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Diagnosis and syntaxonomic interpretation of Annex I Habitats (Dir. 92/43/EEC) in Italy at the alliance level

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Abstract

Starting from the recently produced Italian Habitats interpretation Manual (<http://vnr.unipg.it/habitat>), a thorough diagnosis of the Annex I Habitats recorded in the Italian territory is reported, selecting the alliance level as the most suitable standard phytosociological rank for a detailed nationwide overview. In order to solve a number of well-known problems, arising from the definitions reported in the European EUR/27 Manual, each Habitat has been assigned a short, exhaustive although concise diagnostic sentences which contains its most significant ecologic features, with specific reference to the peculiarities of the Italian territory. Biogeographic, synecological (mainly bioclimatic, morphological, geologic/edaphic), structural and floristic characteristics of each Habitat are pointed out. When the rarity or vulnerability status has been considered worthy of priority at the national scale, it has been indicated.

The 131 Habitats listed for Italy, which represent only partially the Italian biodiversity, have been referred to 268 alliances. A complete syntaxonomic framework is reported in order to offer a robust although still improvable phytosociological ground. The paper aims at standing as a reference document for Natura 2000 knowledge and management in Italy; it also represents a large-scale, expert-revised tool to allow supra-national comparisons and support future implementation of the Annex I.

Key words: biodiversity, biogeography, Habitat Directive, Natura 2000, phytosociology, syntaxonomy, vegetation.

Introduction

Since the approval of the 92/43/EEC Directive, known as "Habitat Directive", phytosociology rose to a new flourishing phase. Included for the first time in an official prescriptive document, its syntaxonomic categories have been acknowledged as suitable synthetic ecological descriptors. The Habitat Directive relied in fact on phytosociology for the identification of habitats deserving the highest efforts of conservation, included in the Annex I and described in the European interpretation Manual (latest version EUR/27, European Commission, 2007).

With its floristic, biogeographical, ecological, statistic and syndynamic grounds, the phytosociological classification stands as the most complete model to systematize such a complex type of living systems as the vegetation ecosystems. This has been recently reaffirmed on the occasion of the celebration of one century from the first accurate definition of plant association (Biondi, 2011; Blasi & Frondoni, 2011; Géhu, 2011; Pott, 2011), while more

and more vegetation scientists have been contributing to the debate about the strict interconnections between phytosociological syntaxa and Annex I Habitats, offering important tools for management and conservation (Seliskar, 1998; Loidi, 1999; Dimopoulos *et al.*, 2006; Costa *et al.*, 2007; Rodwell *et al.*, 2007; Biondi, 2007b).

Besides this merit, the 92/43/EEC Directive introduced a number of open issues, as well underlined by Evans (2006, 2010, 2012) and Paavola (2004). With regard to the Italian context, these issues can be mainly imputed to 1) a scarce homogeneity in the used syntaxonomical ranks, 2) the reference to an (often) out of date classification system, 3) the mostly Central-North-European focus.

The general need to solve those problems became more and more urgent as soon as the European rule on habitats conservation became binding at the national, regional and local level. The wide-mesh net of the Annex I list of Habitats needed to be enforced and made denser by introducing in it the territorial knowledge, with its luggage of floristic, biogeographical and

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ecological peculiarities. This push led to the drawing up of an Italian interpretation Manual, which involved a number of Italian vegetation scientists, coordinated by the Italian Botanical Society. The Manual was developed through a long, cross-referenced, critical and revised analysis of the Italian vegetational heritage at risk of deterioration or disappearance (Biondi *et al.*, 2009; Blasi *et al.*, 2010). This useful product, constantly updated as the Regional Administrations progressively adopt the latest improvement suggested by the botanical experts, is currently available online (<http://vnr.unipg.it/habitat/>).

