MEDITERRANEAN HOLM-OAK FORESTS**
 Formations of the supra-Mediterranean levels, often mixed with deciduous oaks, *Acer spp.* or *Ostrya carpinifolia*.
- 45.321** **French supra-Mediterranean holm-oak forests**
Quercus ilex formations colonizing, with a very reduced cortège of Mediterranean undergrowth species, localized, mostly rocky, stations in the supra-Mediterranean levels of the Pyrenees, Central Massif and Alps.
- 45.322** **Corsican supra-Mediterranean holm-oak forests**
Ilici-Quercetum ilicis
Quercus ilex formations of the supra-Mediterranean (*Pinus laricio*) level of Corsica with an undergrowth rich in mesophilous species and practically devoid of meso-Mediterranean elements.
- 45.323** **Sardinian supra-Mediterranean holm-oak forests**
 Uppermost levels of the *Quercus ilex* forests of the Gennargentu and Marghine regions of Sardinia with *Quercus pubescens*, *Taxus baccata*, *Ilex aquifolium*, *Acer monspessulanum*, *Ostrya carpinifolia*, *Amelanchier ovalis*. The separation between these formations and those of 45.31 is not as well-marked as in more northern locations; only the stations most impoverished in meso-Mediterranean elements should be listed here.
- 45.324** **Italian supra-Mediterranean holm-oak forests**
Quercus ilex-dominated formations colonizing enclaves within the supra-Mediterranean deciduous forest belt of northern and central Italy, in particular on sunny slopes of the southern Alps, of the Egadean hills and of the Bolognese Apennines, along the great Insubrian lakes, on sea-facing slopes of the Apennines of Tuscany, Latium, Marche and Abruzzi and in a few central valleys of the Apennines of Umbria and Latium, accompanied by an undergrowth typical of the *Ostryo-Carpinion*. Very well preserved, fully developed examples survive, in particular at Monte Subasio (Umbria).
- 45.33** **AQUITANIAN HOLM-OAK WOODLAND**
 Isolated *Quercus ilex*-dominated stands occurring as a facies of dunal pine-holm oak forests.
- 45.34** **QUERCUS ROTUNDIFOLIA WOODLAND**
 Iberian forest communities formed by *Q. rotundifolia*. Generally, even in mature state, less tall, less luxuriant and drier than the fully developed forests that can be constituted by the closely related *Q. ilex*, they are, moreover, most often degraded into open woodland or even arborescent matorral. Species characteristic of the undergrowth are *Arbutus unedo*, *Phillyrea angustifolia*, *Rhamnus alaternus*, *Pistacia terebinthus*, *Rubia peregrina*, *Jasminum fruticans*, *Smilax aspera*, *Lonicera etrusca*, *L. implexa*.
 (Rivas-Martinez, Diaz *et al.*, 1984; Fernandez-Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987)
- 45.341** **Continental *Quercus rotundifolia* woodland**
 Forests and woodland of *Q. rotundifolia* occupying mostly base-rich soils of the meso- and supra-Mediterranean areas of the central and eastern Meseta, of the edges of the Ebro basin and of their bordering northern and eastern mountain ranges, under fairly continental, dry climates.

- 45.3411 **Meso-Mediterranean formations**
Bupleuro rigidi-Quercetum rotundifoliae
Q. rotundifolia formations distributed over a large potential range on the Meseta and its margins, from the upper Ebro to the Valencian hinterland and the cold, dry plateaux of north-eastern Andalusia. Well-preserved examples are rare, most of the forests on good soils having been replaced by cultivation.
- 45.3412 **Supra-Mediterranean Iberian formations**
Junipero thuriferae-Quercetum rotundifoliae
 Basophilous, dry to sub-humid woodland widespread in the supra-Mediterranean levels of the Castilian Duero basin, and of the north-eastern mountains and plateaux associated with the Iberian Range. They are often rich in *Juniperus thurifera* and associate or alternate with juniper woodland and *Q. faginea* or *Q. pyrenaica* deciduous woodland.
- 45.3413 **Northern supra-Mediterranean formations**
Spiraeo obovatae-Quercetum rotundifoliae
Q. rotundifolia woods of superficial calcareous soils of crests, spurs and upper adret slopes of the upper Ebro basin and southern slopes of the Cordillera Cantabrica, locally entering also Euro-Siberian Cantabrian areas, with *Amelanchier ovalis*, *Rosa agrestis*, *Lonicera etrusca*, *Spiraea hypericifolia* ssp. *obovata*, *Juniperus communis*, *J. oxycedrus*, *J. phoenicea*.
- 45.3414 **Oro-Cantabrian formations**
Cephalanthero longifoliae-Quercetum rotundifoliae
 Relict, xerophile collinar-montane *Q. rotundifolia* and *Q. rotundifolia* x *Q. ilex* forests developed on mostly calcareous, well-drained shallow soils of steep slopes and gorges in the Cordillera Cantabrica and a very few areas of Galicia, rich in *Cephalanthera* and *Epipactis* orchids.
- 45.342 **Western *Quercus rotundifolia* woodland**
 Forests and woodland of *Q. rotundifolia* occupying mostly siliceous soils of the meso- and supra-Mediterranean areas of the western Meseta and neighbouring regions under more Atlantic, though generally dry, climates. Well-preserved examples are rare, most of the remaining wooded areas being under dehesa (84.5) regime.
- 45.3421 **Luso-Extremaduran formations**
Pyro bourgaenae-Quercetum rotundifoliae
 Meso-Mediterranean *Q. rotundifolia* formations widespread on the plains and plateaux of Extremadura, Alentejo and neighbouring regions, and in the Sierra Morena and the Montes de Toledo. It is almost entirely transformed into dehesa.
- 45.3422 **Castilian formations**
Genisto hystricis-Quercetum rotundifoliae
 More northern, upper meso-Mediterranean and lower supra-Mediterranean *Q. rotundifolia* formations, poorer in Mediterranean species, of the western plateaux of Old Castile and adjacent southern Leon and Galicia; *Genista hystrix* is a physiognomically striking element. Also essentially eliminated as forest formations, these woodlands constitute, together with the preceding unit, the basis for the western Iberian dehesa, one of the most characteristic landscapes of the peninsula and an important habitat of larger fauna.
- 45.3423 **Cordilleran formations**
Junipero oxycedri-Quercetum rotundifoliae
Q. rotundifolia formations of the Cordillera Central, characteristic of cool meso-Mediterranean and sunny supra-Mediterranean slopes of the Sierras de Guadarrama, de Gredos, de Bejar, de Ayllon and neighbouring areas; they extend east to siliceous enclaves of the Iberian Range. Adapted to a more continental climate than the two previous units, they are poorer in shrubs and lianas. They often constitute low, open woodland.
- 45.3424 **Villuercan formations**
 Summital *Q. rotundifolia* elfin forests of the high elevations of the Montes de Toledo.

- 45.343 Andalusian *Quercus rotundifolia* woodland**
Forests and woodland of *Q. rotundifolia* developed in the meso- and supra-Mediterranean levels of Baetic mountains and foothills, and neighbouring interior plains. Well-preserved examples are extremely rare.
- 45.3431 Meso-Mediterranean basophilous formations**
Paenion coriaceae-Quercetum rotundifoliae
Woodland dominated by *Q. rotundifolia* with *Juniperus oxycedrus*, *Daphne gnidium*, *Ruscus aculeatus*, *Asparagus acutifolius*, *Crataegus monogyna*, *Lonicera implexa*, *Rubia peregrina*, *Paeonia coriacea*, *P. broteroi*, *Endymion hispanicus* that represents the potential, mature vegetation of a great part of Andalusia, in the Guadalquivir basin, coastal areas and Baetic ranges, on base-rich and often silt-laden soils, under meso-Mediterranean conditions. They have been largely replaced by cultivation and, where they subsist, are often very degraded.
- 45.3432 Supra-Mediterranean basophilous formations**
Berberido hispanicae-Quercetum rotundifoliae
Woodland dominated by *Q. rotundifolia*, with *Q. faginea*, *Acer monspessulanum*, *Sorbus aria*, *S. aucuparia*, *Taxus baccata*, *Berberis hispanica*, *Crataegus monogyna*, *Lonicera arborea*, *Daphne laureola*, *Rosa spp.*, *Polygala boissieri*, *Helleborus foetidus* and many orchids, of the supra-Mediterranean level (1 400-1 900 m) of calcareous Baetic ranges.
- 45.3433 Meso- and supra-Mediterranean silicicolous formations**
Adenocarpo-Quercetum rotundifoliae
Q. rotundifolia-dominated woodland characteristic of the meso- and supra-Mediterranean levels of the Sierra Nevada and of a few siliceous mountain ranges of the arid south-east. Totally destroyed in the Sierra Nevada, this community is still represented by well-preserved examples in the Sierras de Carrascoy and Alhamilla, and to a lesser extent, in the Sierra de Cabrera.
- 45.344 South-western *Quercus rotundifolia* woodland**
Forests and woodland of *Q. rotundifolia* developed in the thermo-Mediterranean zone of Andalusia and neighbouring areas. Well-preserved examples are extremely rare.
- 45.3441 Basophilous formations**
Oleo sylvestris-Quercetum rotundifoliae
Q. rotundifolia formations of thermo-Mediterranean calcareous slopes of the Guadalquivir basin and the coastal foothills of Baetic and arid south-eastern ranges, with *Olea europaea* ssp. *sylvestris*, *Chamaerops humilis*, *Pistacia lentiscus*, *Smilax aspera*, *Asparagus albus*, *Rhamnus oleoides*, *Quercus coccifera*, *Clematis cirrhosa*, *Aristolochia baetica*, *Bupleurum gibraltarium* and, locally, *Maytenus senegalensis* or *Buxus balearica*. They have almost disappeared in forest form except in a few ranges of the arid Iberian South-east.
- 45.3442 Silicicolous formations**
Myrto communis-Quercetum rotundifoliae
Formations of *Q. rotundifolia* with *Myrtus communis*, *Pulicaria odora*, *Pistacia lentiscus*, *Phillyrea angustifolia* and *Arbutus unedo* occupying the siliceous soil of the thermo-Mediterranean levels of eastern Andalusia between the Sea of Alboran and the coastal Tejada, Almirajara, Alpujarra and Gador ranges, a few granitic outcroppings of the Sierra Morena and limited enclaves of the Badajoz region. They have almost entirely disappeared.
- 45.345 Valencian *Quercus rotundifolia* woodland**
Rubio longifoliae-Quercetum rotundifoliae
Thermo-Mediterranean, basophilous forests and woodland of *Q. rotundifolia* characteristic of the south-eastern maritime façade of the Iberian peninsula in Valencia and Levante, rich in shrubs and lianas, with *Rubia peregrina* ssp. *longifolia*, *Osyris quadripartita*, *Chamaerops humilis*, *Phillyrea angustifolia*, *Clematis flammula*. Well-preserved examples survived until recently in, among others, the Sierra del Ave y Cortes de Pallas, in the Poble Tornesa, in Millares, in Montduver. This community now appears extinct in its full forest form.

- 45.346 **Balearic *Quercus rotundifolia* woodland**
Clematidi cirrhosae-Quercetum rotundifoliae
 Forests or woodland of *Q. rotundifolia* occupying deep soils in the dry thermo-Mediterranean areas of the Balearic islands. Reasonably preserved examples are extremely rare.
- 45.4 **KERMES OAK FORESTS**
 Forest or woodland formations dominated by arborescent *Quercus coccifera* (*Q. calliprinos*, *Q. pseudococcifera*).
 (Rechinger, 1951; Braun-Blanquet *et al.*, 1956; Polunin and Walters, 1985; Pratesi and Tassi, 1985)
- 45.41 **GREEK KERMES OAK FORESTS**
 Arborescent *Quercus coccifera*-dominated formations of peninsular Greece, the Ionian and Aegean archipelagoes and of Crete. Extensive, fully-developed stands exist in several areas of Crete. The most representative forests occupy valleys in the 700-800 m range of the southern slopes of the Psiloriti mountains; *Acer orientale*, *Cephalanthera cucullata* and *Epipactis cretica* are associated. Other forests are found in the Lefka and Lassithi mountains; *Pyrus amygdaliformis*, *Prunus webbii*, *Pistacia terebinthus*, *Phillyrea latifolia*, *Styrax officinalis* are characteristic of various Cretan stands. Outside of Crete, forest stands are found sporadically, in particular on Ikaria, Samothrace and Mount Athos, where *Q. coccifera* is associated with *Q. ilex*, and at high elevations of Rhodes, where *Q. coccifera* forms woodland fragments with arborescent *Phillyrea media*. In many areas remnant tall *Q. coccifera* may form arborescent matorral; coppice-like formations of young trees also occur.
- 45.42 **ITALIAN KERMES OAK WOODLAND**
 Very local *Quercus coccifera* formations of Puglia and southern Sicily.
- 45.43 **PORTUGUESE KERMES OAK FOREST**
Arisaro-Quercetum fagineae phillyretosum p.
 Extremely isolated *Quercus coccifera*-dominated forest of Nazare, Monte de S. Bartolomeu, with *Phillyrea media*, *Pistacia lentiscus*, *P. angustifolia*, *Arbutus unedo*, *Viburnum tinus*, *Smilax aspera*, *Asplenium onopteris*.
- 45.5 **CONTINENTAL LAUREL-OAK WOODLAND**
Lauro nobilis-Quercetum ilicis p. i.a.
Laurus nobilis-dominated facies of evergreen oak forests, in particular, in coastal Asturias (see 45.311) and Andalusia.
 (Polunin and Walters, 1985; Dias Gonzalez and Fernandez Prieto, 1987: 93)
- 45.6 **MACARONESIAN LAUREL FORESTS**
Pruno-Lauretalia
 Humid to hyper-humid, mist-bound, luxuriant, evergreen, lauriphyllous forests of the cloud belt of the Macaronesian islands, extremely rich in floral and faunal species, among which many are restricted to these communities. Genera such as *Picconia*, *Semele*, *Gesnouiinia*, *Lactucosonchus*, *Ixanthus* are entirely endemic to these communities, while others, such as *Isoplexis*, *Visnea* and *Phyllis* reach in them their maximum development; in addition, each of the formations of the various archipelagoes harbours distinctive endemic species. Laurel forests are the most complex and remarkable relict of the humid sub-tropical vegetation of the Mioceno-Pliocene late Tertiary of southern Europe. Areas of intact forests have been drastically reduced to a level below which the preservation of their elements could not be sustained.
 (Ortuno and Ceballos, 1977; Duvigneaud, 1977; White, 1983; Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988; Santos, 1990)

- 45.61** **AZOREAN LAURISILVAS**
Ericetalia azoricae p.: *Culcito-Juniperion brevifoliae* p., *Myrico-Pittosporion undulati* p.
 Lauriphyllous forests of the Azores, with *Laurus azorica*, *Myrica faya*, *Frangula azorica*, *Ilex perado* ssp. *azorica*, *Juniperus brevifolia*, *Picconia azorica*, *Prunus lusitanica* ssp. *azorica*, *Euphorbia stygiana*, *Viburnum tinus* ssp. *subcordatum*, *Vaccinium cylindraceum*, *Smilax divaricata*. The humid forests of the coastal areas (*Myrico-Pittosporietum undulati* p.) have been totally or almost totally degraded, largely invaded by the introduced Australian *Pittosporum undulatum*. A better representation survives of the hyper-humid forests (*Culcito-Juniperion brevifoliae* p.) of higher elevations.
 (White, 1983; Santos, 1990)
- 45.62** **MADEIRAN LAURISILVAS**
Pruno-Lauretalia azoricae: *Clethro-Laurion azoricae*
 Lauriphyllous forests of Madeira with *Laurus azorica*, *Persea indica*, *Ocotea foetens*, *Apollonias barbujana*, *Pittosporum coriaceum*, *Clethra arborea*, *Visnea mocanera*, *Picconia excelsa*, *Prunus lusitanica* ssp. *hixa*, *Heberdenia excelsa*, *Vaccinium padifolium*, *Ilex perado* ssp. *perado*, *I. canariensis*, *Myrica faya*, *Erica arborea*, *Hedera canariensis*, *Isolexis canariensis*, *Euphorbia mellifera*, *Sambucus lanceolata*, *Teline maderensis*, *Sonchus fruticosus*, *Senecio auritus*, *Ruscus streptophyllus*, *Rubus bollei*, *Semele androgyna*, *Smilax canariensis*, *Tamus edulis*, *Carex peregrina* and many ferns. These forests, which still occupy a relatively large surface, of the order of 10 000 ha (15% of their former surface), are the habitat of the threatened endemic Madeiran Pigeon, *Columba trocaz*.
 (Duvigneaud, 1977; White, 1983; Santos, 1990)
- 45.63** **CANARIAN LAURISILVAS**
Ixantho-Laurion azoricae
 Lauriphyllous forests of the Canary Islands, with *Laurus azorica*, *Picconia excelsa*, *Persea indica*, *Ocotea foetens*, *Apollonias barbujana*, *Visnea mocanera*, *Pleiomeris canariensis*, *Heberdenia excelsa*, *Prunus lusitanica*, *Sambucus palmensis*, *Euphorbia melifera*, *Ixanthus viscosus*, *Rubus bollei*, *Convolvulus canariensis*, *Geranium canariensis*, *Hedera canariensis*, *Smilax aspera*, *S. canariensis*, *Canarina canariensis*, *Semele androgyna*, *Sideritis macrostachys*, *S. canariensis*, *Cryptotaenia elegans*, *Rubia peregrina*, *Carex canariensis*, *Asparagus fallax* and many ferns. They are the habitat of the threatened endemic laurel pigeons *Columba junoniae* and *C. bollei*, now limited to La Gomera, Tenerife and La Palma. The laurel forests of each island harbour a distinctive set of endemic plants and animals, as exemplified by the species of the composite genus *Pericallis*, the well-marked races of the chaffinch *Fringilla coelebs* or the carabid faunas. They are thus best listed separately. The total remnant surface of laurel forest for the four islands, La Gomera, Tenerife, La Palma and Hierro, does not exceed 5 000 ha.
 (Delvosalle, 1964; Machado, 1976; Schmid, 1976; Bramwell, 1976; Follmann, 1976; Bacallado, 1976; Ortuno and Ceballos, 1977; White, 1983; Bramwell and Bramwell, 1983; Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 45.631** **Laurisilvas of La Gomera**
 Laurel forests of La Gomera, best preserved and most extensive of the archipelago, with large areas of humid *Persea indica-Laurus azorica* forests (*Lauro-Perseetum indicae*), particularly in high areas, and good examples of *Ocotea foetens*-dominated forests, hyperhumid and very rich in ferns and epiphytes (*Athyrio-Ocoteetum foetentis*).
- 45.632** **Laurisilvas of Tenerife**
 Laurel forests of Tenerife, mostly restricted to the Anaga range and Los Silos, with a few smaller patches in Guimar ravines and at a few north slope sites in the La Esperanza-Agua Garcia area and the Barranco de San Antonio-Icod area. There are good representations of til (*Ocotea foetens*) forests (Anaga), as well as of drier *Picconia excelsa-Apollonias barbujana* forests (Los Silos).
- 45.633** **Laurisilvas of La Palma**
 Laurel forests of La Palma essentially restricted to a few large, deep ravines of the northern slope, particularly in the Las Sauces area, including both *Lauro-Perseetum vinyatigo-laurel* and *Athyrio-Ocoteetum* til stands.
- 45.634** **Laurisilvas of Hierro**
 Laurel forests of Hierro, very small and limited to cliff sides in the Ensenada El Golfo area of the north coast.

- 45.635 Laurisilvas of Gran Canaria**
Laurel forests of Gran Canaria, extinct. Very small, but fully expressed, fragments existed until very recently, notably at Los Tiles, but now appear to have been totally degraded.
- 45.7 PALM GROVES**
Woods, often riparian, formed by the two endemic palm trees of the Community, *Phoenix theophrasti* of Crete, and *P. canariensis* of the Canary Islands.
- 45.71 CRETAN PALM GROVES**
Relict *Phoenix theophrasti* woods of Crete, restricted to damp, sandy, coastal valleys; they include the extensive forest of Vai, where the luxuriant palm growth is accompanied by a thick shrubby undergrowth rich in *Nerium oleander*, and about four other smaller coastal groves, notably on the south coast of the prefectorate of Rethimnon.
(Polunin, 1983; Sfikas, 1984, 1987; Iatridis, 1988; Kassioumis, 1988)
- 45.72 CANARIAN PALM GROVES**
Relict *Phoenix canariensis* woods of the Canary Islands, mostly characteristic of the bottom of barrancos and of alluvial soils, below 600 metres. Palm groves are now very rare, but still exist in all the islands, with particularly representative examples at Haria on Lanzarote, Vega del Rio Palmas on Fuerteventura, Fataga, Maspalomas and the Barranco de Tirajana in Gran Canaria, Valle Gran Rey in La Gomera, Masca in Tenerife and Brena Alta in La Palma.
(Bramwell and Bramwell, 1983; Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 45.8 HOLLY WOODS**
Woods dominated by tall arborescent *Ilex aquifolium*, present in the supra-Mediterranean level of Sardinia and Corsica and in Atlantic mountains of north-western Spain; they usually constitute a facies of the relict yew-holly forests (42.A7).
(Fenaroli, 1970; Groppali *et al.*, 1983; Gamisans, 1985; Pratesi and Tassi, 1986; Noifalisse, 1986, 1987)
- 45.9 CANARIAN HEATH FORESTS**
Fayo-Ericion arboreae
Very tall, forest-like, formations dominated by *Erica arborea*, *Myrica faya*, *Arbutus canariensis* or *Visnea mocanera*, occurring naturally in the most wind-exposed and the driest stations within the 'monte verde' of the Canary Island cloud belt; they also form extensively as degradation stages of the laurisilva or as secondary colonists.
(Delvosalle, 1964; Schmid, 1976; Machado, 1976; Kämmer, 1976; Bramwell and Bramwell, 1983; White, 1983; Wildpret de la Torre and Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 45.91 CANARIAN FAYAL-BREZAL**
Fayo-Ericetum arboreae i.a.
Tall *Erica arborea*-dominated formations of Tenerife, La Palma, La Gomera, Gran Canaria and Hierro, with *Myrica faya*, *Ilex canariensis*, *Rhamnus glandulosus*, *Viburnum tinus* ssp. *rigidum*, *Cedronella canariensis*, *Bystropogon canariensis*, *Isoplexis canariensis*, *Urtica morifolia*, *Teline canariensis*, *Sonchus abbreviatus*, *Hypericum glandulosum*, *Gesnouinia arborea* and many species of the genus *Pericallis*, including several island or local endemics that characterize several differentiated communities; among these are *Pericallis (Senecio) tussilaginis*, *P. webbii*, *P. cruenta*, *P. steetzii*, *P. murrayi*.
- 45.92 HIERRAN FAYAL**
Senecio murrayi-Myricetum fayae p.
Tall *Myrica faya* formation of the southern slope of Hierro, almost devoid of *Erica arborea*.
- 45.93 VISNEA-ARBUTUS FORESTS**
Formations characterized by the abundance of *Arbutus canariensis* and *Visnea mocanera* occurring, in particular, in the Valle de Guimar and Los Silos of Tenerife, and in the Ladera de Jinama of Hierro.

5

Bogs and marshes



51 Raised bogs

Sphagnetalia magellanici, *Scheuchzerietalia palustris* p., *Utricularietalia intermedio-minoris* p., *Caricetalia fuscae* p.

Highly oligotrophic, strongly acidic communities composed mainly of sphagnum growing on, and forming, peat and deriving moisture and nutrients only from rainfall (ombrotrophic). They form only in cool climates with heavy rainfall and are characteristic of lowlands and hills of north-western and northern Europe, the adjacent Hercynian ranges, the Jura and the Alps. Their independence from ground water is the result either of upward growth or of changes in the water table. Bogs harbour, in addition to various sphagnum species, which are abundant, dominant and the major component of their formation, a small number of acidophilous plants such as *Eriophorum vaginatum*, *Scirpus* (*Trichophorum*) *cespitosus*, *Carex pauciflora*, *C. paupercula*, *Ledum palustre*, *Vaccinium oxycoccos*, *Andromeda polifolia*, *Drosera rotundifolia* and lichens. Animal species are not numerous but those that are adapted to bogs are highly specialized. Among typical invertebrates figure dragonflies (*Leucorrhinia dubia*, *Aeshna subarctica*, *A. caerulea*, *A. juncea*, *Somatochlora arctica*, *S. alpestris*), lepidopterans (*Colias palaeno*, *Boloria aquilonaris*, *Coenonympha tullia*, *Vacciniina optilete*, *Hypenodes turfosalis*, *Eugraphe subrosea*), beetles, ants (*Formica exsecta*), bugs and spiders (*Pardosa sphagnicola*, *Glyphesis cottonae*). Most of the species that bogs harbour are rare and their populations fragmented into isolated relictual elements; several are threatened. The remaining intact or nearly intact communities are exceptional.

(Vanden Berghen, 1951; Ellenberg, 1963, 1988; Pearsall, 1971; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Dierssen, 1978; Tüxen, 1978; Muller, 1978; Pedrotti, 1978; Petermann and Seibert, 1979; Ozenda, 1981, 1985; Condry, 1982; Drachenfels, 1984; Nordiska ministerradet, 1984; Bournières, 1984; Mollet *et al.*, 1985; Bellamy, 1986; Oberdorfer, 1990)

51.1

NEAR-NATURAL RAISED BOGS

Undisturbed, or little disturbed, peat-forming bogs, often taking the shape of a convex lens. Such intact or nearly intact systems have become very rare or even exceptional. They are composed of a number of communities, which form and occupy the topological features of the bog. These communities are interrelated and function as a unit, so that they cannot be regarded as separate subhabitats; their presence and combination, however, characterize the various types of bogs. Simultaneous use of an appropriate selection of the sub-units below can thus contribute to a description of individual bog systems.

51.11

BOG HUMMOCKS, RIDGES AND LAWNS

Sphagnion magellanici, *Oxycocco-Ericion tetralicis* p.

Vegetation of the higher parts of the bog plateau and of its drier, marginal slope.

51.111

Colourful sphagnum hummocks (bulten)

Cushiony domes or buttes, mainly made of red, yellow or brown sphagnums, with other mosses, liverworts (*Odontoschisma sphagni*, *Campylopus pyriformis*, *Mylia anomala*), lichens (*Cladonia* spp., *Cladina* spp.), *Eriophorum vaginatum*, *Carex pauciflora*, *Calluna vulgaris*, *Ledum palustre*, *Andromeda polifolia*, *Vaccinium oxycoccos*, *Scirpus cespitosus*, *Erica tetralix*, *Drosera rotundifolia*.

- 51.1111** *Sphagnum magellanicum* hummocks
Typical Central European hummocks, formed by the swollen-leaved, brownish or greenish-red *Sphagnum magellanicum*.
- 51.1112** *Sphagnum fuscum* hummocks
Shiny brown *Sphagnum fuscum* hummocks replacing or accompanying the *Sphagnum magellanicum* hummocks in eastern, Alpine and some western communities.
- 51.1113** *Sphagnum rubellum* hummock wreaths
Dark red *Sphagnum rubellum* communities often encircling the bases of *Sphagnum magellanicum* or *S. fuscum* hummocks.
- 51.1114** *Sphagnum rubellum* hummocks
Hummocks dominated by *Sphagnum rubellum*.
- 51.1115** *Sphagnum imbricatum* hummocks
Often tall hummocks formed by the large, orange-gold *Sphagnum imbricatum*, mostly western and increasingly uncommon.
- 51.1116** *Sphagnum papillosum* hummocks
Low hummocks of olive-brown or ocre *Sphagnum papillosum*, formed mostly in western bogs.
- 51.1117** *Sphagnum capillifolium* hummocks
Large cushion hummocks formed by the reddish *Sphagnum capillifolium*, mostly western.
- 51.112** **Green sphagnum hummock bases and lawns**
Green or yellow *Sphagnum cuspidatum*, *S. apiculatum*, *S. pulchrum*, *S. papillosum* i.a. communities forming in the transition zone between hollows and hummocks; *Drosera rotundifolia*, *Eriophorum vaginatum*, *Andromeda polifolia*, *Vaccinium oxycoccos* are often common.
- 51.113** **Dwarf shrub hummocks**
Ericaceous dwarf shrub communities forming on the top of drying hummocks, often with the moss *Polytrichum strictum*.
- 51.1131** **Ling dwarf shrub hummocks**
Calluna vulgaris-dominated communities characteristic of Central European formations.
- 51.1132** **Cross-leaved heather shrub hummocks**
Erica tetralix-dominated communities characteristic of Atlantic formations.
- 51.1133** **Crowberry shrub hummocks**
Empetrum nigrum-dominated communities of slightly more mineral-rich formations.
- 51.1134** **Vaccinium shrub hummocks**
Formations of taller hummocks with *Vaccinium uliginosum*, *V. vitis-idaea*, *V. myrtillus* and, locally, *Betula nana*.
- 51.1135** **Labrador tea shrub hummocks**
Ledum palustre communities of tall hummocks of north-eastern bogs.
- 51.1136** **Bog myrtle hummocks**
Myrica gale communities of hummocks of western bogs.
- 51.114** **Bog deergrass communities**
Eriophoro-Trichophoretum cespitosi
Scirpus cespitosus-dominated bogs or parts of bogs, mostly characteristic of Hercynian and peri-Alpine regions.

51 Raised bogs

- 51.115** **Bog *Erica-Sphagnum* communities**
Erico-Sphagnetum p.
 Bogs or parts of bogs dominated by *Erica tetralix* and *Sphagnum papillosum*, characteristic of raised bog systems of Atlantic regions, particularly the British Isles.
- 51.12** **BOG HOLLOWES (SCHLENKEN)**
Scheuchzerietalia palustris p.
 Temporarily or permanently rainwater-filled depressions of bogs, occupied by communities similar to those of larger intermediate mires (54.5, 54.6).
- 51.121** **Deep schlenken**
Caricetum limosae p.
 Constantly submerged hollows with bright green *Sphagnum cuspidatum*, *S. recurvum*, *S. dusenii* and with *Drepanocladus fluitans*, *Lophozia inflata*, *Eriophorum angustifolium*, *Rhynchospora alba*, *Menyanthes trifoliata*, *Carex limosa*, *C. paupercula*, *C. pauciflora*, *Scheuchzeria palustris*.
- 51.122** **Shallow schlenken**
Rhynchosporetum albae
 Temporarily inundated shallow hollows with *Rhynchospora alba*, *R. fusca*, *Drosera intermedia*, *Lycopodiella inundata*.
- 51.13** **BOG POOLS**
 Larger, deep, permanently filled depressions, usually dystrophic, occurring near the centre of raised bogs or along tension lines. Their planktonic communities are original. Floating plant communities may sometimes develop, in particular those comprising *Sparganium minimum* and *Utricularia spp.* (22.45) and, sometimes, beds of *Nymphaea spp.* (22.4311).
- 51.131** **Bog eye (kolk)**
 Large pools or lakes occurring near the centre of Central European raised bogs, often with relatively firm, steep banks colonized by trees or scrub forming a ring of woodland.
- 51.132** **Other bog pools**
- 51.14** **BOG SEEPS AND SOAKS**
 Paths of water runoff carving the marginal slope of the bog, carrying water from the centre to the lagg. They are in part colonized by intermediate mire or acid fen vegetation (54.5, 54.4).
- 51.141** **Bog asphodel seeps**
Narthecium ossifragum colonies in seep rivulets, mostly characteristic of western bogs.
- 51.142** **Bog myrtle soaks**
Myrica gale thickets of Atlantic raised bog soaks.
- 51.143** **Other bog soak and runoff gully communities**
- 51.15** **LAGG**
 Ring of water surrounding raised bogs, often colonized by intermediate mire or acid fen communities (54.5, 54.4), sometimes accompanied by more basicline species typical of neighbouring fens; *Eriophorum angustifolium*, *E. vaginatum*, *Scirpus hudsonianus*, *Carex rostrata*, *C. flava*, *Parnassia palustris* are frequent components.
- 51.16** **BOG PRE-WOODS**
Sphagnetum magellanici pinetosum rotundatae i.a.
 Parts of raised bogs colonized by shrubs or small trees of *Pinus rotundata*, *P. sylvestris* var. *turfosa*, *Picea abies*, *Betula pubescens*, *B. carpatica*, eventually leading to bog woods (44.A).
- 51.2** **PURPLE MOORGRASS BOGS**
Ericion tetralicis p.
 Drying, mowed or burned bogs invaded by *Molinia caerulea*.
 (Lebrun *et al.*, 1949; Noirfalise *et al.*, 1980; Drachenfels, 1984)

52 Blanket bogs

Sphagnetalia magellanici: Oxycocco-Ericion tetralicis (Calluno-Sphagnion papilloso, Erico-Sphagnion papilloso) p.; Scheuchzerietalia palustris p., Utricularietalia intermedio-minoris p., Caricetalia fuscae p.

Communities similar to raised bogs, on flat or gently sloping ground with poor surface drainage, in oceanic climates with heavy rainfall, characteristic of the western and northern British Isles. In spite of some lateral water flow, blanket bogs are mostly ombrotrophic. They often cover extensive areas with local topographic features supporting distinct communities. Sphagnums (*S. papillosum*, *S. tenellum*, *S. compactum*, *S. magellanicum*) play an important role in all of them, accompanied by *Narthecium ossifragum*, *Molinia caerulea*, *Scirpus cespitosus*, *Schoenus nigricans*, *Eriophorum angustifolium*, *E. vaginatum*. High and low altitude forms and numerous variants can be distinguished. Blanket bogs constitute a habitat endemic to north-western Europe, of which intact examples are relatively uncommon.

(Pearsall, 1971; Pearsall and Pennington, 1977; Ratcliffe, 1977, 1980, Doyle and Moore, 1978; Dierssen, 1978; Tüxen, 1978; Heal and Smith, 1978; Currie, 1979; Condry, 1982; White and Doyle, 1982; Polunin and Walters, 1985; Bellamy, 1986; Ellenberg, 1988; Morrison, 1989)

52.1

LOWLAND BLANKET BOGS

Sphagnetalia magellanici: Pleurozio purpureae-Ericetum tetralicis; Scheuchzerietalia palustris p., Caricetalia fuscae p., Utricularietalia intermedio-minoris p., Littorelletalia, Potamogetonalia

Hyper-Atlantic blanket bogs of the western coastlands of Ireland, western Scotland and its islands, Cumberland, northern Wales and Devon, developed under very high rainfall climates. The main vascular plants are *Molinia caerulea*, *Eriophorum angustifolium*, *E. vaginatum*, *Scirpus cespitosus*, *Schoenus nigricans*, *Rhynchospora alba*, *Narthecium ossifragum*, *Carex panicea*, *Calluna vulgaris*, *Erica tetralix*, *Myrica gale*, *Pedicularis sylvatica*, *Potentilla erecta*, *Polygala serpyllifolia*, *Pinguicula lusitanica*, *Drosera rotundifolia*. The colourful mucinal layer comprises the black and crimson liverwort *Pleurozia purpurea*, the black and gold moss *Campylopus atrovirens*, the woolly fringe moss *Rhacomitrium lanuginosum*; it is often dominated by sphagnums (*Sphagnum auriculatum*, *S. magellanicum*, *S. compactum*, *S. papillosum*, *S. nemoreum*, *S. rubellum*, *S. tenellum*, *S. subnitens*), or, particularly in parts of western Ireland, mucilaginous algal deposits (*Zygonium*). Some of the distinctive features of the blanket bog can be, as in 52.1, individualized by the codes below.

52.11

BLACK BOG-RUSH SWARDS

Schoenus nigricans-Rhacomitrium lanuginosum formations, particularly widespread on deep peat in the Galway and Mayo peninsulas of Ireland, local in Scotland. *Pinguicula lusitanica* and *Pedicularis sylvatica* may occur.

52.12

SPHAGNUM-ALGAE CARPETS

Waterlogged pool edges and bog surfaces rich in *Sphagnum magellanicum* or *S. papillosum*, *S. rubellum*, *S. cuspidatum*, *S. auriculatum*, *S. palustre* and *Zygonium* deposits, often with *Drosera anglica*, *D. rotundifolia*, *Menyanthes trifoliata*.

52 Blanket bogs

- 52.13** DEERGRASS SWARDS
Scirpus cespitosus-dominated swards on slopes, tops of slopes, shallow peat, and slightly drier areas, particularly abundant in Scotland and Kerry. *Carex panicea*, *Sphagnum compactum*, *Pinguicula grandiflora* may be prominent.
- 52.14** OBLONG-LEAVED SUNDEW COMMUNITIES
Formations rich in *Drosera intermedia*, with *Riccardia pinguis*, *Rhynchospora fusca* or *Carex limosa* of slope areas submitted to surface water movement and shallow hollows.
- 52.15** BULBOUS-RUSH COMMUNITIES
Formations of *Juncus bulbosus*, *Eleocharis multicaulis* and *Carex panicea* of shallow drainage channels and shallow pools.
- 52.16** FLUSHES, DEEP HOLLOWES AND POOLS
Wet depressions and seeps colonized by communities of the *Scheuchzerietalia palustris* (54.5, 54.6), the *Caricetalia fuscae* (54.4), the *Utricularietalia intermedio-minoris* (22.45), the *Littorelletalia* (22.31) or the *Potamogetonetalia* (22.43), which can be noted by use of appropriate codes. Among important elements are *Potamogeton polygonifolius*, *Eriocaulon aquaticum*, *Lobelia dortmanna*, *Menyanthes trifoliata*.
- 52.2** UPLAND BLANKET BOGS
Sphagnetalia magellanici: *Vaccinio-Ericetum tetralicis*; *Ericion tetralicis* p., *Scheuchzerietalia palustris* p., *Caricetalia fuscae* p., *Utricularietalia intermedio-minoris* p., *Littorelletalia*, *Potamogetonetalia*
Blanket bogs of high ground, hills and mountains in Scotland, Ireland, western England and Wales. Characteristic species are *Eriophorum vaginatum*, *Calluna vulgaris*, *Erica tetralix*, *Rubus chamaemorus*, *Narthecium ossifragum*, *Scirpus cespitosus*, *Drosera rotundifolia*, *Rhacomitrium lanuginosum* and abundant sphagnum mosses.
- 52.21** COTTONGRASS-LING BOGS
Upland blanket bogs dominated by *Eriophorum vaginatum* and *Calluna vulgaris* with *Rubus chamaemorus*, *Sphagnum rubellum*, *Hypnum cupressiforme*.
- 52.22** COTTONGRASS BOGS
Species-poor upland blanket bogs, dominated by *Eriophorum vaginatum*, mostly widespread in the Pennines.
- 52.23** UPLAND SPHAGNUM MATS
Sphagnum papillosum, *S. magellanicum*, *S. rubellum*, *S. imbricatum*, *S. fuscum* carpets and hummocks of the cottongrass-ling blanket bogs.
- 52.24** DWARF SHRUB-COTTONGRASS BOGS
Upland cottongrass-ling blanket bogs with an abundance of *Empetrum hermaphroditum*, *E. nigrum*, *Betula nana*, *Vaccinium uliginosum*, *V. myrtillus*, *Arctostaphylos uva-ursi*, *A. alpina* and *Sphagnum fuscum*.
- 52.25** WOOLLY FRINGE MOSS HUMMOCKS
Formations dominated by *Rhacomitrium lanuginosum*.
- 52.26** BLANKET BOG WET HEATH
Ericion tetralicis
Formations of *Scirpus cespitosus*, *Myrica gale*, *Erica tetralix*, *Calluna vulgaris*, *Molinia caerulea*, *Sphagnum* spp. (*S. papillosum*, *S. rubellum*, *S. magellanicum*, *S. auriculatum*), *Rhacomitrium lanuginosum* and lichens, similar to 31.1, integrated within blanket bog systems.
- 52.27** FLUSHES, DEEP HOLLOWES AND POOLS
Wet depressions and seeps colonized by communities of the *Scheuchzerietalia palustris* (54.5, 54.6), the *Caricetalia fuscae* (54.4), the *Utricularietalia intermedio-minoris* (22.45), the *Littorelletalia* (22.31) or the *Potamogetonetalia* (22.43).