Two decades after the European Directive promulgation, it's time for Italy to strike a balance. The main aim of the present paper is to offer, starting from the above-mentioned Italian Manual, an expert-reviewed omogeneous, standardized, thorough diagnosis of the Annex I Habitats recorded in the Italian territory, with a nationwide validity and applicability. The paper also aims at offering the international audience an updated synthetic outline of the Italian Habitats' interpretation and actual occurrence. This will allow, in future, supra-national comparisons and syntaxonomical analyses, emphasizing on the vegetational peculiarities of the national territories. Furthermore, it represents a possible tool to improve and implement the Annex I itself, thanks to the advances in territorial knowledge.

Materials and methods

The results of the large, many-voiced analytic process that led to the Italian Habitats interpretation Manual are here reported in a standardized way. Each of the 131 Habitats recorded in Italy is assigned a diagnosis, whose structure is composed by three parts: name/code, diagnostic sentence, syntaxonomic reference.

The Habitat's name, fixed by the 43/92/EEC Directive, is reported unchanged for reasons of opportunity, since it, together with the code, represents an identificative string at the European level.

The diagnostic sentence is a condensed Habitat description, formed by at most 40 words. It contains a biogeographic, synecological (mainly bioclimatic, morphological, geologic/edaphic), structural and floristic characterization, however some of these features may be missing when they are not crucial for the identification, or vary in very wide range, or cannot be univocally defined. The 40-words format was chosen in order to create a nimble, easy and fast nevertheless complete descriptive tool; of course it imposed a severe synthesis and forced the description of complex environmental conditions into a narrow case, but on the other side it allowed a homogeneous adjustment of the diagnoses to a standard. Further

informations and details are constantly available in the online version of the Italian Manual (<http://vnr.unipg.it/habitat/>).

These short diagnoses aim at solving some well-known problems concerning Habitat uncertain attribution, overlapping and misinterpretation, often resulting from the European Habitat interpretation manual (European Commission, 2007). The here reported descriptions result from the wide scientific phytosociological production regarding the Italian territory in the last 2 decades, whose complete and updated references are available in the online version. In many cases, these descriptions derive from scientific texts specifically dealing with one or few Habitat-related topics, based on specialistic analyses, discussions or revisions (e.g. Assini, 2007; Bagella *et al.*, 2007; Biondi, 2007a; Biondi *et al.*, 1997, 2001, 2003, 2005, 2009, 2010; Blasi *et al.*, 2004; Brullo *et al.*, 1986, 1998, 2001; Brullo & Guarino, 2002; Brullo & Minissale, 1998; Brullo & Spampinato, 2003; Gigante *et al.*, 2007; Poldini *et al.*, 2010; Spampinato *et al.*, 2008; Terzi, 2011; Vagge & Biondi, 2008). The Regional Manuals and other contributions produced at Regional level represent also a useful source of informations, regarding for instance Friuli-Venezia Giulia (Poldini *et al.*, 2006), Trentino-Alto Adige (Ruffini *et al.*, 2001; Agostini, 2003; Caldonazzi *et al.*, 2004; Lasen & Wilhelm, 2004; Lasen, 2006), Veneto (AA.VV., 2007; Masutti & Battisti, 2007; Buffa & Lasen, 2010), Lombardy (Sartori *et al.*, 2004; Fornasari & Brusa, no date), Piedmont (Sindaco *et al.*, 2003; Casale & Toninelli, 2005), Emilia-Romagna (Alessandrini & Tosetti, 2001; Tinarelli, 2005; Bassi, 2007), Liguria (Mariotti *et al.*, 2003; Mariotti, 2008), Lazio (Calvario *et al.*, 2008). Large-scale documents recently published about the Italian territory were also extremely useful to understand the phytosociological context of the Annex I Habitats and their links to the landscape (Blasi, 2010; Blasi *et al.*, 2000, 2001, 2005). The bioclimatic characterization is in accordance with terms, indexes and definitions reported in Rivas-Martínez *et al.* (1999, 2002); the abbreviation b.b. is used for bioclimatic belt(s). Only in extremely peculiar cases a remark about rarity or conservation risk is added. Plant names, when present, are always followed by the corresponding Author's name, according to the most recent taxonomic revisions (Conti *et al.*, 2005, 2007; www.anarchive.it). The typical species of each habitat are not reported, unless it's needed for the diagnosis; more details about this and other aspects can be found in the online version.