53 Water-fringe vegetation

Phragmitetea

Reed beds and large sedge communities of the margins of lakes, rivers, and brooks and of fens and eutrophic marshes.

53.1

REED BEDS

Phragmites australis, *Scirpus maritimi*

Reed bed formations of tall helophytes, usually species-poor and often dominated by one species, growing in stagnant or slowly flowing water of fluctuating depths, and sometimes on waterlogged ground. They can be classified according to the dominant species, which gives them a distinctive appearance.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1984; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Noirfalise *et al.*, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Wheeler, 1980a; Pignatti, 1982; Rivas-Martinez *et al.*, 1984; Polunin and Walters, 1985; Wolff, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Arriza and Peinado Lorca, 1987; Costa, 1987; Oberdorfer, 1990)

53.11

COMMON REED BEDS

Phragmitetum (*Scirpo-Phragmitetum p.*, *Typho-Phragmitetum maximi*, *Scirpo lacustris-Phragmitetum mediterraneum*)

Beds of *Phragmites australis*.

53.111

Flooded *Phragmites* beds

Permanently inundated reed beds.

53.112

Dry *Phragmites* beds

Reed beds dry for at least a large part of the year, often invaded by other species.

53.113

Giant *Phragmites* beds

Formations of the very tall *Phragmites* 'maximus', occurring locally in the Mediterranean basin, in particular on islets of lagoons of the east coast of Spain, where they harbour the very local, spectacular *Kosteletzkya pentacarpos*.

53.12

COMMON CLUBRUSH BEDS

Scirpetum lacustris (*Scirpo-Phragmitetum p.*)

Scirpus lacustris formations, intolerant of drying, tolerant of water circulation, and thus forming the outer belts of reedbeds.

53.13

REEDMACE BEDS

Typhetum angustifoliae, *Typhetum latifoliae* (*Scirpo-Phragmitetum p.*)

Typha latifolia, *T. angustifolia*, *T. domingensis*, *T. laxmannii* formations, usually extremely species-poor and sometimes almost pure, tolerant of extended periods of dryness and of pollution.

53.14

MEDIUM-TALL WATERSIDE COMMUNITIES

Formations of shorter, mostly non-graminoid helophytes emerging from mesotrophic or eutrophic, stagnant or slow-moving, shallow water, and constituting fringes or patches within or alongside reedbeds.

53.141

Arrowhead communities

Sagittario-Sparganietum emersi

Formations of *Sagittaria sagittifolia* and *Sparganium emersum* of slowly flowing, and sometimes standing, meso-eutrophic waters.

53.142

Neglected bur-reed communities

Glycerio-Sparganietum neglecti

Formations dominated by *Sparganium neglectum*, characteristic of standing or slowly flowing waters on mineral-rich, lime-poor muddy substrates.

- 53.143 Erect bur-reed communities**
Sparganietum erecti
 Formations rich in *Sparganium erectum*, characteristic of riparian reedbeds along standing waters on lime-rich, mineral-rich muddy substrates.
- 53.144 Sweet flag communities**
Acoretum calami
 Formations dominated by the long-introduced thermophile *Acorus calamus*.
- 53.145 Flowering rush communities**
Butometum umbellati
 Usually open formations dominated by, or rich in, *Butomus umbellatus* characteristic of strongly fluctuating still or slow-flowing base- and mineral-rich waters.
- 53.146 Water dropwort-great yellowcress communities**
Oenanthro-Rorippetum amphibiae
 Formations, often at the edges of reedbeds, rich in *Oenanthe aquatica* or *Rorippa amphibia*.
- 53.147 Water horsetail beds**
 Low, often extensive, homogeneous, usually inundated formations dominated by *Equisetum fluviatile*.
- 53.148 Water parsnip communities**
 Formations dominated by, or rich in, the tall umbellifer *Sium latifolium*.
- 53.149 Marestalk beds**
 Formations, usually of still or running, clear, cold to temperate nutrient-rich water, dominated by *Hippuris vulgaris*.
- 53.14A Common spikerush beds**
 Low, often extensive and very homogeneous formations dominated by *Eleocharis palustris*.
- 53.15 REED SWEETGRASS BEDS**
Glycerietum maximae
Glyceria maxima formations, rather low, usually constituting strips in or along ditches or small streams, often in grasslands, requiring fairly constant inundation by eutrophic water and with a fairly rich associated flora.
- 53.16 REED CANARY-GRASS BEDS**
Phalaridetum arundinaceae
Phalaris arundinacea formations, pure or mixed with *Phragmites australis*, very tolerant of drying, pollution and perturbation, susceptible of forming the landward belt of reedbeds and often characteristic of degraded systems.
- 53.17 HALOPHILE CLUBRUSH BEDS**
Scirpion maritimi
 Formations of *Scirpus tabernaemontani*, *S. maritimus*, *S. triqueter*, *S. litoralis*, *S. pungens* mostly characteristic of brackish or saline waters to 1.5 m deep.
- 53.2 LARGE SEDGE COMMUNITIES**
Magnocaricion
 Formations of large Cyperaceae of genera *Carex* or *Cyperus* occupying the edge or the entirety of humid depressions, oligotrophic mires and rich fens, on ground that can be dry for part of the year. They occur, in particular, on the landward side of reedbeds in waterside successions and as colonists of humid depressions on mineral soils, or of acid and alkaline fens.

- 53.21** **LARGE CAREX BEDS**
Formations of social sedges of genus *Carex*, usually dominated by one species that can be either tussock-forming or bed-forming. They can be arranged according to dominant species.
(Ellenberg 1963, 1988; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Rivas-Martinez *et al.*, 1980; Wheeler, 1980a; Jermy *et al.*, 1982; Pignatti, 1982; Dethioux, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Wolff, 1987; Navarro Andres and Valle Gutierrez, 1987; Asensi Marfil and Diez Garretas, 1987; Costa, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Oberdorfer, 1990)
- 53.211** **Brown sedge beds**
Caricetum distichae
Formations of *Carex disticha* of humid alluvial meadows on clay and of temporarily drying peatbogs; often in contact with grasslands of the *Calthion* and sometimes placed in that alliance; they tolerate fairly long dessication and have a relatively rich accompanying flora.
- 53.212** **Slender tufted sedge beds and related communities**
Formations dominated by *Carex acuta*, *C. acutiformis* or their relatives.
- 53.2121** **Slender tufted sedge beds**
Caricetum gracilis
Formations of *Carex acuta* of wet, alkaline or slightly acid depressions with mineral soil; *C. acuta* does not tolerate prolonged dessication.
- 53.2122** **Lesser pond sedge beds**
Carex acutiformis is more tolerant of dessication than *C. acuta*. It forms beds on mesotrophic, base-rich, neutral to slightly acid, peaty or mineral soils. Large beds may form in fens, often with *Carex paniculata*; otherwise, they are widespread along watercourses on the landward side of *Carex acuta* or *C. vesicaria* beds, in alluvial plains, ditches and depressions of humid meadow systems; they may occupy stations that almost totally escape periodical inundation.
- 53.2123** **Inn sedge beds**
Caricetum oenensis
Formations of *Carex oenensis*, restricted to oligotrophic, base-rich streamsides of the pre-Alpine Bavarian plateau.
- 53.2124** **Banat sedge beds**
Caricetum buekii
Carex buekii formations of mesotrophic sandy or clay soils in Franconia, eastern Bavaria, Saxony and northern Italy.
- 53.2125** **Water sedge beds**
Caricetum aquatilis
Mesotrophic *Carex aquatilis* formations of Lower Saxony, Wales, Lakeland, Scotland and Ireland.
- 53.2126** **Brotero sedge beds**
Galio broteriani-Caricetum broterianae
Carex acuta ssp. *broteriana* formations of Iberia, lining river courses on the inner side of alder galleries, or replacing them.
- 53.213** **Greater pond sedge beds**
Caricetum ripariae, *Caricetum vulpino-ripariae*, *Leucojo-Caricetum ripariae*
Formations of *Carex riparia*, mostly characteristic of larger valleys and southern regions, intolerant of dessication. They form on mineral or thinly peaty substrates, often in areas almost permanently inundated by somewhat lime-rich water.
- 53.214** **Bottle and bladder sedge beds**
Caricetum vesicariae, *Caricetum rostrato-vesicariae*, *Caricetum acuto-vesicariae*
Formations of *Carex vesicaria* and *C. rostrata* of moderately to strongly acid, fairly constantly inundated soils and poor fens.

- 53.2141** **Bottle sedge beds**
Dense formations of *Carex rostrata*, of usually very wet, meso-oligotrophic substrates.
- 53.2142** **Bladder sedge beds**
Formations of *Carex vesicaria*, usually characteristic of less oligotrophic situations than the previous ones. *C. vesicaria*, however, often accompanies *C. rostrata*, forming then the outer, drier edge of the sedge bed.
- 53.215** **Tufted sedge and sward sedge tussocks**
Formations dominated by the large, tussock-forming *Carex elata* or its relatives.
- 53.2151** **Tufted sedge tussocks**
Caricetum elatae
Formations of large, often crowded tussocks of *Carex elata*, of alkaline or eutrophic, peaty or organic soils. *Carex elata* is, in particular, one of the constituents of species-rich sedge communities in alkaline fens. It is also typical of the flood plain of large, slow-flowing rivers.
- 53.2152** **Sward sedge tussocks**
Caricetum cespitosae
Formations of *Carex cespitosa*, characteristic of nutrient- and base-rich, neutral to acid peaty soils of north-eastern Central Europe and northern Italy.
- 53.216** **Greater tussock sedge tussocks**
Caricetum paniculatae, *Galio palustri-Caricetum lusitanicae*
Formations of large, usually well-spaced tussocks of *Carex paniculata*, of alkaline to acid, usually mesotrophic, often somewhat shady, habitually peaty stations, including marshy woods. *C. paniculata* is also a constituent of species-rich alkaline fen sedge communities
- 53.217** **Fibrous tussock sedge tussocks**
Caricetum appropinquatae p.
Formations of *Carex appropinquata*, alone or mixed with *C. paniculata*, essentially of mesotrophic, basicline peaty or mineral soils.
- 53.218** **Cyperus sedge tussocks**
Cicuto-Caricetum pseudocyperi
Formations of *Carex pseudocyperus* of mostly slightly acid peaty soils, in very wet situations.
- 53.219** **Fox sedge tussocks**
Caricetum vulpinae
Formations of *Carex vulpina* or *C. otrubae*, of eutrophic humus-poor clay soils, inundated for part of the year.
- 53.2191** **True fox sedge tussocks**
Formations of the very large *Carex vulpina*.
- 53.2192** **False fox sedge tussocks**
Formations of the often less robust *Carex otrubae*.
- 53.21A** **Club sedge beds**
Beds of *Carex buxbaumii* of wet grasslands, lake shore swamps and fens, on temporarily inundated relatively nutrient-rich, somewhat acid peaty sandy or clay soils of eastern France, southern and eastern Germany, the southern Alps and the central Apennines.
- 53.22** **TALL GALINGALE BEDS**
Formations dominated by large perennial Cyperaceae of genus *Cyperus* other than *Cyperus papyrus*.
- 53.221** **Common galingale beds**
Cyperetum longi
Cyperus longus formations of Greece and Italy.
(Horvat *et al.*, 1974; Pignatti, 1982)

- 53.222** **Slender galingale beds**
Formations dominated by *Cyperus laevigatus*, characteristic, in particular, of saline depressions in the Canary Islands and of thermal water bodies on Pantelleria. (Brullo et al., 1977; Pignatti, 1982; Wildpret de la Torre and del Arco Aguilar, 1987)
- 53.23** **PAPYRUS SWAMP**
Cyperus papyrus ssp. *siculus* gallery of the Cyane river in south-eastern Sicily. Taxonomic and historical evidence strongly suggest that this unique station is of natural origin, an extraordinary relict of an extensive Tertiary distribution. (Tournay, 1950; Pignatti, 1982)
- 53.3** **FEN-SEDGE BEDS**
Cladietum marisci i.a.
Cladium mariscus-dominated formations, mostly limited in the northern part of their range, where they have a distinct relict distribution, to alkaline and sometimes acid fens and to the land-building zone of calcareous lakes, somewhat more widespread in the Mediterranean region as a waterside vegetation. (Ellenberg 1963, 1988; De Sloover, 1970; Schumacher, 1977; Rivas-Martinez et al., 1980; Pignatti, 1982; Bournérias, 1984; Rivas-Martinez et al., 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Oberdorfer, 1990)
- 53.31** **FEN CLADIUM BEDS**
Species-rich, fairly open *Cladium mariscus* beds of alkaline and sometimes acid fens, accompanied by cortèges of the *Caricion davallianae* or of the *Caricion lasiocarpae*. These formations are in grave decline throughout their range.
- 53.32** **VALENCIA CLADIUM ISLANDS**
Hydrocotylo-Cladietum marisci
Endangered endemic association of peaty islets of the Albufera de Valencia, with *Kosteletkia pentacarpos*. (Rivas-Martinez et al., 1980)
- 53.33** **RIPARIAN CLADIUM BEDS**
Species-poor *Cladium mariscus* formations of mostly Mediterranean riversides or lakesides, with a *Phragmition* cortège.
- 53.4** **SMALL REED BEDS OF FAST-FLOWING WATERS**
Glycerio-Sparganion
Formations of small helophytes, *Glyceria fluitans*, *G. plicata*, *G. nemoralis*, *G. declinata*, *Leersia oryzoides*, *Catabrosa aquatica*, *Sparganium neglectum*, *S. microcarpum*, *Nasturtium officinale*, *N. microphyllum*, *Veronica beccabunga*, *V. anagallis-aquatica*, *Apium nodiflorum*, *Sium erectum* occupying, throughout the Community, the banks of small rivers or springs on alluvial or peaty soils. (Ellenberg 1963, 1988; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Rivas-Martinez et al., 1980; Rivas-Martinez et al., 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Martinez Parras et al., 1987; Wolff, 1987; Oberdorfer, 1990)
- 53.5** **TALL RUSH SWAMPS**
Agropyro-Rumicion crispi p.
Formations of *Juncus* invading heavily grazed and trampled marshes or fens or (with *Juncus effusus*) eutrophized poor fens and bogs as in the vicinity of bird colonies. Similar formations developing within the environment of wet meadows have been listed under 37.241. (Westhoff and den Held, 1975; Oberdorfer, 1990)
- 53.6** **RIPARIAN CANE FORMATIONS**
Mediterranean beds of tall canes along permanent or temporary water courses.

53.61

RAVENNA CANE COMMUNITIES

Imperato-Erianthion

Mediterranean tall cane formations of temporary water courses, formed by *Imperata cylindrica*, *Saccharum (Erianthus) ravennae*, *S. strictum*, *Arundo plinii*.
(Pignatti, 1982; Izco, *et al.*, 1984)

53.62

PROVENCE CANE BEDS

Very tall formations of the long-introduced *Arundo donax* along water courses.

54 Fens, transition mires and springs

Small-sedge and related communities of fens, transition mires and quaking bogs; vegetation of springs.

54.1

SPRINGS

Montio-Cardaminetea i.a.

Gushing springs (rheocrenes), spring basins (limnocrenes) and seepages (helocrenes) and the communities closely associated with them and dependent on the peculiar microclimatic and hydrological situation created by the spring. These comprise the specialized spring communities (*Montio-Cardaminetea*) as well as the fen communities (*Caricetalia davallianae*, 54.2, *Caricetalia fuscae*, 54.4) or other communities (*Caricion bicoloris-atrofuscae*, 54.3, *Festuco-Brometea*, 34.3), that are interwoven with them. (Ellenberg, 1988)

54.11

SOFT WATER SPRINGS

Cardamino-Montion, Myosotidion stoloniferae i.a.

Acid or neutral, oligotrophic to eutrophic non-calcareous springs.

The specialized spring communities belong to the various associations of the *Cardamino-Montion* or, in the Iberian mountains, the *Myosotidion stoloniferae*; some of them are individualized below. The associated swamp communities belong to the *Caricetalia fuscae* and their presence can be indicated by use, simultaneously with one of the codes of 54.11, of a code of 54.4.

(Ellenberg 1963, 1988; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Schumacher, 1977; Guinochet and Vilmorin, 1978; Bournérias, 1979, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Martinez Parras *et al.*, 1987; Oberdorfer, 1990)

54.111

Soft water bryophyte springs

Montienion (Cardamino-Montienion)

Spring communities of waters poor in lime dominated by bryophytes, mostly characteristic of northern upland and high montane, alpine or subalpine levels, also locally of well-lit lowland sites. The principal mosses that compose them are *Philonotis fontana*, *P. seriata*, *Anthelia julacea*, *Pohlia wahlenbergii*, *Scapania paludosa*, *Bryum schleicheri*, *Sphagnum auriculatum*. A few small vascular plants accompany them, in particular *Montia fontana*, *Saxifraga stellaris*, *S. rivularis*, *S. aquatica*, *Cerastium cerastoides*, *Epilobium anagallidifolium*.

54.112

Bittercress springs

Cardaminenion

Spring communities of mostly collinar and montane, shaded waters poor in lime, with *Ranunculus hederaceus*, *Cardamine amara*, *C. flexuosa*, *C. raphanifolia*, *Chrysosplenium oppositifolium*, *C. alternifolium*, *Saxifraga clusii* ssp. *lepismigena*, ranging south-west to the Cordillera Cantabrica.

54.113

Forget-me-not springs

Myosotidion stoloniferae

Spring and rivulet communities of the high Iberian mountains, characteristic of the oro- and cryo-Mediterranean levels of the Cordillera Cantabrica, and of the Cordillera Central, the Iberian Range, the Sierra Nevada, with *Myosotis stolonifera*, *Veronica langei*, *Festuca rivularis*, *Stellaria alsine*, *Saxifraga stellaris* ssp. *alpigena*.

54.12

HARD WATER SPRINGS

Cratoneurion i.a.

Calcareous, often petrifying, springs. Their specialized communities, usually dominated by bryophytes, belong to the *Cratoneurion commutati*. Characteristic species are the mosses *Cratoneuron filicinum*, *C. commutatum*, *C. commutatum* var. *falcatum*, *Catoscopium nigratum*, *Eucladium verticillatum*, *Gymnostomum recurvirostrae*, with *Equisetum telmateia*, *E. variegatum* and flowering plants including *Cochlearia pyrenaica*, *Arabis soyeri*, *Pinguicula vulgaris*, *Saxifraga aizoides*. The associated swamp communities belong to the *Caricetalia davallianae* and their presence can be recorded by the use, simultaneously with one of the codes of 54.12, of a code of 54.2. Large petrifying springs form tufa cones that

constitute singular habitats with several interacting plant and animal communities; they have thus been individualized below.

(Ellenberg 1963, 1988; Braun-Blanquet *et al.*, 1964; Parent, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Braun-Blanquet, 1978; Guinochet and Vilmorin, 1978; Bournérias, 1979, 1984; Oberdorfer, 1990)

54.121

Tufa cones

Large tufa deposits of petrifying springs. When active, they comprise a hydrosere in which the *Cratoneurion* plants, and in particular, *Cratoneuron spp.*, are accompanied by fen species such as *Carex lepidocarpa* and *Sesleria caerulea*; the latter may physiognomically dominate both the hydrosere and the adjacent xerosere, developed on fossil tufa deposits, in which it is accompanied by *Brometalia* plants.

54.122

Calcareous springs

Other calcareous springs, with their associated flush.