The syntaxonomic reference (Sr) reports for each Habitat one of more of the 268 identified alliances, thus offering a clear, unequivocal phytosociological framework for each Italian Habitat. As indicated in the Introduction, one of the weak points of the

Annex I Habitats definitions (European Commission, 2007) is a wide heterogeneity in the syntaxonomical indications: some of them are extremely definite and reach the association level, some other are more general (alliance, order or class level), some only mention specific or generic plant names. In this paper, the alliance level has been selected as the most suitable for a Habitat overview at the national scale, since it carries a large amount of precise floristic and biogeographical informations, keeps a robust link to the upper ranks with their ecological, physiognomical, structural features, nevertheless it leaves a wide range of potentially different expressions at the local level. The alliance level has been used several times to indicate the ecological context for threatened species and habitats (Papastergiadou *et al.*, 1997; Rodwell *et al.*, 2002; Stanova, 2003). In this sense, it's a good compromise between an endless list of associations and a generic indication of orders or classes. In the text, the alliances are listed according to their sequence in the syntaxonomic frame.

When needed, a short note is added to provide explanatory details or correspondences to other habitat classification systems. The following abbreviations are used to mention the related codes: H is for Habitat; CB is for Corine Biotopes (Devillers *et al.*, 1991); E is for Eunis (Davis *et al.*, 2004).

As emphasized by Blasi *et al.* (2010), the Italian Habitats Manual drew attention to the fact that sometimes the "priority" status should be gauged on the ground of its actual territorial rarity or risk. The most prominent cases of Habitats which, according to their Italian distribution and status, should be assimilated to priority ones are here indicated.

For each Habitat, number of Natura 2000 Sites where it has been recorded and total surface (ha) inside the Sites are indicated in brackets. These data derive from Natura 2000 data bank of the Italian Ministry (<http://www.minambiente.it>). In order to clarify controversial aspects and to avoid misinterpretations, in the list, we included also those Habitats which had erroneously been recorded for the Italian territory in the past, but should definitely be excluded on the ground of the present interpretation and knowledge.

Finally, a complete syntaxonomic scheme is reported in Appendix I, including also the names of the Authors of each syntaxon which are here omitted. Only in few cases (mainly, but not only, occurring with forest habitats), due to a very narrowly-defined biogeographical range, the suballiance is indicated in the syntaxonomic frame. The syntaxa names comply with the ICPN (Weber *et al.*, 2000). The syntaxonomic nomenclature and framework are mostly the fruit of a large compromise, considering that many problematic syntaxa are still under revision and there is a scarce agreement, among different authors, about some

of them. Most of the cases the authors, by mutual consent, assented to comply with Rivas-Martínez *et al.* (2001, 2002), waiting for a definite solution of the most ticklish syntaxonomic issues. In particular, as concerns the class *Festuco-Brometea erecti* Br.-Bl. & Tüxen ex Klika & Hadač 1944, recently subjected to revisions and new interpretative proposals (Mucina *et al.*, 2009; Di Pietro, 2011; Biondi & Galdenzi, 2012), the authors here refer to Biondi *et al.* (2005), waiting for a more exhaustive arrangement of this complex phytosociological class.

The Italian Habitats

1 - COASTAL AND HALOPHYTIC HABITATS

This type includes both marine and seawater closely related Habitats. It is divided in 6 subgroups, 5 of which occur in Italy: Open sea and tidal areas (11), Sea cliffs and shingle or stony beaches (12), Atlantic and continental salt marshes and salt meadows (13), Mediterranean and thermo-Atlantic salt marshes and salt meadows (14) and Salt and gypsum inland steppes (15). Within this group, 16 Habitats (four of which have priority status) have been recognized in Italy.

11 - OPEN SEA AND TIDAL AREAS

1110 - Sandbanks which are slightly covered by sea water all the time (63 Sites - 13,326 ha)

Permanently submerged infralittoral sandbanks (depth generally < 20 m), giving rise to very heterogeneous habitats, in relation to sediment grain size and presence/absence of vegetation.

Sr: *Zosterion marinae*, *Lithophyllion stictaeformis*, *Caulerpion*.

Note: when the sandbanks regularly emerge with low tide, see H1140.

1120* - *Posidonia* beds (*Posidonium oceanicae*) (166 Sites - 172,023 ha)

Submerged grasslands characteristic of the Mediterranean infralittoral belt (depth generally between 30 and 40 m), dominated by *Posidonia oceanica* (L.) Delile, colonizing hard or mobile substrates, with water salinity between 36 and 39‰.

Sr: *Zosterion marinae*, *Peyssonnelion squamariae*, *Cystoseirion crinitae*, *Caulerpion*.

1130 - Estuaries (25 Sites - 1,555 ha)

Final stretch of rivers influenced by tidal action, with a wide salinity gradient (from fresh to purely salt water), frequent presence of fine sediments and extensive intertidal sandy/muddy bars, with or without vegetation from purely marine to brackish or halophytic.

Sr: *Ruppion maritima*, *Zosterion marinae*, *Salicornion*

fruticosae, *Arthrocnemion macrostachyi*, *Spartinion maritimae*.

1140 - Mudflats and sandflats not covered by seawater at low tide (8 Sites -10,107 ha)

Coastal sands and muds of oceans, seas and lagoons, emerging during low tide, generally lacking in vascular vegetation, coated by blue algae and diatoms; when the emerging period is very restricted, *Zostera marina* L. dominated communities may be present.

Sr: *Zosterion marinae*.

1150* - Coastal lagoons (91 Sites - 76,907 ha)

Coastal aquatic environments with shallow, lentic, salt/brackish waters, with considerable seasonal variations in salinity and depth in relation to water supply, rainfall and temperature, usually separated by sandy/pebbly bars, less frequently by low rocky coasts, with or without vegetation.

Sr: *Charion fragilis*, *Charion canescentis*, *Potamion*, *Zannichellion pedicellatae*, *Zannichellion obtusifoliae*, *Ruppion maritimae*, *Riellion helicophyllae*, *Zosterion marinae*, *Cystoseirion crinitae*, *Ulvion laetevirentis*.

1160 - Large shallow inlets and bays (11 Sites - 3,010 ha)

Large coastal coves and shallow bays, sheltered from waves, characterized by a complex mosaic of photophilous, interdependent, benthic communities with high biodiversity, belonging to the mediolittoral (intertidal) and sublittoral (subtidal) belts; the influence of fresh water is limited or absent.

Sr: *Zosterion marinae*, *Cystoseirion crinitae*.

1170 - Reefs (117 Sites - 28,396 ha)

Cliffs of either biogenic or geogenic origin, made out of hard/compact substrata, emerging from the seabed in the sublittoral and coastal belts, hosting a zonation of benthic communities of algae, animal species and corallogenous concretions.

Sr: *Lithophyllion stictaeformis*, *Peyssonnelion squamariae*, *Schotterion nicaeensis*, *Cystoseirion crinitae*, *Sargassion hornschurchii*, *Ulvion laetevirentis*, *Entophysalidion deustae*, *Bangion fuscopurpureae*, *Ralfsion verrucosae*.

12 - SEA CLIFFS AND SHINGLE OR STONY BEACHES

1210 - Annual vegetation of drift lines (182 Sites - 7,726 ha)

Therophytic halo-nitrophilous vegetation colonizing the sandy/pebbly beaches, between the aphytoic area and the psammophilous perennials coenoses, on substrata rich in sea salts and organic matter accumulated by the waves.