54.2

RICH FENS*Tofieldietalia (Caricetalia davallianae): Caricion davallianae*

Wetlands mostly or largely occupied by peat- or tufa-producing small sedge and brown moss communities developed on soils permanently waterlogged, with a soligenous or topogenous base-rich, nutrient-poor, often calcareous water supply, and with the water table at, or slightly above or below, the substratum. Peat formation, when it occurs, is infra-aquatic. Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the *Caricion davallianae*, characterized by a usually prominent 'brown moss' carpet formed by *Campylium stellatum*, *Drepanocladus intermedius*, *D. revolvens*, *Cratoneuron commutatum*, *Acrocladium cuspidatum*, *Ctenidium molluscum*, *Fissidens adiantoides*, *Bryum pseudotriquetrum* and others, a grasslike growth of *Schoenus nigricans*, *S. ferrugineus*, *Eriophorum latifolium*, *Carex davalliana*, *C. flava*, *C. lepidocarpa*, *C. hostiana*, *C. panicea*, *Juncus subnodulosus*, *Scirpus cespitosus*, *Eleocharis quinqueflora*, and a very rich flora including *Tofieldia calyculata*, *Dactylorhiza incarnata*, *D. traunsteineri*, *D. traunsteinerioides*, *D. russowii*, *D. majalis* ssp. *brevifolia*, *D. cruenta*, *Liparis loeselii*, *Herminium monorchis*, *Epipactis palustris*, *Pinguicula vulgaris*, *Pedicularis sceptrum-carolinum*, *Primula farinosa*, *Swertia perennis*. Wet grasslands (*Molinietalia caerulea*, 37), tall sedge beds (*Magnocaricion*, 53.2), reed formations (*Phragmition*, 53.1), fen-sedge beds (*Cladietum mariscae*, 53.3), may form part of the fen system, with communities related to transition mires (54.5, 54.6) and amphibious or aquatic vegetation (22.3, 22.4) or spring communities (54.1) developing in depressions. The sub-units below, which can, alone or in combination, and together with codes selected from the categories just mentioned, specify the composition of the fen, are understood to include the mire communities *sensu stricto* (*Caricion davallianae*), their transition to the *Molinion*, and assemblages that, although they may be phytosociologically referable to alkaline *Molinion* associations, contain a large representation of the *Caricion davallianae* species listed, in addition to being integrated in the fen system; this somewhat parallels the definition of an integrated class *Molinio-Caricetalia davallianae* in Rameau *et al.*, 1989. Outside of rich fen systems, fen communities can occur on small surfaces in dune slack systems (16.3), in transition mires (54.5), in wet grasslands (37), on tufa cones (54.121) and in a few other situations. The codes below can be used, in conjunction with the principal code relevant, to signal their presence. Rich fens are exceptionally endowed with spectacular, specialized, strictly restricted species. They are among the habitats that have undergone the most serious decline. They are essentially extinct in several regions and gravely endangered in most. A very few large systems remain, in particular in pre-Alpine Bavaria, in the Italian pre-Alps, in collinar and montane eastern France, in north-eastern Germany, in the coastal marshes of northern France, in south-eastern and northern England, in Wales and in Ireland.

(Duvigneaud, 1947; Braun-Blanquet, 1954, 1971a; Ellenberg 1963, 1988; Vanden Berghen, 1963; Braun-Blanquet *et al.*, 1964; Berset, 1969; Géhu and Wattez, 1971; Herbauts, 1971; Parent, 1973; Westhoff and den Held, 1975; Schumacher, 1977; Guinochet and Vilmorin, 1978; Dierssen, 1978; Ratcliffe, 1980; Wheeler, 1980a, b, c; Jermy *et al.*, 1982; Lembrechts and Van Straaten, 1982; Wheeler *et al.*, 1983; Schmid, 1984; Nordiska ministerradet, 1984; Bournérias, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Gruber, 1984; Dupias, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)

- 54.21** **BLACK BOG-RUSH FENS**
Schoenetum nigricantis (*Orchio-Schoenetum nigricantis*, *Schoeno-Juncetum subnodulosi*, *Juncus baltici-Schoenetum nigricantis*)
Schoenus nigricans-dominated or -rich communities, of wide distribution, though less common in Alpine and peri-Alpine regions than the next unit, and confined to lower altitudes. Rushes, *Juncus subnodulosus* in British and western continental inland fens, *J. balticus* in dune-slack fens, are often abundant. Other accompanying species include *Carex lepidocarpa*, *C. hostiana*, *C. panicea*, *C. pulicaris*, *Eriophorum latifolium*, *Molinia caerulea*, *Dactylorhiza incarnata*, *D. praetermissa*, *D. purpurella*, *D. traunsteineri*, *D. traunsteinerioides*, *Epipactis palustris*, *Parnassia palustris*, *Pinguicula vulgaris*, brown mosses and, locally, *Pinguicula lusitanica* and *Drosera anglica*. These communities have enormously regressed, particularly in northern and north-western continental Europe, and are extinct in many regions.
- 54.22** **BROWN BOG-RUSH FENS**
Schoenus ferrugineus-dominated communities.
- 54.221** **Peri-Alpine brown bog-rush fens**
Primulo-Schoenetum ferruginei
Schoenus ferrugineus-dominated formations of Alpine and peri-Alpine regions, with a predominance of *Schoenus ferrugineus* among the gramineous growth which is often overwhelming, imparting to the fens a distinctive brown tone in summer. *Schoenus ferrugineus* may be accompanied by *Schoenus nigricans*, *Eriophorium latifolium*, *Carex hostiana*, *C. davalliana*, *C. panicea*, *C. flacca*, *C. lepidocarpa*, *C. demissa*, *C. dioica*, *Eleocharis quinqueflora*, *Molinia caerulea*; non-gramineous herbs include *Pinguicula vulgaris*, *Gentiana utriculosa*, *Drosera anglica*, *Primula farinosa*, *Parnassia palustris*, *Dactylorhiza traunsteineri*, *D. lapponica*, *Tofieldia calyculata*; the rich moss layer is formed by *Drepanocladus intermedius*, *D. revolvens*, *Campylium stellatum*.
- 54.222** **Scottish brown bog-rush fens**
Pinguiculo-Caricetum dioicae p.
Schoenus ferrugineus stands of base-rich Perthshire flushes, with *Eleocharis quinqueflora*, *Carex hostiana*, *C. panicea*, *C. lepidocarpa*, *Saxifraga aizoides*, *Scirpus cespitosus*, *Eriophorum latifolium*, *E. angustifolium*, *Tofieldia pusilla*, *Pinguicula vulgaris*, *Scorpidium scorpioides*.
- 54.223** **Baltic brown bog-rush fens**
Schoenus ferrugineus-dominated fens of north-eastern Jutland, the Danish archipelago and north-eastern Germany, with *Carex panicea*, *Tofieldia pusilla*, *Andromeda polifolia* and brown mosses.
- 54.23** **DAVALL SEDGE FENS**
Caricetum davallianae
Diverse, often extensive, fen communities, with *Carex davalliana*, *C. hostiana*, *C. lepidocarpa*, *C. capillaris*, *C. panicea*, *C. nigra*, *C. demissa*, *C. flava*, *C. pulicaris*, *Eriophorum latifolium*, *Blysmus compressus*, *Schoenus ferrugineus*, *Eleocharis quinqueflora*, *Juncus articulatus*, *Scirpus cespitosus*, *Molinia caerulea*, *Dactylorhiza traunsteineri*, *Tofieldia calyculata*, *Allium schoenoprasum*, *Potentilla erecta*, *Swertia perennis*, *Primula farinosa*, *Parnassia palustris*, *Pinguicula vulgaris* and a moss layer formed by *Drepanocladus intermedius*, *Cratoneuron glaucum*, *Campylium stellatum*, mostly characteristic of Alpine and peri-Alpine regions, with outlyers in the Hercynian system. This extremely species-rich community is still represented by a few large, very well-preserved examples on the Bavarian plateau. These are a refuge for many rare species, including the relict, threatened *Pedicularis sceptrum-carolinum* and the orchids *Dactylorhiza traunsteineri*, *D. ochroleuca*, *D. incarnata*, *Herminium monorchis*, *Epipactis palustris*. Elsewhere in their range, the Davall sedge fens have undergone a drastic reduction, leading to extinction in many areas.
- 54.231** **Species-rich Davall sedge fens**
Caricetum davallianae
Small *Carex*, *Eriophorum* and herb-rich facies of Davall sedge fens, with high species diversity.

54.232

Deergrass Davall sedge fens*Caricetum davallianae trichophoretosum*

Generally impoverished *Scirpus cespitosus*-dominated facies of Davall sedge fens. Common companions are *Carex davalliana*, *Parnassia palustris*, *Potentilla erecta* and the mosses *Campylium stellatum*, *Drepanocladus intermedius*.

54.24

PYRENEAN RICH FENS*Carici davallianae-Eriophoretum latifoliae*, *Pinguiculo grandiflorae-Caricetum davallianae*, *Pediculari sylvaticae-Caricetum davallianae*

Uncommon calcareous fens of the Pyrenees, with *Eriophorum latifolium*, *Carex davalliana*, *C. lepidocarpa*, *C. echinata*, *C. rostrata*, *C. flacca*, *C. panicea*, *C. paniculata*, *C. ovalis*, *Eleocharis quinqueflora*, *Juncus articulatus*, *J. inflexus*, *Tofieldia calyculata*, *Epipactis palustris*, *Crepis paludosa*, *Parnassia palustris*, *Succisa pratensis*, *Pinguicula grandiflora*.

54.25

DIOECIOUS-FLEA-YELLOW SEDGE FENS

Diverse rich fen communities dominated by small sedges, among which *Carex dioica*, *C. pulicaris* or species of the *Carex flava* group, are usually prominent, but with little or no *Carex davalliana*. They mostly have a distinctly western distribution, occurring, in particular, in Denmark, on the western Hercynian periphery, in the Causses, in Iberia and in the British Isles.

54.251

British dioecious-yellow sedge fens*Pinguiculo-Caricetum dioicae*

Small *Carex* swards of calcareous, soligenous mires on peat or mineral gleys, with *Carex dioica*, *C. lepidocarpa*, *C. demissa*, *C. nigra*, *C. hostiana*, *C. flacca*, *C. panicea*, *Eriophorum latifolium*, *Eleocharis quinqueflora*, *Blysmus compressus*, *Scirpus setaceus*, *Pinguicula vulgaris*, *Primula farinosa*, *Bartsia alpina*, *Tofieldia pusilla* and sometimes, *Juncus articulatus*, *J. alpinoarticulatus*, *Molinia caerulea*, *Equisetum variegatum*, *Anagallis tenella*, *Epipactis palustris* and the bryophytes *Campylium stellatum*, *Bryum pseudotriquetrum*, *Drepanocladus revolvens*, *Riccardia pinguis*, *Cratoneurum commutatum*, *Fissidens adianthoides*, characteristic mostly of northern England and Scotland.

54.252

Scandinavian dioecious-yellow sedge fens

Short *Carex*-dominated fen communities with *Carex flava* s.l., *C. panicea*, *C. dioica*, *Eriophorum latifolium*, *Tofieldia pusilla* and brown mosses.

54.253

Middle European yellow sedge fens

Fen communities of middle latitudes of continental western Europe (the Netherlands, Belgium, western Germany, France, northern Italy), with *Carex dioica*, *C. lepidocarpa*, *C. demissa*, *C. serotina*, *C. panicea*, *Eriophorum latifolium*, *Juncus articulatus*, *J. alpinoarticulatus* and *Campylium stellatum*.

54.254

Cantabrian yellow sedge fens*Pinguiculo grandiflorae-Caricetum lepidocarpae*, *Primulo farinosae-Caricetum lepidocarpae*

Rare exiguous alkaline spring and gully communities of the montane level of the Cordillera Cantabrica, with *Carex lepidocarpa*, *C. demissa*, *C. davalliana*, *C. echinata*, *C. nigra*, *C. panicea*, *Eriophorum latifolium*, *Eleocharis quinqueflora*, *Juncus articulatus*, *Equisetum variegatum*, *Pinguicula grandiflora*, *Parnassia palustris* and, in more eastern communities, *Tofieldia calyculata*, *Primula farinosa*, *Bartsia alpina*.

54.255

Eastern Iberian rich fens

Calcareous fens of the southern Iberian Range (Sierra de Gudar, Sierra de Javalambre).

54.256

Flea sedge fens*Parnassio-Caricetum pulicaris*, *Campyllo-Caricetum dioicae*

Fen formations intermediate between the *Caricion davallianae* and the *Caricion fuscae*, often developed in ecotonal situations, with *Carex pulicaris* and *C. dioica*, dispersed over a fairly wide range in continental middle Europe.

54.26

BLACK SEDGE ALKALINE FENS

Rich fen communities dominated by *Carex nigra*, accompanied by calciphile species and brown mosses.

- 54.27** **RUSSET SEDGE FENS**
Carex saxatilis-dominated mires of high calcareous mountains of the central Highlands of Scotland, with *Carex saxatilis*, *Juncus triglumis*, *J. castaneus*, *Saxifraga aizoides* and brown mosses.
- 54.28** **ICE SEDGE FENS**
Caricetum frigidae (*Saxifrago-Caricetum frigidae*, *Tofieldio-Caricetum frigidae*, *Cariceto frigidae-Pinguiculo grandiflorae*, *Primulo-Caricetum frigidae*, *Soldanello-Caricetum frigidae*)
 Mostly subalpine formations dominated by *Carex frigida*, colonizing seepages and flushes on stony slopes of the Alps, the Pyrenees and the Black Forest, with *Carex davalliana*, *C. demissa*, *C. panicea*, *C. nigra*, *Juncus triglumis*, *J. castaneus*, *Blysmus compressus*, *Tofieldia calyculata*, *Parnassia palustris*, *Pinguicula vulgaris*, *P. grandiflora*, *Primula farinosa*, *Saxifraga aizoides*, *Campylium stellatum*.
- 54.29** **BRITISH SAXIFRAGE-SEDE FLUSHES**
Carex demissa-Saxifraga aizoides communities of sub-montane base-rich seeps in northern Wales, northern England, southern Scotland and, mostly, the Scottish Highlands, with *Juncus articulatus*, *Carex panicea*, *Eleocharis quinqueflora*, *Selaginella selaginoides* and brown mosses. Montane saxifrage-sedge flushes with glacial relicts have been listed under 54.34.
- 54.2A** **SPIKE-RUSH FENS**
Eleocharis quinqueflora-dominated rich fen communities, for the most part species-poor pioneering formations.
- 54.2B** **GREEK FLAT SEDGE FENS**
Blysmus compressus-dominated communities of Greek mountains, with *Parnassia palustris*, *Veronica balcanica*, *V. anagallis-aquatica*, *Eleocharis uniglumis*, *E. quinqueflora*, *Carex hirta*, and with *Juncus thomasi*, *Bellis perennis* or *Leontodon hispidus* on limestone, *Pinguicula hirtiflora*, *P. balcanica*, *Soldanella pindicola*, *Eriophorum latifolium*, *Carex nigra* on ophiolites.
- 54.2C** **BOTTLE SEDGE ALKALINE FENS**
Carex rostrata-dominated formations of very wet sites in rich fens, usually with a carpet of brown mosses and few vascular plants other than the sedge; these grade into transition mire communities of 54.5.
- 54.2D** **ALPINE DEERGRASS ALKALINE FENS**
Scirpus hudsonianus-dominated stands of fens, less common than those of transition mires (54.5).
- 54.2E** **DEERGRASS ALKALINE FENS**
Scirpus cespitosus stands of rich fens, other than those that occur as facies of Davall sedge fens.
- 54.2F** **MIDDLE EUROPEAN FLAT SEDGE FENS**
Blysmus compressus-dominated stands of rich fens other than Greek flat sedge fens (54.2B).
- 54.2G** **SMALL HERB ALKALINE FENS**
 Simplified fen communities formed by a few non-gramineous species, in particular, *Anagallis tenella* and *Parnassia palustris*.
- 54.2H** **CALCAREOUS DUNAL RUSH-SEDE FENS**
Cariceto-Drepanocladetum
 Formations of *Carex trinervis*, *C. scandinavica*, *Juncus anceps*, *J. subnodulosus*, *Parnassia palustris*, *Gentianella amarella*, *Herminium monorchis*, *Drepanocladus aduncus*, *Campylium stellatum*, without, or with little, *Schoenus nigricans*. These communities, characteristic of calcareous Belgian and northern French wet dune slacks are limited to dunal systems and this code will thus be used in conjunction with 16.33. They are gravely threatened.

54.2I

TALL HERB FENS

Fens invaded by *Peucedanum palustre*, *Eupatorium cannabinum*, *Cicuta virosa*, *Symphytum officinale*, *Lysimachia vulgaris*, *Cladium mariscus*, *Phragmites australis*, *Glyceria maxima*, *Calamagrostis canescens*.

54.3

ARCTO-ALPINE RIVERINE SWARDS

Caricion bicolori-atrofuscae

Rare Alpine, peri-Alpine and northern British communities of glacial relicts colonizing neutral or basic gravelly, sandy, stony, sometimes somewhat argilous or peaty substrates soaked by cold water, in moraines and on edges of springs, rivulets, glacial torrents of the alpine or subalpine levels, or on alluvial sands of pure, cold, slow-flowing rivers and calm backwaters. The highly characteristic constituents are *Carex bicolor*, *C. microglochin*, *C. maritima*, *C. atrofusca*, *C. vaginata*, *Kobresia simpliciuscula*, *Scirpus pumilus*, *Juncus arcticus*, *J. alpinoarticulatus*, *J. castaneus*, *J. triglumis*, *Typha minima*, *T. lugdunensis*, *T. shuttleworthii*, *Tofieldia pusilla*; they are often accompanied by *Carex davalliana*, *C. dioica*, *C. capillaris*, *C. panicea*, *C. nigra*, *Blysmus compressus*, *Eleocharis quinqueflora*, *Scirpus cespitosus*, *Primula farinosa*, *Equisetum variegatum*, *Drepanocladus intermedius*, *Campylium stellatum*.

(Braun-Blanquet, 1954, 1967, 1971; Braun-Blanquet *et al.*, 1964; Dierssen, 1978; Guinochet and Vilmorin, 1978; Ratcliffe, 1980; Jermy, 1982; Ellenberg, 1988; Oberdorfer, 1990)

54.31

ARCTO-ALPINE RIVERINE FALSE SEDGE SWARDS

Kobresietum simpliciusculae

Communities of *Kobresia simpliciuscula*, *Carex microglochin*, *Scirpus pumilus*, *Tofieldia pusilla*, *Carex dioica*.

54.32

ARCTO-ALPINE RIVERINE CURVED SEDGE SWARDS

Caricetum maritimae

Communities of *Carex bicolor*, *C. maritima*, *C. atrofusca*, *Juncus arcticus*.

54.33

ARCTO-ALPINE RIVERINE TYPHA SWARDS

Equiseto-Typhetum minimae

Typha minima, *T. shuttleworthii*, *Juncus alpinoarticulatus*, *Equisetum variegatum* communities of cold slow-flowing waters.

54.34

BRITISH MICA FLUSHES

Rare communities of micaceous stony flushes of the Highlands of Scotland and of upper Teesdale, with *Carex atrofusca*, *C. microglochin*, *C. demissa*, *C. dioica*, *C. panicea*, *Juncus triglumis*, *J. biglumis*, *J. castaneus*, *Kobresia simpliciuscula*, *Tofieldia pusilla*, *Saxifraga aizoides*, *Thalictrum alpinum*, *Equisetum variegatum*, *E. hyemale* and the moss *Blindia acuta*.

54.4

ACIDIC FENS

Caricetalia fuscae, *Caricion fuscae*

Topogenous or soligenous valley, basin or spring mire systems fed by waters poor in bases. As in the rich fens, the water level is at or near the surface of the substratum and peat formation is infra-aquatic. The mire communities themselves, dominated by small sedges and brown mosses or sphagnum, belong to the *Caricetalia fuscae*, but, in large fen systems, they are accompanied by acidocline wet grasslands (*Molinietalia caeruleae*), large sedge beds (*Magnocaricion*) and reed or related communities (*Phragmition*). Sphagnum hummocks (51.11) form locally and transition mires (54.5) or aquatic (22.3), amphibian (22.2) and spring (54.1) communities colonize small depressions. Thus, codes from all the above categories are used in conjunction with the ones below to completely describe the fen. The subdivisions listed here are, in any case, understood to include, besides strict mire communities, their transitions to humid grasslands, and groupings phytosociologically affiliated with *Molinion* associations, but rich in species of the *Caricion fuscae*, provided they are integrated in a fen system (somewhat paralleling the *Junco acutiflori-Caricetalia nigrae* of Rameau *et al.*, 1989). Acidic fen communities also occur on small surfaces or within mosaics in other ecosystems, in particular in typical humid grasslands (37), humid woodlands and thickets (44), decalcified dune slacks (16.3) and spring systems (54.1). Their presence can be indicated by codes from this unit used in conjunction with the relevant main codes. Characteristic species of acidic mire communities are *Carex canescens*, *C. echinata*, *C. nigra*, *Eriophorum angustifolium*, *E. scheuchzeri*, *Scirpus cespitosus*, *Juncus filiformis*, *Agrostis canina*, *Viola palustris*, *Cardamine pratensis*, *Ranunculus flammula* and the mosses *Calliargon sarmentosum*, *C. stramineum*, *C. cuspidatum*, *Drepanocladus exannulatus*, *D.*

fluitans, *Sphagnum recurvum*, *S. auritum*, *S. cuspidatum*, *S. subsecundum*, *S. apiculatum*, *S. papillosum*, *S. russowii*.

(Braun-Blanquet, 1954, 1971; Ellenberg 1963, 1988; Berset, 1969; Schumacker and Froment, 1971; Parent, 1973; Westhoff and den Held, 1975; Schumacker, 1976; Wattez, 1976; Schumacher, 1977; Brasseur *et al.*, 1977; Guinochet and Vilmorin, 1978; Brasseur *et al.*, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Prieto, 1983; Nordiska ministerradet, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Bournérias, 1984; Ochsenbein, 1984a, b; Gamisans, 1985; Dias Gonzalez and Fernandez Prieto, 1987; Martinez Parras and Peinado Lorca, 1987; Rivas-Martinez *et al.*, 1987; Martinez Parras *et al.*, 1987; Rameau *et al.*, 1989; Salomez *in litt.*, 1989; Oberdorfer, 1990)

54.41

ALPINE COTTONGRASS LAKE GIRDLES*Eriophoretum scheuchzeri*

Almost pure swards of *Eriophorum scheuchzeri* fringing small, cold, acidic lakes above the tree limit. Permanently inundated, they include few other vascular plants, limited to a few individuals of *Carex nigra*, *C. rostrata*, *C. lachenalii*, *C. brunnescens*, *Juncus filiformis*, *Eriophorum angustifolium*; the moss *Drepanocladus exannulatus* is usually present and abundant.

54.42

BLACK-WHITE-STAR SEDGE FENS*Caricetum fuscae s.l.*

Acidic fen communities of middle Europe, the Alpine system, the Pyrenees and northern Iberia, rich in *Carex nigra*, *C. canescens*, *C. echinata*, often accompanied by *Eriophorum angustifolium* and *Juncus spp.*, with a muscinal layer of brown mosses, sphagnum or both.

54.421

Alpine black sedge fens*Caricetum fuscae (Caricetum nigrae) s.s.*

Acidophilous small sedge communities of the alpine and subalpine levels of the Alps and Alpine periphery, occupying wet gentle slopes and plateaux where melt water lingers or encircling small lakes on the landward, usually emerged, side of the *Eriophoretum scheuchzeri* girdle. The sward is formed by *Carex nigra*, *C. canescens*, *C. echinata*, *Juncus filiformis* variously accompanied by *Eriophorum angustifolium*, *Carex magellanica*, *C. lachenalii*, *C. norvegica*, *C. panicea*, *C. demissa*, *Phleum alpinum*, *Agrostis canina*, *Viola palustris*, *Parnassia palustris*, *Pedicularis palustris*; the moss layer is formed by *Scapania paludosa*, *Paludella squarrosa*, *Drepanocladus exannulatus*, *D. revolvens*, *D. intermedium*, *Calliergon stramineum*, *C. sarmentosum*, *Willemetia stipitata*, *Sphagnum recurvum*.

54.422

Sub-Atlantic black-white-star sedge fens*Caricetum curto-echinatae (Carici canescenti-Agrostitetum caninae)*

Acidic fen communities of lowland, collinar and montane areas of northern and western Europe, excluding the British Isles and the Iberian peninsula. *Carex nigra*, *C. canescens* and *C. echinata* are always represented, often accompanied by dispersed *C. rostrata*. Rushes, *Juncus filiformis*, *J. articulatus*, *J. acutiflorus*, *J. effusus*, may be numerous, often marking the transition towards humid grasslands of the *Molinietalia*, the moss layer is formed by *Sphagnum apiculatum*, *S. cuspidatum*, *S. recurvum* and *Polytrichum commune* in the more oligotrophic, acidic sites, by brown mosses *Drepanocladus fluitans*, *Calliergon stramineum*, *C. cuspidatum*, in more mesotrophic situations. Other characteristic species include *Eriophorum angustifolium*, *E. vaginatum*, *Agrostis canina*, *Molinia caerulea*, *Pedicularis palustris*, *Viola palustris*, *Parnassia palustris*, *Comarum palustre*, *Drosera rotundifolia*, *Menyanthes trifoliata*, *Ranunculus flammula* and *Willemetia stipitata*. Included in this unit are the extensive peatlands of Hercynian valley fens, often invaded by rushes, and with characters both of the transition mires and of the humid grasslands.

54.4221

Sub-Atlantic *Carex* acidic fens

Sedge-dominated formations in which *Carex canescens*, accompanied by *Agrostis canina*, is often the most abundant, with a brown moss layer that can sometimes be very partial; *Carex nigra* and *C. echinata* facies also occur.

54.4222

Sub-Atlantic *Carex-Juncus* acidic fens

Acidic fen formations in which *Carex nigra*, *C. canescens*, *C. echinata*, and sometimes *C. rostrata* are accompanied by, and sometimes dominated by, abundant rushes, in particular *Juncus filiformis* and *J. acutiflorus*, and with a pleurocarpic moss layer.

- 54.4223** **Sub-Atlantic *Carex-Sphagnum* fens**
Sphagnum peatlands in which the herbaceous sward is formed by *Carex nigra*, *C. canescens*, *C. echinata* and *C. rostrata*, generally with *Eriophorum angustifolium* and *E. vaginatum*. These very wet formations are closely related to transition mires.
- 54.4224** **Sub-Atlantic *Carex-Juncus-Sphagnum* fens**
Sphagnum peatlands in which the herbaceous sward is formed by *Carex nigra*, *C. canescens*, *C. echinata*, *C. rostrata* and abundant rushes, in particular *Juncus filiformis* and *J. acutiflorus*, generally with *Eriophorum angustifolium* and *E. vaginatum*. These formations are often related to wet grasslands.
- 54.423** **British black-white-star sedge acidic fens**
Acidic sphagnum fens of the British Isles in which the herbaceous sward is formed by *Carex echinata*, *C. canescens*, *C. nigra* or *Carex rostrata* and sometimes *Juncus effusus*, *J. acutiflorus* or *Nardus stricta*.
- 54.4231** **British *Carex-Sphagnum* fens**
Acidic sphagnum fens of the British Isles dominated by *C. canescens*, *C. echinata*, *C. nigra*, *C. panicea*, *C. demissa*, *C. rostrata*, with *Sphagnum recurvum*, *S. papillosum*, *S. russowii*.
- 54.4232** **British *Juncus-Sphagnum* fens**
Acidic sphagnum fens of the British Isles physiognomically dominated by *Juncus effusus* and *J. acutiflorus*, with *Carex echinata*, *C. nigra*, *Agrostis stolonifera*, *Sphagnum recurvum*, *Polytrichum commune*.
- 54.4233** **British high montane *Sphagnum* fens**
Very local fens of the high Scottish Highlands, with *Carex echinata*, *C. nigra*, *C. bigelowii*, *C. aquatilis*, *C. rariflora*, *Saxifraga stellaris*, *Sphagnum recurvum*, *S. lindbergii*, *S. riparium*, *S. russowii*.
- 54.424** **Pyrenean black sedge acidic fens**
Caricetum fuscae p.
Carex nigra-dominated acidic fens of the Pyrenees, very similar to those of the Alps, in particular to the floristically rather impoverished south-western Alpine communities.
- 54.425** **Iberian black sedge acidic fens**
Caricetum carpetanae, *Sphagno recurvi-Caricetum carpetanae*
Carex nigra ssp. *carpetana*-dominated communities of acid infra-aquatic peat mires of the montane and subalpine levels of the Cordillera Cantabrica and of the Cryo-Mediterranean level of the Cordillera Central.
- 54.43** **APENNINE ACIDIC FENS**
Rare infra-aquatic acidic peat mire communities of the Apennines south to the Sila, with *Carex nigra*, *C. echinata* and *C. panicea*.
- 54.44** **INTRICATED SEDGE POZZINES**
Oro-Mediterranean *Carex intricata* (*Carex nigra* ssp. *intricata*)-dominated formations of the Sierra Nevada, Corsica and the Nebrodi.
- 54.441** **Nevadan Borreguile fens**
Ranunculo-Caricetum intricatae
Formations occupying permanently waterlogged peaty soils of glacial depressions and edges of their small lakes, and also waterholes in *Nardus* grasslands, at the oro-Mediterranean level of the Sierra Nevada, dominated by *Carex intricata*, with *C. echinata*, *Eleocharis uniglumis*, *Viola palustris*, *Cerastium cerastoides*, *Veronica repens* and Sierra Nevada endemics *Ranunculus alismoides*, *Festuca frigida*, *Pinguicula nevadensis*, *Leontodon microcephalus*.
- 54.442** **Corsican intricated sedge pozzines**
Caricetum intricatae
Peaty swards surrounding waterholes, in particular glacial lakes, in the subalpine level of Corsica, dominated by *Carex intricata*.

- 54.443** **Nebrodi pozzines**
Isolated *Carex intricata* stations of Mount San Fratello in the Nebrodi mountains of Sicily.
- 54.45** **DEERGRASS ACIDIC FENS**
Acidic fen communities dominated by *Scirpus cespitosus*.
- 54.451** **Alpine deergrass acidic fens**
Trichophoretum caespitosum
Scirpus cespitosus-dominated communities of subalpine and alpine fens of the Alps, generally installed on somewhat drier ground than the *Caricetum fuscae* and providing the transition between it and the wetter fringe of the *Nardus* grasslands.
- 54.452** **Pyrenean deergrass acidic fens**
Primulo integrifoliae-Trichophoretum caespitosi, *Nartheccio ossifragi-Trichophoretum caespitosi*
Scirpus cespitosus-dominated formations of acidic fens of the Pyrenees, often, particularly in the west, rich in *Narthecium ossifragum*, and with *Carex frigida*.
- 54.453** **Cantabrian deergrass acidic fens**
Erico tetralicis-Trichophoretum germanici
Subalpine formations of the Cordillera Cantabrica, and, very locally, of the Orensano-Sababrian mountains and the Cordillera Central, dominated by *Scirpus cespitosus* and *Narthecium ossifragum*, usually forming an outer fringe to the *Caricetum carpetani*, on somewhat less wet ground. Among companion species are *Carex echinata*, *C. fusca*, *C. binervis*, *Drosera rotundifolia*, *Erica tetralix*.
- 54.454** **Sub-Atlantic deergrass acidic fens**
Scirpus cespitosus-dominated communities of lowland and collinar middle European acidic fens.
- 54.455** **Corsican deergrass fens**
Pinguiculo-Trichophoretum caespitosi
Scirpus cespitosus-dominated formations of subalpine pozzines of Corsica, mostly confined to the edge of rivulets.
- 54.46** **ERIOPHORUM ANGUSTIFOLIUM MIRES**
Eriophorum angustifolium-dominated swards of usually very wet sites within acidic fens, generally with a sphagnum carpet, formed in particular by *Sphagnum cuspidatum*.
- 54.47** **DUNAL SEDGE ACIDIC FENS**
Caricetum trinervi-fuscae
Formations of *Carex nigra*, *C. trinervis*, *C. x timmiana*, *Juncus anceps*, *J. subnodulosus* and introduced *Vaccinium macrocarpum*, restricted to wet, peaty, acidified dune slacks of the continental North Sea coast. This unit is to be used in conjunction with 16.33.
- 54.5** **TRANSITION MIRES**
Scheuchzerietalia palustris: *Caricion lasiocarpae*, *Rhynchosporion albae* p. i.a.
Wetlands mostly or largely occupied by peat-forming plant communities developed at the surface of oligotrophic or meso-oligotrophic water reaching a level above, sometimes well above, the substratum, providing little or no mineral or nutrient supply. Their characteristics are thus intermediate between those of soligenous and topogenous mires and those of strictly ombrogenous bogs. In large systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium-sized or small sedges, associated with sphagnums or brown mosses. They are accompanied by aquatic and amphibious communities (22.3, 22.4) and by formations transitional to these on the one hand, to fens (54.2, 54.4), bogs (51.1) or humid grasslands (37) on the other; sphagnum buttes (51.11), in particular, are often an important feature. Tall sedge and reed communities (53), willow and alder carrs (44) invade part of the peatland. Transition mires form mostly as colonists of oligotrophic ponds and lakes, large bog pools or lags. Their distribution is mostly northern peri-Alpine, peri-Hercynian and northern European. Outside of transition mire systems, their communities can be found in bog hollows (51.12), in blanket bogs (52), in depressions of rich or acidic fens (54.2, 54.4), in spring systems (54.1), in humid heaths (31.1) and a few other habitats. Characteristic species include *Eriophorum gracile*, *Carex lasiocarpa*, *C. chordorr-*

hiza, *C. limosa*, *Scheuchzeria palustris*, *Hammarbya paludosa*, *Liparis loeselii*, *Calla palustris*. Transition mires are an extremely important refuge of specialized, threatened species of both plants and animals; their richness and diversity in remarkable invertebrates, dragonflies among others, is even greater than that of most other mire ecosystems.

(Robyns, 1958; Ellenberg, 1963, 1988; Braun-Blanquet, 1971; Géhu and Wattez, 1971; Parent, 1973; Lambinon, 1974; Westhoff and den Held, 1975; Willems *et al.*, 1975; Guinochet and Vilmorin, 1978; Muller, 1978; Schumacker, 1978; Bresseur *et al.*, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Lembrechts and Van Straaten, 1982; Jermy *et al.*, 1982; Nordiska ministerradet, 1984; Bournérias, 1984; Ochsenein, 1984a, b; Fabri *et al.*, 1985; Mollet *et al.*, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)

54.51

SLENDER-SEDGE SWARDS*Caricetum lasiocarpae*

Usually floating meadows of the medium-sized *Carex lasiocarpa* associated with either sphagnum or pleurocarps and often accompanied by *Eriophorum gracile*, *Menyanthes trifoliata*.

54.511

Brown moss slender-sedge swards*Caricetum lasiocarpae scorpidietosum*

Basiline quaking mires and floating mats dominated by *Carex lasiocarpa* associated with *Scorpidium scorpioides* and other pleurocarps, and with charophytes. Among characteristic accompanying species are *Pedicularis palustris* and *Liparis loeselii*.

54.512

Sphagnum slender-sedge swards*Caricetum lasiocarpae sphagnetosum recurvae* (*Sphagno-Caricetum lasiocarpae*)

Acidocline quaking mires and floating mats dominated by *Carex lasiocarpa* associated with sphagnum (*Sphagnum angustifolium*, *S. recurvum*, *S. lindbergii*, *S. pulchrum*, *S. balticum*, *S. dusenii*, *S. papillosum*, *S. subsecundum*, *S. riparium*, *S. subnitens*, *S. cuspidatum*, *S. flexuosum*, *S. fimbriatum*, *S. palustre*, *S. auriculatum*) and *Polytrichum commune*. Characteristic accompanying species include *Carex rostrata*, *C. nigra*, *C. panicea*, *Equisetum fluviatile*, *Narthecium ossifragum*, *Dactylorhiza sphagnicola*, *Comarum palustre*, *Vaccinium oxycoccus*.

54.52

CAREX DIANDRA QUAKING MIRES*Caricetum diandrae* (*Scorpidio-Caricetum diandrae*)

Usually open swards formed by *Carex diandra* in association with *C. lasiocarpa*, *C. appropinquata*, *C. limosa*, *C. lepidocarpa*, *Eriophorum gracile*, *E. angustifolia*, *Menyanthes trifoliata*, *Comarum palustre*, *Hydrocotyle vulgaris*, *Pedicularis palustris* and an abundance of bryophytes, including the pleurocarps *Campylium stellatum*, *Drepanocladus intermedius* and the liverwort *Riccardia pinguis*. These mires are an important habitat for the threatened *Liparis loeselii*.

54.53

BOTTLE SEDGE QUAKING MIRES

Usually sparse low formations of *Carex rostrata* on sphagnum or, sometimes, pleurocarp carpets.

54.531

Acidocline bottle sedge quaking mires*Sphagno-Caricetum rostratae*

Mats of acidophilous sphagnum with a usually low, open growth of *Carex rostrata*, accompanied by *C. nigra*, *C. canescens*, *C. limosa*, *Vaccinium oxycoccus*; the main sphagnum are *Sphagnum recurvum*, *S. angustifolium*, *S. auriculatum*, *S. flexuosum*, *S. riparium*, *S. obtusum*, *S. dusenii*.

54.532

Basiline bottle sedge quaking mires

Formations of *Carex rostrata* and basiphilous sphagnum or pleurocarps.

54.5321

Basiline sphagnum-bottle sedge quaking mires

Mats of basiphilous sphagnum, *Sphagnum contortum*, *S. teres*, *S. warnstorffii*, *S. squarrosum* with *Carex rostrata*.

54.5322

Brown moss-bottle sedge quaking mires

Carex rostrata formations, with *Calliargon cuspidatum*, *C. giganteum*, *Campylium stellatum*, *Scorpidium scorpioides*.

- 54.54 MUD SEDGE SWARDS
Caricetum limosae p.
Low floating or quaking swards of *Carex limosa*.
- 54.541 **Brown moss mud sedge swards**
Caricetum limosae hypnetosum
Basicline *Carex limosa* swards and floating rafts, with *Carex lasiocarpa*, *C. lepidocarpa*, *Eriophorum gracile* and a rich bryophyte cortège formed by the mosses *Scorpidium scorpioides*, *Drepanocladus revolvens*, *Calliergon giganteum*, *C. trifarium*, *C. stramineum*, *Campylium stellatum*, *Bryum pseudotriquetum*, the liverwort *Riccardia pinguis*, and occasionally sphagnums. *Scheuchzeria palustris* or *Liparis loeselii* may be present. Outside of transition mires, elements of these communities occur in the depressions of rich fens.
- 54.542 **Sphagnum mud sedge swards**
Caricetum limosae sphagnetosum recurvi
Acidocline *Carex limosa* swards and floating rafts, with *Scheuchzeria palustris*, *Drosera rotundifolia*, *D. anglica*, *Menyanthes trifoliata* and the sphagnums *Sphagnum recurvum*, *S. subsecundum*, *S. imbricatum*, *S. papillosum*. Outside of transition mires, elements of these communities, and notably *Scheuchzeria palustris*, occur in deep hollows of bogs (51.121), with *Rhynchospora alba* and *Carex pauciflora* and often without *Carex limosa*.
- 54.55 **STRING SEDGE SWARDS**
Drepanoclado-Caricetum chordorrhizae
Short to medium-tall, usually inundated, swards formed by the Scandinavian, pre-Alpine, eastern-Hercynian, and, very locally, Scottish, *Carex chordorrhiza*, associated with *Carex limosa* and with varied pleurocarps, *Scorpidium scorpioides*, *Calliergon trifarium*, *C. stramineum*, *Campylium stellatum*, *Paludella squarrosa*, *Drepanocladus exanulatus*, *D. revolvens*, *D. procerus* or, occasionally, with sphagnums.
- 54.56 **PEAT SEDGE SWARDS**
Caricetum heleonastae
Short to medium-tall swards formed by *Carex heleonastes*, often associated with *Meesea triquetra*, in transition mires and in bog hollows of peri-Alpine areas.
- 54.57 **BEAK-SEDE QUAKING BOGS**
Sphagno-Rhynchosporetum albae
Rhynchospora alba-rich formations of transition mires, with *Drosera anglica*, *D. intermedia*, *D. rotundifolia*, *Vaccinium oxycoccus*, *Carex limosa*, *C. rostrata*, *Sphagnum recurvum* and sometimes with *Eleocharis quinqueflora*, *Eriophorum latifolium*, *Andromeda polifolia* or *Scheuchzeria palustris*.
- 54.58 **SPHAGNUM AND COTTONGRASS RAFTS**
Floating, sometimes drifting, carpets of sphagnums (*Sphagnum cuspidatum*, *S. recurvum*, *S. obesum*) or of sphagnums and *Eriophorum angustifolium*. They may form fairly large transition mire communities in permanent heath pools, peri-glacial palsas, large raised bog and blanket bog pools and in former peat-extraction holes. They often constitute the stage succeeding 54.59 in the colonization process. They have an appearance that ranges from low, barely emerging sphagnum mats to fairly dense cottongrass beds. *Drosera rotundifolia* is often abundant. The sphagnum and common cottongrass communities are an important habitat for the threatened *Hammarbya paludosa*.
- 54.59 **BOG BEAN AND MARSH CINQUEFOIL RAFTS**
Pioneering floating carpets of *Menyanthes trifoliata*, *Potentilla palustris* (*Comarum palustre*), *Hydrocotyle vulgaris*, often with *Equisetum fluviatile*, *Carex rostrata*, *Cicuta virosa* or sphagnums, forming the transition between amphibious communities and mire communities. Initial stages have *Potamogeton polygonifolius* or *P. coloratus*, late stages, *Carex nigra*, *Juncus acutiflora*, *Molinia caerulea*.
- 54.5A **BOG ARUM MIRES**
Calletum palustris i.a.
Floating meadows, quaking bogs or sphagnum mats dominated by, or rich in, *Calla palustris*, often with *Potentilla palustris*.