Sr: *Euphorbion peplis*, *Thero-Atriplicion*.

1240 - Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp. (156 Sites - 11,475 ha)

Mediterranean cliffs and rocky shores colonized by chasmophytic/comophytic, halophilous and rupicolous, highly specialized vegetation, living in the crevices of rocks, withstanding direct contact with marine aerosols, characterized by many local endemisms of the genus *Limonium* Mill.

Sr: *Helichryson litorei*, *Crithmo-Staticion*, *Crucianellion rupestris*, *Erodio corsici-Limonion articulati*, *Anthyllidion barbae-jovis*.

Note: N-Sardinia *Euphorbia pithyusa* L. communities should be referred to H5320.

13 - ATLANTIC AND CONTINENTAL SALT MARSHES AND SALT MEADOWS

1310 - *Salicornia* and other annuals colonizing mud and sand (85 Sites - 7,926 ha)

Pioneer halophilous annual vegetation (mainly *Salicornia* L. sp. pl.) developed in salt marshes, colonizing large mudflats or clearings in salt-tolerant perennial vegetation, or along the edge of halo-nitrophilous communities dominated by *Suaeda* Forsskål, *Kochia* Roth, *Atriplex* L., *Salsola* L. species.

Sr: *Frankenion pulverulentae*, *Saginion maritimae*, *Crypsidion aculeatae*, *Salicornion patulae*, *Microcnemion coralloidis*, *Thero-Suaedion*.

1320 - *Spartina* swards (*Spartinion maritimae*) (9 Sites - 2,129 ha)

Perennial halophytic vegetation, mainly composed by pioneer herbaceous species belonging to the genus *Spartina* Schreber, [e.g. *Spartina maritima* (Curtis) Fernald], typically colonizing muddy brackish coastal environments ("velme"), on soaked soils rich in organic matter, represented in Italy by endemic communities.

Sr: *Spartinion maritimae*.

1340* - Inland salt meadows (2 Sites - 4 ha)

Non-coastal salty environments hosting halophilous vegetation; in Italy a typical example is represented by the phytocoenoses dominated by *Puccinellia fasciculata* (Torr.) E.P. Bicknell subsp. *fasciculata* [= *Puccinellia borreri* (Bab.) Hitchc.], at present only known in Emilia-Romagna.

Sr: *Puccinellion distantis*

14 - MEDITERRANEAN AND THERMO-ATLANTIC SALT MARSHES AND SALT MEADOWS

1410 - Mediterranean salt meadows (*Juncetalia maritimi*) (122 Sites - 12,156 ha)

Mediterranean, coastal and subcoastal, hygro-halophilous and sub-halophilous grasslands dominated by species of the genus *Juncus* L. (including *J.*

subulatus, CB15.58), colonizing the back dune wet ecosystems on sandy substrates inundated by brackish water for medium-long periods.

Sr: *Juncion maritimi*, *Plantaginion crassifoliae*, *Elytrigio athericae-Artemision coerulescentis*.

1420 - Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornietea fruticosi*) (86 Sites - 13,960 ha)

Perennial, halophilous, species-poor, succulent chamaephytic/nanophanerophytic vegetation, mainly formed by species of the genera *Sarcocornia* A.J. Scott and *Arthrocnemum* Moq., with a Mediterranean-Atlantic distribution, colonizing flooded, from hypersaline to mesosaline, clay-rich soils, occasionally standing long periods of desiccation.

Sr: *Salicornion fruticosae*, *Arthrocnemion macrostachyi*, *Suaedion verae*, *Limoniastrion monopetali*, *Triglochino barrelieri-Limonion glomerati*.