54.5B

BROWN MOSS CARPETS

Formations dominated by *Drepanocladus exannulatus*, *D. revolvens*, *Scorpidium scorpioides*, *Calliergon giganteum*, *C. cuspidatum*, *C. richardsonii*, *Campylium stellatum*, *Paludella squarrosa*, associated with sparse *Carex limosa*, *C. rostrata*, *C. lasiocarpa*, *C. chordorrhiza*, *C. aquatilis*, sometimes with *Potentilla palustris*, *Equisetum fluviatile*, *Sphagnum recurvum*, *S. dusenii*, *S. riparium*, *S. squarrosum*, *S. subsecundum* or *Sphagnum teres*, *S. warnstorffii*, *S. contortum*, *S. auriculatum*, *S. platyphyllum*, characteristic of mesocline or basicline quaking bogs, often occurring in mosaic with *Carex lasiocarpa* or *Carex diandra* formations.

54.5C

HARESTAIL COTTONGRASS QUAKING BOGS

Transition mire communities in which the grass layer is dominated by *Eriophorum vaginatum*, on a thick mat of *Sphagnum recurvum*, with *Polytrichum commune* often forming a second moss layer. Associated plants include *Carex nigra* and *Agrostis canina*. Typical raised bog plants are few, often limited to *Carex pauciflora* and *Vaccinium oxycoccos*.

54.5D

PURPLE MOORGRASS QUAKING BOGS

Molinia caerulea-dominated formation with *Sphagnum cuspidatum*, *Eleocharis palustris*, *Rhynchospora alba*, characteristic of lowlying areas in wet heaths and the periphery of fluctuating oligotrophic moor and heath pools.

54.5E

NARROW SMALL-REED QUAKING BOGS

Basicline transition mire communities characterized by the very rare, decreasing, threatened glacial relict *Calamagrostis stricta*, often associated with *Carex diandra*, of northern Ireland, northern Scotland, East Anglia, northern Netherlands, northern, eastern and pre-Alpine Germany.

54.5F

ALPINE DEERGRASS QUAKING BOGS

Transition mire communities dominated by *Scirpus hudsonianus*. It is in these that the species finds its principal habitat.

54.5G

IBERIAN QUAKING BOGS

Erico mackayanae-Sphagnetum papillosoi i.a.

Sphagnum communities of the collinar, and locally, montane, areas of north-western Iberia, intermediate between transition mire and bog, with *Drosera rotundifolia*, *Carex durieui*, *Narthecium ossifragum*, *Sphagnum tenellum*, *S. subnitens*, *Odontoschisma sphagni*, *Aulacomnium palustre*.

54.6

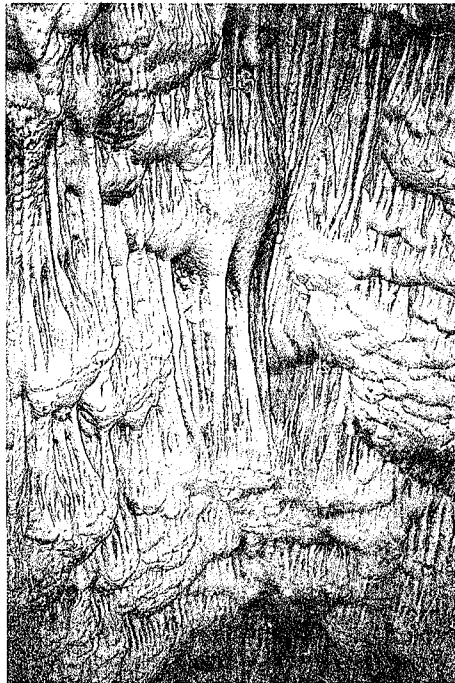
WHITE BEAK-SEDGE COMMUNITIES

Rhynchosporion albae

Highly constant pioneer communities of humid exposed peat or, sometimes, sand, with *Rhynchospora alba*, *R. fusca*, *Drosera intermedia*, *D. rotundifolia*, *Lycopodiella inundata*, forming on stripped areas of blanket bogs or raised bogs, but also on naturally seep- or frost-eroded areas of wet heaths and bogs, in flushes and in the fluctuation zone of oligotrophic pools with sandy, slightly peaty substratum. These communities are similar, and closely related, to those of shallow bog hollows (51.122) and of transition mires (54.57).

(Ellenberg, 1963, 1988; Depasse *et al.*, 1970; Guinochet and Vilmorin, 1973; Parent, 1973; Westhoff and den Held, 1975; Muller, 1978; Schumacker, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Nordiska ministerradet, 1984; Bournérias, 1984; Mollet *et al.*, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)

6 Inland rocks, screes and sands



61 Screes

Thlaspietea rotundifolii p., *Drypetea spinosae* i.a.

Vegetated or sparsely vegetated and frequently unstable areas of stones, boulders or rubble on steep slopes, produced by erosion in mountainous terrain. They are mostly developed in the Alps, the Pyrenees and the Mediterranean mountains and hills.

(Lebrun *et al.*, 1949; Rechinger, 1951; Braun-Blanquet, 1954, 1975, 1977; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Schaer *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Fernandez Casas, 1975; Ratcliffe, 1977; Gruber, 1978; Bournérias, 1979, 1984; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Fernandes Casas and Ceballos Jimenez, 1982; Pignatti, 1982; Duvigneaud, 1982; Prieto Fernandez, 1983; Lippert, 1983; Géhu, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Salomez *in litt.*, 1990; Jonglet *in litt.*, 1990; Oberdorfer, 1990)

- 61.1 ALPINE AND NORTHERN SILICEOUS SCREES**
Androsacetalia alpinae p., *Galeopsietalia segetum*
 Siliceous screes of high altitudes and cool sites within the Alpine system and the Pyrenees, of the Jura and Hercynian ranges and of middle European uplands.
- 61.11 ALPINE SILICEOUS SCREES**
Androsacion alpinae
 Siliceous, cool, damp screes of the subalpine and alpine levels of the Alps and the Pyrenees, with *Androsace alpina*, *Achillea nana*, *Oxyria digyna*, *Geum reptans*, *Saxifraga bryoides*, *Ranunculus glacialis*, *Linaria alpina*.
- 61.111 Mountain sorrel screes**
Oxyrietum digynae i.a.
 Typical Alpine and Pyrenean stabilized silicate screes, poor in humus, characterized by *Oxyria digyna* and with *Cerastium uniflorum*, *Doronicum clusii*, *D. grandiflorum*, *Poa laxa*.
- 61.1111 Alpine mountain sorrel screes**
Oxyrietum digynae i.a.
 Formations of most of the Alpine system.
- 61.1112 South-western Alpine mountain sorrel screes**
Thlaspeetum limosellifolii
 Local formations comprising the endemics *Viola valderia* and *Thlaspi limosellifolium*.
- 61.1113 Pyrenean mountain sorrel screes**
Oxyrio digynae-Doronicetum viscosae i.a.
 Stabilized silicate screes of the Pyrenees.
- 61.112 Rock jasmine screes**
Androsacetum alpinae
 Stony silicate screes of the high alpine and nival levels of the central Alps, with *Androsace alpina*.
- 61.113 Alpine woodrush screes**
Luzuletum spadiceae
 Humid, humus-rich silicate screes of slopes long-covered with snow, carpeted by the alpine woodrush, *Luzula alpinopilosa*.

- 61.114** **Cold silicate block screes**
Rubro-Dryopteridetum disjunctae
 Non-stabilized, shady subalpine silicate screes with a high proportion of large blocks, colonized by ferns and brambles.
- 61.12** **NORTHERN UPLAND SILICEOUS SCREES**
Galeopsis segetum
 Siliceous screes of hills of Western and Central Europe, with *Epilobium collinum*, *Galeopsis segetum*, *Senecio viscosus*, *Anarrhinum bellidifolium*, *Cryptogramma crispa*. Upland siliceous screes, often resulting from quarry activity, and colonized by very impoverished forms of the Alpine communities, usually rich in mosses, lichens and sometimes ferns, notably *Cryptogramma crispa*, are included.
- 61.2** **ALPINE CALCAREOUS SCREES**
Thlaspietalia rotundifolii p., *Drabetalia hoppeanae*
 Calcareous and calcschist screes of high altitudes and cool sites of the Alps and, locally, of peri-Alpine ranges.
- 61.21** **ALPINE CALCSCHIST SCREES**
Drabion hoppeanae
 Calcareous slate slope communities of the Alps, with *Draba hoppeana*, *Campanula cenisia*, *Saxifraga biflora*, *Herniaria alpina*, *Trisetum spicatum*.
- 61.22** **ALPINE PENNYCRESS SCREES**
Thlaspiion rotundifolii: *Thlaspietum rotundifolii* i.a.
 Unstable, hard limestone and dolomite coarse screes of the alpine and nival levels of the Alps, with *Thlaspi rotundifolium*, *Papaver rhaeticum*, *P. sendtneri*, *Viola cenisia*, *Linaria alpina*, *Arabis alpina*.
- 61.23** **FINE CALCAREOUS SCREES**
Petasition paradoxo, *Thlaspiion rotundifolii*: *Leontodontetum montani* i.a.
 Fine-element calcareous screes of the alpine, subalpine and high montane levels of the Alps and neighbouring ranges.
- 61.231** **Butterbur screes**
Petasition paradoxo
 High montane and subalpine, relatively humid, fine limestone and marl screes, with *Petasites paradoxus*, *Valeriana montana*, *Gypsophila repens*.
- 61.232** **Mountain hawkbit screes**
Leontodontetum montani i.a.
 Damp, marlo-calcareous screes of the alpine level of the Alps.
- 61.2321** **Central Alpine mountain hawkbit screes**
Leontodontetum montani
 Screes of the north-western and central Alps, with *Leontodon montanus*, *Ranunculus parnassifolius*, *Saxifraga biflora*.
- 61.2322** **Berardia screes**
Berardietum lanuginosi
 Screes of the south-western Alps, with the spectacular endemics *Berardia subacaulis* and *Brassica repanda* ssp. *repanda*.
- 61.3** **WESTERN MEDITERRANEAN AND THERMOPHILOUS SCREES**
Androsacetalia alpinae p., *Thlaspietalia rotundifolii* p., *Stipetalia calamagrostis*, *Polystichetalia lonchitis*
 Screes of warm exposures in the Alps and the Pyrenees, of calcareous substrates in the Pyrenees, of Mediterranean mountains, hills and lowlands and, locally, of warm, sunny middle European upland or lowland sites.
- 61.31** **PERI-ALPINE THERMOPHILOUS SCREES**
Stipion calamagrostidis, *Leontodontion hyoseroidis*
 Mostly coarse, unstabilized, sunny calcareous screes of the montane and subalpine levels of the Alps and of the uplands and lowlands of middle, central and western Europe.

- 61.311** **Rough-grass screes**
Stipetum calamagrostidis, *Calamagrostido-Centranthetum angustifolii*
Achnatherum calamagrostis screes of warmer, lower parts of Alpine valleys and of the south-western outer Alps.
- 61.312** **Sub-montane calcareous screes**
- 61.3121** **Hemp-nettle screes**
 Galeopsietum angustifoliae
 Galeopsis angustifolia communities of central Europe.
- 61.3122** **French sorrel screes**
 Rumicetum scutati
 Pioneering community of dry screes of south-western central Europe.
- 61.3123** **Limestone fern screes**
 Gymnocarpietum robertiani
 Fern swards of *Gymnocarpium robertianum* colonizing often slightly damp screes.
- 61.313** **Paris Basin screes**
Leontodontion hyoseroidis
Calcareous screes of the Paris Basin and its periphery, with *Leontodon hyoseroides*, *Sisymbrium supinum*, *Linaria supina*, *Galeopsis angustifolia* and many rare or endemic plants, including *Viola hispida* (endangered endemic), *Galium timeroyi* ssp. *fleurotii*, *Iberis violetii*, *I. durandii*, *Biscutella neustriaca*.
- 61.32** **PROVENÇAL SCREES**
Pimpinello-Gouffeion
Screes of Mediterranean southern France, with *Gouffeia arenarioides*, *Ptychotis heterophylla*, *Linaria supina*, *Centranthus ruber*, *Crucianella latifolia*.
- 61.33** **PYRENEO-ALPINE THERMO-SILICEOUS SCREES**
Senecion leucophyllae, *Taraxacion pyrenaici*
Siliceous screes of warm slopes of the subalpine level of the Alps and of the alpine and subalpine levels of the Pyrenees, usually composed largely of big stones or boulders, with *Senecio leucophyllus*, *Taraxacum pyrenaicum*, *Galeopsis pyrenaica*, *Xatartia scabra*, *Armeria alpina*.
- 61.34** **PYRENEAN CALCAREOUS SCREES**
Iberidion spathulatae
Calcareous screes of the Pyrenees.
- 61.341** **Fine Pyrenean calcareous screes**
Fine limestone or calcschists on gentle slopes of the alpine level, with *Iberis spathulata*, *Papaver suaveolens*, *Galium cometerhizon*, *Plantago monosperma*, *Viola lapeyrousiana*, *Campanula jaubertiana*.
- 61.342** **Coarse Pyrenean calcareous screes**
Coarse, relatively dry screes on steep slopes, forming debris cones at the foot of cliffs, with *Crepis pygmaea*, *Doronicum grandiflorum*, *Campanula cochleariaefolia*, *Carduus carlinoides*, *Galium cespitosum*, *Festuca glacialis*.
- 61.343** **High Pyrenean calcareous screes**
Flattish screes of high altitudes of the central Pyrenees, with *Androsace ciliata*, *Saxifraga oppositifolia*, *Hutchinsia alpina*, *Galium pyrenaicum*, *Minuartia cerastiifolia*.
- 61.344** **Humid Pyrenean calcareous screes**
Damp, cool screes with prolonged snow cover, with *Saxifraga praetermissa*, *S. aizoides*, *Epilobium anagallidifolium*, *Veronica alpina*, *Taraxacum alpinum*.
- 61.345** **Subalpine Pyrenean calcareous screes**
Calcareous screes developed at the foot of the cliffs of the great calcareous ranges, with *Crepis pygmaea*, *Carduus carlinoides* and the endemics *Borderea pyrenaica*, *Cirsium glabrum*, *Lithospermum gastonis*, *Iberis bernardiana*, *Armeria pubinervis*.

- 61.35** ORO-CANTABRIAN CALCAREOUS SCREES
Linarion filicaulis, *Saxifragion praetermissae*
Basiphile screes of the Cordillera Cantabrica.
- 61.351** Oro-Cantabrian mobile calcareous screes
Alti-montane, subalpine and alpine unstabilized calcareous screes of the Cordillera Cantabrica, made of stones of medium size, with *Linaria filicaulis*, *Arabis cantabrica*, *Iberis lereschiana*, *Ranunculus parnassifolius* ssp. *favargerii*, *Crepis pygmaea*.
- 61.352** Fine oro-Cantabrian calcareous screes
Fine screes of the collinar and montane levels, with *Iberis aperta* and *Rumex scutatus*.
- 61.353** Chionophilous oro-Cantabrian calcareous screes
Somewhat stabilized coarse screes of the subalpine and alpine levels, subjected to prolonged snow cover, characterized by *Epilobium anagallidifolium*, *Doronicum grandiflorum* ssp. *braunblanquetii* and *Campanula arvatica*.
- 61.354** Seeping oro-Cantabrian calcareous screes
Fine screes of the subalpine and alpine levels, submitted to prolonged snow cover and waterlogging, with *Saxifraga praetermissa*, *Arabis cantabrica* and *Ranunculus alpestris* ssp. *leroyi*.
- 61.355** Oro-Cantabrian calcareous lapiaz screes
Screes developed on the surface of frost-broken rocks in areas of short snow cover in the alpine and subalpine levels, with *Salix breviserrata* and *Galium pyrenaicum*.
- 61.36** ORO-CANTABRIAN SILICEOUS SCREES
Linarion filicaulis p., *Linario-Senecion carpetani* p.
Siliceous screes of the Cordillera Cantabrica; floristically rich formations of the 'dark' screes of the Cordillera are related to those of 61.351, though somewhat intermediate towards 61.38; other more species-poor ones, characterized by *Trisetum hispidum* and *Rumex suffruticosus*, belong to the latter.
- 61.37** IBERIAN FERN SCREES
Dryopteridion oreadis, *Dryopteridion submontanae*
Fern-dominated chaotic, boulder fields of siliceous and calcareous Iberian mountains.
- 61.38** CARPETANO-IBERIAN SILICEOUS SCREES
Linario-Senecion carpetani
Screes of the Cordillera Central, the Iberian Range, the Leonese mountains, with *Linaria saxatilis*, *L. alpina*, *Digitalis purpurea* var. *carpetana*, *Senecio pyrenaicus* ssp. *carpetanus*, *Rumex suffruticosus*, *Santolina oblongifolia*, *Conopodium butinioides*, *Reseda gredensis*.
- 61.39** NEVADAN SILICEOUS SCREES
Holcicon caespitosae
Siliceous screes of the high levels of the Sierra Nevada, very rich in endemics.
- 61.391** Nevadan foxglove screes
Digitali purpureae-Senecietum granatensis
Screes at the sub-summital levels of the Sierra Nevada, between 1 900 and 2 900 m, with *Senecio tournefortii* var. *granatensis*, *Digitalis purpurea* var. *nevadensis*, *Cirsium gregarium*, *Solidago virgaurea* var. *alpestris*, *Holcus caespitosus*, *Crepis oporinoides*, *Eryngium glaciale*, *Linaria aeruginea* var. *nevadensis*.
- 61.392** Nevadan violet screes
Violo-Linarietum glacialis
Screes of the summital region of the Sierra Nevada, at around 2 800-3 000 m, with a very sparse community formed by *Viola crassiuscula*, *Linaria glacialis*, *Rhynchosinapis cheiranthos* ssp. *nevadensis*, *Ranunculus glacialis*, *R. parnassifolius*, *Saxifraga oppositifolia*, *Papaver suaveolens*, *Holcus caespitosus*, *Crepis oporinoides* and, in more stabilized areas, *Erigeron frigidus*.