1430 - Halo-nitrophilous scrubs (*Pegano-Salsoletea*) (34 Sites - 1,305 ha)

Perennial, halo-nitrophilous, chamaephytic/nanophanerophytic, often succulent, shrubby vegetation developing on salty arid soils, usually in dry or semi-arid Thermo-Mediterranean bioclimate, colonizing both coastal (e.g. cliffs, back dunes) and inland (e.g. argillaceous badlands) environments.

Sr: *Suaedion verae*, *Limoniastrion monopetali*, *Salsolo vermiculatae-Peganton harmalae*, *Artemision arborescentis*.

15 - SALT AND GYPSUM INLAND STEPPES

1510* - Mediterranean salt steppes (*Limonietalia*) (75 Sites - 19,749 ha)

Perennial, halophilous grasslands dominated by *Limonium* Mill. species, developing in coastal environments or in inland areas (salty endorheic basins), on clayey/sandy-clayey soils, temporarily soaked (exceptionally flooded) by salt waters, subject to summer desiccation, in the Thermo- and Meso-Mediterranean b.b.

Sr: *Limoniastrion monopetali*, *Triglochino barrelieri-Limonion glomerati*, *Inullion crithmoidis*.

Note: when regularly flooded, or with other macrobioclimates than Mediterranean, see H1420.

2 – COASTAL SAND DUNES AND INLAND DUNES

Sand dune Habitats include recent coastal sand dune systems characterised by strictly psammophilous vegetation, the only exception being 2330 (Inland dunes with open *Corynephorus* and *Agrostis* grasslands), including ancient, noncoastal sand dunes, only found in Lombardy and Piedmont. This type is divided in 3 subgroups, all of which are represented in

Italy: Sea dunes of the Atlantic, North Sea and Baltic coasts (21); Sea dunes of the Mediterranean coast (22); Inland dunes, old and decalcified (23). It contains a total of 21 Habitats of community interest, 11 of which are found in Italy (3 have priority status).

21 - SEA DUNES OF THE ATLANTIC, NORTH SEA AND BALTIC COASTS

Note on the habitat type 21: differently from the N-W European coasts, in Italy the dune systems are heavily damaged and fragmented by human settlements and facilities, thus all the corresponding Habitats (when present) should be given the priority level.

2110 - Embryonic shifting dunes (108 Sites - 4,128 ha)

Psammophilous, perennial, hemicryptophytic/geophytic vegetation, colonizing embryonic dunes on low sandy coasts, often contributing to their stabilization by an effective rhizomatic system; a prominent role is often performed by *Agropyron junceum* (L.) Beauv. subsp. *mediterraneum* Simonet et Guinochet (= *Elymus farctus* (Viv.) Runemark ex Melderis subsp. *farctus*).

Sr: *Ammophilion australis*.

2120 - Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (113 Sites - 4,632 ha)

Psammophilous, perennial, hemicryptophytic/geophytic vegetation, colonizing the inner, higher coastal dunes (defined as “shifting” or “white” dunes), dominated by *Ammophila arenaria* (L.) Link subsp. *arundinacea* H. Lindb. [= subsp. *australis* (Mabille) M. Laínz].

Sr: *Ammophilion australis*.

2130* - Fixed coastal dunes with herbaceous vegetation (grey dunes) (23 Sites - 1,126 ha)

Fully or partially stabilized sandy and sandy-pebbly coastal deposits, colonized on their inward slope (usually sheltered from salt winds and sea water) by both annual and perennial, cryptogamic-chamaephytic vegetation.

Sr: *Crucianellion maritimae*, *Saturejion subspicatae*, *Koelerion arenariae*.

2160 - Dunes with *Hippophäe rhamnoides* (7 Sites - 336 ha)

Endemic, edapho-xerophilous, shrubby vegetation of the North-Adriatic dune systems, standing the salty sea-aerosol, on scarcely developed soils, in the Supra-Temperate b.b.

Sr: *Pruno-Rubion ulmifolii*.

Note: very rare in Italy and therefore to be assimilated with a priority Habitat; with Mediterranean

macrobioclimate, see H2250*.

2190 - Humid dune slacks (not present)

Due to misinterpretation, this Atlantic Habitat had been recorded in some Italian Regions (19 Sites - 909 ha); however its occurrence has to be excluded from Italy and the observed Habitats referred to H3120, H3130, H3140, H3150, H3170* and H6420.

22 - SEA DUNES OF THE MEDITERRANEAN COAST

2210 - *Crucianellion maritimae* fixed beach dunes (92 Sites - 3,175 ha)

Chamaephytic and suffruticous, short-sized primary vegetation colonizing the inward slope of stabilized and well-developed dune systems, on compact sand, mainly in the Mediterranean Bioclimate.

Sr: *Crucianellion maritimae*.

Note: very localized and in regression in Italy due to the reduction of suitable sites, to be assimilated with a priority Habitat.

2230 - *Malcolmietalia* dune grasslands (106 Sites - 2,240 ha)

Mostly annual, weakly to strongly nitrophilous vegetation, with a late winter/early spring phenology, colonizing the clearings of perennial grass communities belonging to the class *Ammophiletea*, on sandy dunes, both in Mediterranean and Temperate Macrobioclimate.

Sr: *Alkanno-Maresion nanae*, *Laguro ovati-Vulpion membranaceae*, *Maresion nanae*.

2240 - *Brachypodietalia* dune grasslands with annuals (86 Sites - 5,399 ha)

Ephemeral annual vegetation, with a spring phenology, colonizing the clearings in the shrubby/woody or herbaceous perennial vegetation of stabilized dunes (including palaeodunes), on sands resulting from the degradation of basic substrata.

Sr: *Tuberarion guttatae*, *Trachynion distachyae*, *Thero-Brachypodion ramosi*.

2250* - Coastal dunes with *Juniperus* spp. (104 Sites - 9,918 ha)

Heterogeneous habitat including several woody vegetation types dominated by species of the genus *Juniperus* L. with Mediterranean sclerophyllic shrubs, developed on stabilized coastal dunes along the sandy shores of the Mediterranean, mostly in Mediterranean (rarely Temperate) Macrobioclimate.

Sr: *Pruno-Rubion ulmifolii*, *Berberidion*, *Juniperion turbinatae*.

2260 - *Cisto-Lavanduletalia* dune sclerophyllous scrubs (33 Sites - 3,757 ha)

Inner stabilized part of the coastal sandy dune system,

from Mediterranean to Temperate (Submediterranean) Macrobioclimate colonized by xero-thermophilous vegetation dominated by sclerophyllic shrubs and chamaephytes (e.g. maquis, garrigues).

Sr: *Teucrion mari*, *Cistion ladaniferi*, *Cisto cretici-Ericion manipuliflorae*, *Helianthemo italici-Aphyllanthion monspeliensis*, *Rosmarinion officinalis*, *Cisto eriocephali-Ericion multiflorae*, *Juniperion turbinatae*.

2270* - Wooded dunes with *Pinus pinea* and/or *Pinus pinaster* (74 Sites - 18,519 ha)

Inner stabilized part of the coastal sandy dune system, from Mediterranean to Temperate (Submediterranean) Macrobioclimate, colonized (or sometimes forested) by Mediterranean thermophilous pine species (*Pinus halepensis* Mill., *P. pinea* L., *P. pinaster* Aiton).

Sr: *Juniperion turbinatae*, *Oleo-Ceratonion siliquae*.

Note: pine forests on different types of substrata should be referred to H9540.

23 - INLAND DUNES, OLD AND DECALCIFIED

2330 - Inland dunes with open *Corynephorus* and *Agrostis* grasslands (not officialized yet, however already included in the Italian Manual)

Dry lichen-rich acidophilic grasslands developed on sandy inland dunes and deposits with fluvio-glacial origin, in the Western Po Valley; being a disjointed distribution area, the Italian sites lack in some strictly Atlantic species.

Sr: *Corynephorion canescentis*.