61 Screes

- 61.3A** SOUTHERN IBERIAN CALCAREOUS SCREES
Platycapno-Iberidion granatensis, *Scrophularion sciaphilae*
Screes of the calcareous Baetic mountains of southern and south-eastern Iberia.
- 61.3B** CENTRAL MEDITERRANEAN SCREES
Screes of the Italian peninsula and of the large Mediterranean islands.
- 61.4** EASTERN MEDITERRANEAN SCREES
Drypetalia spinosae
Screes of the high Greek mountains.
- 61.41** GREEK LIMESTONE SCREES
Drypion spinosae (*Silenion caesia*)
Formations of the higher mountains of Greece, with *Drypis spinosa*, *Ranunculus brevifolius*, *Senecio thapsoides*, *Aethionema saxatile*.
- 61.411** Northern mainland screes
Calcareous screes of the northern and central Pindus, with *Geranium aristatum*, *Achillea abrotanoides*, *Arenaria conferta*.
- 61.412** Olympus screes
Screes of Olympus, with *Asperula muscosa*, *Rhynchosinapis nivalis*, *Alyssum handelii*, *Achillea ambrosiaca*.
- 61.413** Southern mainland screes
Screes of Parnassus, Giona and other southern Pindus ranges, with *Astragalus hellenicus*, *Corydalis bulbosa*, *Sclerochorton junceum*, *Euphorbia deflexa*, *Geranium macrorrhizum*, *Rumex scutatus*.
- 61.414** Peloponnese calcareous screes
Screes of the Taygetos, Kilini and other Peloponnese ranges, with *Valantia aprica*, *Minuartia juniperina*.
- 61.415** Aegean screes
Screes of Crete and Carpathos.
- 61.42** GREEK SERPENTINE SCREES
Campanulion hawkinsoniana
Less widespread formations restricted to serpentines of the Pindus, with *Campanula hawkinsoniana*, *Arenaria serpentina*, *Cardamine glauca*, *Viola magellensis*, *Alyssum scardicum*, *Silene haussknechtii*.

62 Inland cliffs and exposed rocks

Asplenietea trichomanis, *Adiantetea capilli-veneris* i.a.

Cliffs, rock faces, limestone pavements, the plant communities that colonize their cracks, and their associated animal communities.

(Rechinger, 1951; Braun-Blanquet, 1954; Lausi and Poldini, 1962; Niklfeld, 1962; Archiloque *et al.*, 1969; Sutter, 1973; Horvat *et al.*, 1974; Ratcliffe, 1977; Gruber, 1978; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Prieto Fernandez, 1983; Géhu, 1984; Bournérias, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Dupias, 1985; Aparicio Martinez and Silvestre Domingo, 1987; Sfikas, 1987; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Ellenberg, 1988; Iatridis, 1988; Salomez *in litt.*, 1990; Jonglet *in litt.*, 1990; Oberdorfer, 1990)

62.1

VEGETATED CALCAREOUS INLAND CLIFFS

Potentilletalia caulescentis, *Asplenietalia glandulosae*, *Onosmetalia frutescentis*, *Potentilletalia speciosae*

Dry, calcareous inland cliffs and their communities. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions below refer to them. Northern lowland cliffs usually support fragments of communities listed in other chapters.

62.11

WESTERN EU-MEDITERRANEAN AND ORO-IBERIAN CALCAREOUS CLIFFS

Calcareous cliffs of the lower Mediterranean levels of the western Mediterranean and, locally, the northern Adriatic, and of the Iberian mountains.

62.111

Western eu-Mediterranean calcareous cliffs

Asplenietalia glandulosae

Calcareous cliffs of the Mediterranean region of Spain, of the lowest Mediterranean levels of France, of north-western Italy, of Sardinia and of the karstic region of north-eastern Italy.

62.1111

Ibero-Mediterranean calcareous cliffs

Asplenion petrarchae, *Poterion ancistroidis*

Calcareous and dolomitic cliffs of the Mediterranean hills and mountains of Spain, from Catalonia to the Serrania de Ronda, and of the thermo- and lower meso-Mediterranean levels of the coastal chains of Provence and Bas-Languedoc, of the southern Cévennes and of Sardinia, with *Asplenium petrarchae*, *Phagnalon sordidum*, *Sarcocapnos enneaphylla*, *Biscutella frutescens*, *Hieracium stelligerum*, *Lavatera maritima*, *Campanula macrorhiza*, *Melica minuta*, *M. bauhini*.

62.1112

South-eastern Iberian calcareous cliffs

Teucrium buxifolii

Calcareous cliffs of the arid south-eastern regions of Spain, with large shrubs; *Scabiosa saxatilis*, *Teucrium buxifolium*, *Rhamnus lycioides* ssp. *borgiae* are characteristic.

62.1113

Balearic calcareous cliffs

Brassico-Helichryson rupestris

Calcareous cliffs of the Balearics, with many endemics, including *Brassica balearica* and *Helichrysum rupestre* var. *cambessedesii*.

62 Inland cliffs and exposed rocks

- 62.1114** **Triestine karst cliffs**
Centaureo-Campanulion
Cliffs of the karst region of north-eastern Italy, with *Centaurea kartschiana*, *Cheiranthus cheiri*, *Campanula pyramidalis*, *Teucrium flavum*, *Euphorbia wulfenii*, *Satureja thymifolia*.
- 62.1115** **Mediterranean fern cliffs**
Polypodium serrati
Cool, shaded calcareous cliffs of the west Mediterranean regions, with mostly bryophytes and ferns (*Polypodium cambricum*), and with *Selaginella denticulata*.
- 62.112** **Ibero-montane calcareous cliffs**
Potentilletalia caulescentis p.
Cliffs of the supra- and oro-Mediterranean levels of calcareous Iberian mountains.
- 62.1121** **Oro-Cantabrian calcareous cliffs**
Saxifragion trifurcato-canaliculatae
Calcareous cliffs of the Cantabrian Cordillera and a few other north-western Iberian ranges, with *Asperula hirta*, *Asplenium viride*, *Erinus alpinus*, *Globularia repens*, *Hypericum nummularium*, *Rhamnus pumilus*, *Saxifraga aretioides*.
- 62.1122** **Baetic calcareous cliffs**
Saxifragion camposii
Calcareous cliffs of high altitudes of Baetic and sub-Baetic ranges of eastern Andalusia, with *Linaria verticillata*, *Potentilla caulescens*, *Saxifraga camposii*, *S. erioblasta*, *Teucrium rotundifolium*, *Silene boryi*.
- 62.1123** **Valencian calcareous cliffs**
Jasion foliosae
Shady calcareous cliffs of Valencian mountains.
- 62.12** **CENTRAL PYRENEAN CALCAREOUS CLIFFS**
Saxifragion mediae
Calcareous cliffs of the central and eastern Pyrenees, with *Saxifraga media*, *S. longifolia*, *S. aretioides*, *Potentilla alchimilloides*, *P. nivalis*, *Ramonda myconi*, *Asperula hirta*.
- 62.13** **LIGURO-APENNINE CALCAREOUS CLIFFS**
Saxifragion lingulatae
Calcareous cliffs of the Maritime Alps and northern Apennines, with *Saxifraga lingulata*, *Primula marginata*, *P. allionii*, *Phyteuma charmelii*, *P. villarsii*, *Silene campanula*, *Potentilla saxifraga*, *Ballota frutescens*.
- 62.14** **SOUTHERN ITALIAN CALCAREOUS CLIFFS**
Dianthion rupicolae
Calcareous cliffs of southern Italy and Sicily, with *Dianthus rupicola*.
- 62.15** **ALPINE AND SUB-MEDITERRANEAN CALCAREOUS CLIFFS**
Potentilletalia caulescentis p.
Calcareous cliffs of the Alps, of lesser satellite ranges and of sub-Mediterranean areas of the northern Tyrrhenian periphery.
- 62.151** **Sunny Alpine calcareous cliffs**
Potentillion caulescentis
Well-lit calcareous cliffs of the Alpine system and neighbouring regions, including upper Provence, upper Languedoc, the pre-Pyrenees and Corbières, the Catalanian mountains, with *Potentilla caulescens*, *P. clusiana*, *P. nitida*, *Primula auricula*, *Hieracium humile*, *Cardaminopsis petraea*, *Androsace helvetica*, *Minuartia rupestris*.
- 62.152** **Middle-European calcareous fern cliffs**
Cystopteridion fragilis
Shady, cool, often moist rockfaces of the Alps and neighbouring regions, of the Jura, the Hercynian ranges, the British Isles, with many ferns, including *Cystopteris fragilis*, *C. regia*, *Asplenium viride*, *A. scolopendrium*, *A. trichomanes*, and with *Carex brachystachys*.

- 62.16** EU-MEDITERRANEAN GREEK CALCAREOUS CLIFFS
Campanulion versicoloris
Calcareous cliffs of the thermo- and meso-Mediterranean zones of mainland Greece, up to the *Abies cephalonica* belt, with *Campanula versicolor*, *C. rupestris*, *Sideritis roeseri*, *Stachys candida*, *Hypericum vesiculosum*, *Asperula arcadiensis*, *Galium boryanum*, *Centaurea pelia*, *Alkanna graeca*, *Alyssum orientale*, *Linaria microcalyx*, *Onosma frutescens*, *Inula candida*, *Centranthus ruber*, *Silene congesta*, *Teucrium flavum*.
- 62.17** AEGEAN CLIFFS
Cirsietalia chamaepeucis
Calcareous cliffs of the Aegean archipelagoes, one of the most diverse and endemic-rich groups of communities.
- 62.171** Cliffs of Crete
Petromarulion pinnatae
Cliffs and chasms of Crete, with *Petromarula pinnata*, *Galium fruticosum*, *Centaurea argentea*, *Ebenus cretica*, *Verbascum arcturus*, *Inula candida*, *Eryngium ternatum*, *Asperula incana*, *Dianthus juniperinus*, *Aster canus*, *Campanula pelviformis*, *C. saxatilis*.
- 62.172** Cliffs of Karpathos
Inulion heterolepis: Teucro-Inuletum
Cliffs of Karpathos, with *Teucrium heliotropifolium*, *Silene fruticosum*, *Galium incurvum*, *Inula heterolepis*.
- 62.173** Cliffs of the eastern Aegean
Inulion heterolepis: Campanulo-Inuletum
Cliffs of Rhodes, Samos, Icaria, Lesbos with *Campanula hagielia*, *Lactuca leburnea*, *Dianthus rhodensis*, *Inula heterolepis*, *Rosularia serrata*, *Sedum creticum*.
- 62.174** Cliffs of the Cyclades
Inulion heterolepis, Capparo-Amaracion
Cliffs of the Cyclades, with *Fibigia lunarioides*, *Eryngium amorginum*, *Amaracus tournefortii*, *Campanula amorgina*, *C. heterophylla*, *Helichrysum amorginum*.
- 62.175** Cliffs of the Northern Sporades
Capparo-Amaracion
Cliffs of the Sporades, with *Inula sophiae*, *Capparis spinosa*, *Dianthus arboreus*, *Amaracus tournefortii*.
- 62.18** SOUTHERN GREEK MONTANE CLIFFS
Silenion auriculatae
Calcareous cliffs of high altitudes of the Peloponnese, Giona and Parnassus, with *Silene auriculata*, *Achillea umbellata*, *Campanula rupicola*, *Saxifraga sibthorpii*, *S. marginata*, *S. spruneri*, *Minuartia stellata*, *Valeriana olenaea*, *Satureja parnassica*, *Rosa glutinosa*, *Viola poetica*, *Edraianthus parnassicus*, *Campanula aizoon*.
- 62.19** CENTRAL GREEK MONTANE CLIFFS
Calcareous cliffs of the high altitudes of the central and northern Pindus and of the Thessalian Olympus system.
- 62.191** Olympian cliffs
Saxifragion scardici
Cliffs of the Thessalian Olympus system, with *Saxifraga scardia*, *S. glabella*, *Campanula oreadum*, *Arabis bryoides*, *Potentilla deorum*, *Jankaea heldreichii*, *Omphalodes luciliae*.
- 62.192** Pindus calcareous cliffs
Galion degenii
Calcareous cliffs of the Pindus, with *Galium degenii*, *Edraianthus graminifolius*, *Asplenium fissum*, *Aubrieta gracilis*, *Achillea clavenae*, *Satureja parnassica*, *Hypericum apollinis*, *Gnaphalium roeseri*, *Trifolium noricum*, *Silene pindicola*.

62 Inland cliffs and exposed rocks

- 62.1A** NORTHERN GREEK CALCAREOUS CLIFFS
Ramondion nathaliae
Calcareous cliffs of the Vermion and other Greek ranges, with *Ramondia nathaliae*, *Campanula formanekiana*, *Alyssoides utriculata*, *Jurinea consanguinea*, *Micromeria cristata*.
- 62.1B** LOWLAND NORTHERN CALCAREOUS CLIFFS
Calcareous cliffs of the lowlands of northern and middle Europe colonized by communities referable to units other than 62; their nature can be specified by addition of the relevant codes.
- 62.2** VEGETATED SILICEOUS INLAND CLIFFS
Androsacetalia vandellii, *Asplenietalia lanceolato-obovati*, *Asplenietalia billotii*
Dry, siliceous inland cliffs and their communities. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions below refer to them. Northern lowland cliffs usually support fragments of communities listed in other chapters.
- 62.21** MIDDLE EUROPEAN MONTANE SILICEOUS CLIFFS
Siliceous cliffs of the Alps, the Pyrenees and a few neighbouring ranges.
- 62.211** Pyreneo-Alpine siliceous cliffs
Androsacion vandellii p., *Saxifragion bryoidis*
Siliceous cliffs of the Alps and the Pyrenees, with *Androsace vandellii*, *Artemisia umbelliformis*, *Eritrichium nanum*, *Minuartia cherlerioides*, *Primula hirsuta*, *Phyteuma scheuchzeri*, *Erysimum rhaeticum*, *Saxifraga aspera*, *S. cotyledon*, *S. iratiana*, *S. retusa*, *S. bryoides*.
- 62.212** Hercynian siliceous cliffs
Androsacion vandellii p., *Asarinion procumbentis*
Siliceous cliffs of the Hercynian ranges and their periphery, of the British Isles and, locally, of the Jura, with *Saxifraga sponhemica*, *Biscutella laevigata*, *Asplenium septentrionale*, *A. adiantum-nigrum*, *A. billotii*, *A. foreziense*.
- 62.213** Hercynian serpentine cliffs
Asplenion serpentini
Serpentine cliffs of the Hercynian ranges and their periphery, with *Asplenium adulterinum*.
- 62.22** ORO-IBERIAN SILICEOUS CLIFFS
Siliceous cliffs of high altitudes of the Iberian mountains.
- 62.221** Ibero-Carpetanian siliceous cliffs
Saxifragion willkommianae
Siliceous cliffs of the Cordillera Cantabrica, the Iberian Range, the Cordillera Central and the Leonese mountains, with *Hieracium pallidum* ssp. *graniticum*, *Murbeckiella boryi* ssp. *boryi*, *M. boryi* ssp. *herminii*, *Saxifraga willkommiana*, *Spergula viscosa* ssp. *pouretii*.
- 62.222** Nevadan siliceous cliffs
Saxifragion nevadensis
Siliceous cliffs of the Sierra Nevada, with *Saxifraga nevadensis*, *Sedum brevifolium*, *Centranthus nevadensis*.
- 62.23** SOUTH-WESTERN ALPINE SILICEOUS CLIFFS
Saxifragion pedemontanae
Siliceous cliffs of the Maritime, Ligurian and Cottian Alps, with *Saxifraga pedemontana*.
- 62.24** CYRNO-SARDIAN MONTANE CLIFFS
Potentillion crassinerviae
Siliceous cliffs of the mountains of Corsica and Sardinia, with *Potentilla crassinervia*.
- 62.25** NORTHERN GREEK SILICEOUS CLIFFS
Silenion lerchenfeldianae
Siliceous cliffs of the mountains of northern Greece, with *Silene lerchenfeldiana*.

- 62.26** LANGUEDO-CATALAN SILICEOUS CLIFFS
Antirrhinion asarinae
Low altitude siliceous cliffs of the Cévennes and Catalan hills, with *Antirrhinum asarina*, *Sedum hirsutum*, *Centaurea pectinata*, *Sempervivum arvernense*, *Dianthus graniticus*, *Saxifraga clusii*, *S. hypnoides*.
- 62.27** WESTERN IBERIAN SILICEOUS CLIFFS
Cheilanthion hispanicae
Siliceous cliffs of the meso-Mediterranean level of western Iberia, with *Cheilanthus tinaei*.
- 62.28** PROVENÇO-IBERIAN SILICEOUS CLIFFS
Phagnalo-Cheilanthion fragrantis
Siliceous cliffs and rocks of low altitudes of Provence, Corsica and eastern Spain.
- 62.29** LOWLAND NORTHERN SILICEOUS CLIFFS
Siliceous cliffs of the hills of northern and middle Europe colonized by communities referable to units other than 62; their nature can be specified by addition of the relevant codes.
- 62.3** PAVEMENTS
Almost bare rock pavements and lapiaz. Cracks and superficially decomposed areas may be colonized by communities belonging, in particular, to the *Sedo-Scleranthion*, the *Alysso-Sedion albi* or the *Sedo albi-Veronicion dillenii* (34.11, 36.2).
- 62.4** BARE INLAND CLIFFS
Cliffs, in particular of very high altitudes, devoid of vascular vegetation. They are usually colonized by lichen crusts and 'ink stains'.
(Ellenberg, 1988)
- 62.41** LIMESTONE BARE INLAND CLIFFS
Protoblastenietea immersae i.a.
Rocks colonized by communities of internal crustose lichens (*Protoblastenia*, *Verrucaria*, *Petractis*, *Polyblastia*), external crustose lichens (*Caloplaca*, *Xanthoria*) or gelatinous (*Collema*) and foliose (*Dermatocarpon*) lichens.
- 62.42** SILICEOUS BARE INLAND CLIFFS
Rhizocarpetea geographici i.a.
Rocks colonized by communities of external crustose lichens (*Rhizocarpon*), navel lichens (*Umbilicaria*) and fruticose lichens (*Ramalina*, *Cornicularia*, *Rhizoplaca*).
- 62.5** WET INLAND CLIFFS
Very wet, dripping, overhanging or vertical rocks of hills, mountains and Mediterranean lowlands.
- 62.51** MEDITERRANEAN WET INLAND CLIFFS
Adiantetalia
Wet inland cliffs of Mediterranean regions, with a specialized vegetation formed by *Adiantum capillus-veneris*, mosses, *Borago pygmaea*, *Pinguicula grandiflora* ssp. *coenocantabrica*.
(Guinochet and Vilmorin, 1976; Molinier and Martin, 1980; Rivas-Martinez, Diaz *et al.*, 1984; Lahondère *et al.*, 1985)
- 62.52** NORTHERN WET INLAND CLIFFS
Wet inland cliffs of middle European hills and mountains. They are often colonized by unique plant assemblages, the components of which are, however, equally characteristic of other habitats; notable among such species are *Saxifraga paniculata*, *Alchemilla glabra*, *Viola palustris*, *Phegopteris connectilis*.
- 62.6** MACARONESIAN INLAND CLIFFS
Aeonio-Greenovietae
Inland cliffs of the Canary Islands, Madeira and the Açores, extremely rich in endemic species of both plants and animals, including vertebrates (the endangered *Pterodroma madeira*). The genus *Aeonium* is particularly representative.

63 Eternal snow and ice

High mountain zones occupied by glaciers or by perennial snow. They are inhabited by algae (e.g. *Chlamydomonas nivalis*) and invertebrates.
(Ellenberg, 1988)

63.1

SNOW PACKS

Quasi-permanent snow packs, in particular in avalanche corridors.

63.2

ROCK GLACIERS

63.3

TRUE GLACIERS

64 Inland sand-dunes

Sand bodies of eolian origin, possessing constructional relief and separated from the coast and its dune cordons by non-dunal habitats. They support a vegetation which differs markedly from coastal sand-dune communities.

(Ellenberg, 1963, 1988; Flint, 1971)

- 64.1 FLUVIO-GLACIAL DUNES**
Dunes of the North Sea and Baltic plains, formed of quartzic sands originating in redeposited and reworked glacial drift and outwash. These highly siliceous dunes are characteristic of The Netherlands, northern Belgium and northern Germany. The dune systems, particularly the large ones, harbour a unique ensemble of interacting communities and harbour many specialized and restricted organisms. They have considerably regressed and the remaining examples are fragile and often threatened. The presence of the various elements of the ecosystem can be indicated by simultaneous use of the codes below and of those relevant to the types of plant communities they represent.
(Traets, 1956; Flint, 1971; Westhoff and den Held, 1975; De Smidt, 1981; Fuller, 1982; Nordiska ministerradet, 1984; Drachenfels *et al.*, 1984; Van Dijk *et al.*, 1984; Webb, 1986; Dijkhuizen and Tuttel, 1987; Ellenberg, 1988; Oberdorfer, 1990)
- 64.11 INLAND DUNE PIONEER GRASSLANDS**
Corynephorion canescentis
Formations of inland sands with *Corynephorus canescens*, *Carex arenaria*, *Spergula morisonii*, *Teesdalia nudicaulis* and carpets of fruticose lichens (*Cladonia*, *Cetraria*) (see 35.23).
- 64.12 INLAND DUNE SILICEOUS GRASSLANDS**
Other grasslands of inland dune systems with *Agrostis spp.* and *Corynephorus canescens* or other acidophilous grasses; their composition can be specified by use of codes of 35 other than 35.23.
- 64.13 INLAND DUNE HEATHS**
Genistion pilosae p.
Heaths colonizing inland dunes.
- 64.131 Drente crowberry heaths**
Heaths of the relict wandering dunes of Drente and southern Friesland, with *Empetrum nigrum*, *Salix arenaria*, *Lophocolea cuspidata*, *Pseudoscleropodium purum*, *Hylocomium splendens*.
- 64.132 Other inland dune heaths**
Other heaths colonizing inland dunes; their composition can be specified by use of codes of 31.22.
- 64.14 INLAND DUNE THICKETS**
Formations of large shrubs colonizing inland dunes.
- 64.141 Inland dune juniper scrubs**
Juniperus communis-rich scrubs of inland dunes.
- 64.142 Other inland dune thickets**
Thickets other than juniper scrubs in inland dune systems; their composition can be specified by use of codes of 31.8.
- 64.15 INLAND DUNE WOODS**
Natural woods, usually birch-oak or, east of the Elbe, *Pinus sylvestris*, installed within inland dune systems. Their composition can be specified by use of codes of 41 or 42.

64 Inland sand-dunes

- 64.16** **NORTHERN RIVER DUNES**
Formations in the immediate vicinity of great rivers within the North Sea-Baltic plain, comprising, besides the communities of 64.11 to 64.15, slightly calcareous grasslands of 34.12 and 34.34.
- 64.2** **BRECKLAND INLAND DUNES**
Remnants of the once vast Breckland inland dune system, of similar glacial origin to that of the continental fluvio-glacial dunes of 64.1, and like them, colonized by acidophilous grasslands and heaths.
(Fuller, 1982; Webb, 1986)
- 64.3** **PALAEO-COASTAL DUNES**
Dune cordons marking former, though post-glacial, seashores. They are strongly decalcified and the communities that occupy them are similar to those of continental dunes, though floristically more influenced by the proximity of the sea, and often related to the decalcified inner fringes of the coastal dunes. Subhabitats may be indicated by use of the same codes as in 64.1 (replacing the prefix 64.1 by 64.3), specified by those of 35.2, 31.2, 31.8, 41, 42 or 16.2.
- 64.4** **FLUVIATILE DUNES**
Dunes of the great rivers of middle Europe (Seine, Loire, Saône, Rhine). Like the fluvio-glacial dunes of northern Europe, they carry specialized and rare ecosystems. They are much more calcareous than the northern inland dunes and their grasslands (34.12, 34.34 *i.a*) have a sub-steppic character contrasting with that of neighbouring regions. They are highly vulnerable. A small remnant exists in the Po plain of northern Italy.
(Groppali *et al.*, 1980; Géhu, 1985; Ellenberg, 1988)
- 64.5** **LACUSTRINE DUNES**
Unique dunes of the Savoie shore of Lake Geneva (Excenevex).
(Ozenda, 1982; Géhu, 1985)
- 64.6** **MEDITERRANEAN INLAND DUNES**
Inland dunes of Mediterranean climates.
- 64.61** **RHÔNE RIVERINE DUNES**
Fossil dunes of the Camargue, built up by silty alluvial sands of the Rhône.
(Molinier and Tallon, 1970; Molinier and Martin, 1982)
- 64.611** **Rhône dune grasslands**
- 64.6111** **Rhône dune cane beds**
Imperata cylindrica and *Saccharum ravennae* of the Camargue.
- 64.6112** **Other Rhône dune grasslands**
Dry grasslands of the *Malcomietalia* (35.4), *Thero-Brachypodietea* (34.5), *Brachypodietalia phoenicoidis* (34.36) colonizing inland Camargue dunes.
- 64.612** **Rhône dune scrubs**
Mediterranean scrubs of the Camargue inland dunes (32).
- 64.613** **Rhône dune juniper woodland**
Juniperus phoenicea ssp. *lycia* woodland of the bois des Rièges in the Camargue.
- 64.62** **SOUTHERN IBERIAN INLAND DUNES**
Fossil dunes of the Coto Doñana and other areas of south-western Iberia. They support very specialized brushes (32.2A) and open grasslands belonging to the *Malcomietalia* (35.4, 16.228).
(Rivas-Martinez *et al.*, 1980)

65 Caves

Any natural caves or cave systems. They harbour varied communities of animals that are strictly restricted to them. A classification of caves based on the presence of these communities should be used to subdivide this unit. Provisionally, the following, containing unique endemic vertebrates must, at the very least, be distinguished.

- 65.1 ITALIAN CAVES WITH *PROTEUS ANGUINUS*
- 65.2 NORTHERN ITALIAN AND SOUTH-EASTERN FRENCH CAVES WITH *HYDROMANTES ITALICUS*
- 65.3 SARDINIAN CAVES WITH *HYDROMANTES GENEI*
- 65.4 OTHER CAVES



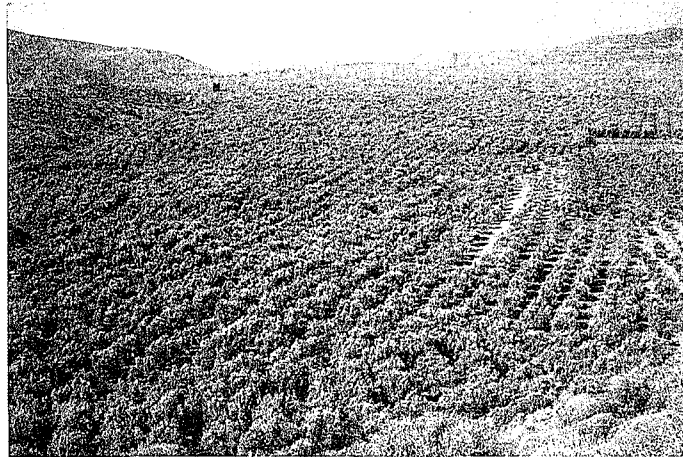
66 Volcanic features

Sites and products of recent volcanic activity harbouring distinct biological communities.

- 66.1 TEIDE VIOLET COMMUNITY**
Violetea cheiranthifoliae
 Very open formation of the summit of the Teide volcano of Tenerife, above (2 700) 3 000 m, with *Viola cheiranthifolia* and a few individuals of *Silene nocteolens* and *Argyranthemum teneriffae*.
 (Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988)
- 66.2 ETNA SUMMITAL COMMUNITIES**
 Communities of Mount Etna, above the limit of hedgehog-heaths.
- 66.3 BARREN LAVA FIELDS**
 Almost bare lava formations of other volcanoes, and of lower altitudes on Etna and Teide, colonized by, besides communities related to ones covered in other sections, lichens (e.g. *Stereocaulon vesubianum*) and invertebrates.
 (Serrada *et al.*, 1988; Machado *in litt.*, 1989)
- 66.4 VOLCANIC ASH AND LAPILLI FIELDS**
- 66.5 LAVA TUBES**
 Caves formed by hollow basaltic tubes resulting from the cooling of the surface of lava flows whose molten interior continued to flow. The very large tube created by the volcano La Corona of Lanzarote harbours unique communities of invertebrates, in particular, the decapode crustacean *Munidopsis polymorpha*, endemic to that locality, and several crustaceans of the genus *Speleonectes*.
 (Serrada *et al.*, 1988; Machado *in litt.*, 1989)
- 66.6 FUMARoles**
 Orifices in volcanic areas through which escape hot gases and vapours. Their very extreme environment is colonized by paucispecific but highly distinct communities.
 (Brullo *et al.*, 1977; Wildpret de la Torre and del Arco Aguilar, 1987)
- 66.61 ITALIAN FUMARoles**
 Fumaroles of the Italian peninsula and its small islands, in particular those of Isola d'Ischia, with communities that include *Cyperus polystachyos*.
- 66.62 ETNA FUMARoles**
 Fumaroles of Mount Etna.
- 66.63 PANTELLERIA FUMARoles**
Radiolo-Kickxietum cirrhosae
 Fumaroles of Pantelleria. Their walls, mouth and immediate vicinity are colonized by a succession of microvegetation composed of bryophytes, ferns and a few angiosperms. Constituting plants include the endemic moss *Calymperes sommieri*, sole Mediterranean representative of a tropical genus, as well as *Radiola linoides*, *Kickxia cirrhosa*, *Trifolium angustifolium*, *Centaurium maritimum*.
- 66.64 CANARIAN FUMARoles**
 Fumaroles of the Canary Islands with, in particular, the endemic *Gnaphalium teydeum*.



Agricultural land and artificial landscapes



Cultivated or built-up areas under the overwhelming influence of human activity; the natural vegetation cover has been totally replaced as a result of agricultural practices, urbanization or industrialization. A natural flora and fauna subsists mainly in areas of extensive and traditional cultivation and dwelling. Wild plants may grow among crops, in hedges, along roads, on walls and in fallow fields. Many animals have, during the course of the past few thousand years, adapted to these man-created habitats.

(Fuller, 1982; Philipps, 1986; Way and Greig-Smith, 1986; Ellenberg, 1988; de Rougemont, 1989; Morrison, 1989; Noirfalise, 1989; Oberdorfer, 1990)

81 Improved grasslands

81 Improved grasslands

Heavily fertilized or reseeded permanent grasslands, sometimes even treated by selective herbicides, with very impoverished flora and fauna.

81.1

DRY IMPROVED GRASSLANDS

Dry or mesophile intensive pastures.

81.2

HUMID IMPROVED GRASSLANDS

Humid intensive pastures, often scored with drainage ditches, and capable of harbouring breeding waders or wintering waterfowl, in particular, geese.

82 Crops

Fields of cereals, beets, sunflowers, leguminous fodder, potatoes and other annually harvested plants. Faunal and floral quality and diversity depend on the intensity of agricultural use and on the presence of borders of natural vegetation between fields. If a tree layer is present, it can be indicated by simultaneous use of a code of 83 or 84 with the present one.

- 82.1 UNBROKEN INTENSIVE CROPLAND**
Intensive cultivation, involving moderate to high chemical or organic fertilization and/or systematic use of pesticides, with complete ground occupation on dry land.
- 82.11 FIELD CROPS**
Cereal and other crops grown on large, unbroken surfaces in open field landscapes.
- 82.12 MARKET GARDENS AND HORTICULTURE**
Intensive cultivation of vegetables, flowers, small fruits, usually in alternating strips of different crops.
- 82.2 FIELD MARGIN CROPLAND**
Intensively treated crops interspersed with strips of spontaneous vegetation.
- 82.3 EXTENSIVE CULTIVATION**
Traditionally and extensively cultivated crops, in particular, of cereals, harbouring a rich and threatened flora of field weeds including *Agrostemma githago*, *Centaurea cyanus*, *Legousia speculum-veneris*, *Chrysanthemum segetum*, *Calendula arvensis*, *Adonis spp.*, *Consolida spp.*, *Delphinium spp.*, *Nigella spp.*, *Papaver spp.*; their varied range of associations can be indicated by subdivisions.
- 82.4 FLOODED CROPS**
Rice fields and other inundated or inundatable croplands.
- 82.41 RICE FIELDS**
- 82.42 WATERCRESS BEDS**

82

83 Orchards, groves and tree plantations

Ligneous crops. Extensive orchards and old plantations may support a rich flora and fauna; it is, in particular, the case of ancient olive groves and old poplar plantations with tall herb undergrowth.

- 83.1 HIGH-STEM ORCHARDS**
Tree crops of standards, cultivated for fruit production.
- 83.11 OLIVE GROVES**
Mediterranean formations of *Olea europaea* ssp. *europaea*.
- 83.111 Traditional olive groves**
Ancient olive groves, often made of very old trees shading herbaceous layer, extensively treated. Greek olive groves are an important habitat of the very restricted sylviid *Hippolais olivetorum*, as well as of many orchids.
- 83.112 Intensive olive groves**
Other formations.
- 83.12 CHESTNUT GROVES**
- 83.13 WALNUT GROVES**
- 83.14 ALMOND GROVES**
- 83.15 FRUIT ORCHARDS**
High-stem orchards of apple, pear, plum, apricot, peach and other Rosaceae.
- 83.151 Northern fruit orchards**
High-stem orchards of apple, pear, cherry of temperate Europe, often extensively treated.
- 83.152 Southern fruit orchards**
Thermophilous Mediterranean and sub-Mediterranean fleshy-fruit Rosaceae orchards, usually intensively treated.
- 83.16 CITRUS ORCHARDS**
- 83.17 DATE PALM GROVES**
- 83.18 OTHER HIGH-STEM ORCHARDS**
- 83.2 SHRUB ORCHARDS**
Ligneous plantations of dwarf trees, shrubs, espaliers and climbers.
- 83.21 VINEYARDS**
Plantations of vine.
- 83.211 Traditional vineyards**
Vineyards that have preserved their characteristic accompanying flora, generally lightly treated.
- 83.212 Intensive vineyards**
Vineyards usually cleared of their herb layer, intensively treated.
- 83.22 LOW-STEM ORCHARDS**
Other small tree crops, in particular, espaliers of various Rosaceae.

- 83.3 PLANTATIONS**
Cultivated ligneous formations planted most often for the production of wood, composed of exotic species or of native species out of their natural range and habitat.
- 83.31 CONIFER PLANTATIONS**
- 83.311 Native conifer plantations**
Plantations of European conifers outside of the conditions described under 'reforestation' in the relevant subdivisions of 42.
- 83.3111 European fir, spruce, larch plantations**
- 83.3112 European pine plantations**
- 83.3113 European cypress and juniper plantations**
- 83.312 Exotic conifer plantations**
Plantations of non-European species of conifers.
- 83.3121 Exotic spruce, fir, douglas fir, deodar plantations**
- 83.3122 Exotic pine plantations**
- 83.3123 Other exotic conifer plantations**
- 83.32 PLANTATIONS OF BROAD-LEAVED TREES**
- 83.321 Poplar plantations**
- 83.3211 Poplar plantations with megaphorb herb layer**
Old poplar plantations with a tall herb-rich undergrowth, substitution habitat for some riparian forest species of plants and animals.
- 83.3212 Other poplar plantations**
- 83.322 Eucalyptus plantations**
- 83.323 Exotic oak plantations**
- 83.324 Locust tree plantations**
Plantations and spontaneous formations of *Robinia pseudacacia*.
- 83.325 Other broad-leaved tree plantations**

84 Tree lines, hedges, small woods, bocage, parkland dehesa

Wooded habitats of small size, arranged in a linear, reticulated or insular manner, closely interwoven with grassy or cultivated habitats. Also, combinations of such elements and mixed agricultural formations, containing both ligneous and herbaceous layers. Landscapes in which pastures, crops and woodland elements are intimately mixed can be described by use of the first three codes below (if useful, specified by codes from 31.8, 41, 42 and 83) in conjunction with other codes from Section 8 and other open habitat sections. Extensive surfaces characterized by mixed agricultural formations, and in particular, those that combine ligneous and herbaceous elements on the same surfaces can be designated by one of the codes 84.4, 84.5 or 84.6 and their elements specified by use of other codes from Section 8 or any other.

- 84.1 TREE LINES**
- 84.2 HEDGEROWS**
- 84.3 SMALL WOODS**
- 84.4 BOCAGE**
Reticulated landscape of tree lines, hedgerows, small woods, pastures and crops, characteristic, in particular, of southern England and western France.
- 84.5 PARKLAND**
Park-like grassland dotted with trees, characteristic of the British Isles.
- 84.6 DEHESA**
A characteristic landscape of the south-western quadrant of the Iberian peninsula in which crops, pasture land or Mediterranean scrub, in juxtaposition or rotation, are shaded by a fairly closed to very open canopy of native oaks, *Quercus suber*, *Q. rotundifolia*, *Q. pyrenaica*, *Q. faginea*. It is an important habitat of raptors, including the threatened Iberian endemic eagle *Aquila adalberti*, of the crane *Grus grus*, of large insects and their predators and of the endangered felid *Lynx pardina*.

85 Urban parks and large gardens

Usually varied formations, created for recreational use. The vegetation, usually composed mainly of introduced species or cultivars, can nevertheless include many native plants and supports a varied fauna when not intensively managed. The heterogeneity of the habitat engenders a high faunal diversity with, however, a preponderance of common species. The frequent presence of old trees favours the installation of rarer species.

- 85.1** **LARGE PARKS**
Large, varied green spaces. Their constituting elements can be specified by use of the codes below.
- 85.11** **PARK WOODLOTS**
- 85.12** **PARK LAWNS**
- 85.13** **PARK BASINS**
- 85.14** **PARK FLOWER BEDS, ARBORS AND SHRUBBERY**
- 85.15** **PARK SUB-NATURAL COMMUNITIES**
Elements of sub-natural communities enclaved in parks or colonizing their elements; codes from sections other than 8 are to be used to specify their nature.
- 85.2** **SMALL PARKS AND CITY SQUARES**
- 85.3** **GARDENS**
- 85.31** **ORNAMENTAL GARDENS**
- 85.32** **SUBSISTENCE GARDENS**
- 85.4** **CITY BLOCK INNER SPACES**

86 Towns, villages, industrial sites

Areas used for human occupation and industrial activities. A considerable fauna has adapted to buildings. Birds such as *Apus apus*, *Tyto alba* and *Hirundo rustica* nest nearly exclusively in them, using mostly structures with traditional architecture. Other species, of montane rocky habitats, such as *Phoenicurus ochruros*, have colonized lowlands in villages and towns. Bats roost in buildings. Rock plants colonize old walls and roofs.

- 86.1 TOWNS
- 86.2 VILLAGES
- 86.3 ACTIVE INDUSTRIAL SITES
- 86.4 OLD INDUSTRIAL SITES
Abandoned industrial sites and by-products of industrial activities susceptible of colonization by semi-natural communities.
- 86.41 QUARRIES
- 86.411 Sand, clay and kaolin quarries
- 86.412 Gravel quarries
- 86.413 Hard stone quarries
- 86.42 SLAG HEAPS AND OTHER DETRITUS HEAPS
- 86.43 RAILROAD SWITCH YARDS AND OTHER OPEN SPACES
- 86.5 GREENHOUSES AND AGRICULTURAL CONSTRUCTIONS
- 86.6 ARCHAEOLOGICAL SITES

87 Fallow land, waste places

Fields abandoned or left to rest, roadsides and other interstitial spaces on disturbed ground. They are colonized by numerous pioneering, introduced or nitrophilous plants. They sometimes provide habitats that can be used by animals of open spaces.

87.1

FALLOW FIELDS

87.2

RUDERAL COMMUNITIES

88 Mines and underground passages

Artificial underground spaces. They may constitute important substitute habitats for cave-dwelling animals such as bats.

89 Industrial lagoons and reservoirs, canals

Very artificial aquatic habitats; semi-natural communities that might colonize them can be indicated by use of codes of 15, 22, 23 or 24.

- 89.1 SALINE INDUSTRIAL LAGOONS AND CANALS**
 - 89.11 SEA HARBOURS**
 - 89.12 SALTWORKS**
Active or recently abandoned salt-extraction evaporation basins.
Detailed habitats can be coded by use of the subdivisions of 15 and 23 in conjunction with 89.12.
 - 89.13 OTHER SALINE INDUSTRIAL LAGOONS AND CANALS**
- 89.2 FRESH-WATER INDUSTRIAL LAGOONS AND CANALS**
 - 89.21 NAVIGABLE CANALS**
 - 89.22 DITCHES AND SMALL CANALS**
 - 89.23 INDUSTRIAL LAGOONS AND ORNAMENTAL PONDS**
 - 89.24 SEWAGE FARMS AND SEWAGE WORKS**



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The primary objective of the list is to identify all major communities whose presence contributes to the conservation significance of a site. It has been endeavoured to strike a balance between the need to emphasize the extremely interesting but rare natural or near-natural communities and the widespread semi-natural ones, which result from a long history of extensive use by man.