3 - FRESHWATER HABITATS

This habitat type is found exclusively in two environments: Standing water (31) and Running water (32). Fifteen such Habitats (only 1 with priority status) are recognised in Italy. They are found in every region, both in the mountains and plains of the Temperate and Mediterranean areas.

31 - STANDING WATER

3110 - Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) (2 Sites - 6 ha)

Perennial, aquatic or amphibious, small-sized vegetation, colonizing the shores of lakes and ponds with shallow, oligotrophic, slightly mineralized and base-poor water, on sandy plains, mainly in the Supra- and Oro-Temperate b.b.

Sr: *Eleocharition acicularis*, *Isoëtion lacustris*, *Hyperico elodis-Sparganion*.

Note: partially overlapped with H3130, the latter to be used when the annual component (*Nanocyperetalia fusci*) is also present.

3120 - Oligotrophic waters containing very few

minerals generally on sandy soils of the West Mediterranean, with *Isoëtes* spp. (9 Sites - 97 ha)

Perennial to annual, amphibious, dwarf-sized vegetation, colonizing oligotrophic, mineral-poor waters, mainly on sandy soils, with a Western Mediterranean distribution, in the Mesosub-, Meso- and Thermo-Mediterranean b.b.

Sr: *Isoëtium*, *Preslion cervinae*, *Agrostion salmanticae*, *Cicendion*, *Cicendio-Solenopsis laurentiae*.

Note: for very shallow, temporary ponds see H3170*.

3130 - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* (126 Sites - 3,830 ha)

Both perennial (1) and annual pioneer (2) small-sized vegetation of the shores of lakes and ponds with oligotrophic to mesotrophic standing water, on nutrient-poor substrata, mainly present in N-Italy in the Mesosub-Mediterranean, Meso- Supra- and Oro-Temperate b.b.

Sr: (1) *Eleocharition acicularis*, *Isoëtium lacustris*, *Hyperico elodis-Sparganion*; (2) *Nanocyperion*, *Verbenion supinae*, *Lythrion tribracteati*.

Note: the two subtypes may be present also separately; for type (1) with permanent water bodies see H3110.

3140 - Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. (102 Sites - 6,832 ha)

Oligo-mesotrophic, phosphate-poor, calcareous, permanent or temporary freshwater (various size and depth), colonized by populations of *Charophyceae*, pure or mixed with aquatic phanerogamic species, tending to form dense carpets.

Sr: *Charion fragilis*, *Charion vulgaris*, *Charion canescentis*, *Nitellion flexilis*.

3150 - Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation (294 Sites - 30,740 ha)

Lakes and other wet environments with base-rich standing freshwater, colonized by hydrophytic, afloat or submerged, rooted or not-rooted vegetation, with a widely distribution in different climatic conditions (azonal vegetation).

Sr: *Potamion*, *Nymphaeion albae*, *Zannichellion pedicellatae*, *Ceratophyllion demersi*, *Utricularion vulgaris*, *Lemnion trisulcae*, *Lemno minoris-Hydrocharition morsus-ranae*, *Lemnion minoris*.

Note: this Habitat includes also CB22.422 and CB22.431; with running water, see H3260.

3160 - Natural dystrophic lakes and ponds (32 Sites - 185 ha)

Natural dystrophic lakes and ponds with acidic water, often brown due to the presence of peat or humic acids, generally on peat substrata, colonized

by submerged hydrophytic species-poor vegetation, mainly distributed in the Oro- and Supra-Temperate b.b.

Sr: *Sphagno-Utricularion*, *Scorpidio-Utricularion*.

3170* - Mediterranean temporary ponds (123 Sites - 5,766 ha)

Perennial to annual, amphibious, Mediterranean vegetation, mainly composed by dwarf-sized therophytes and geophytes, with a late winter/early spring phenology, developing in wet systems with shallow temporary ponds, in the Mesosub-, Meso- and Thermo-Mediterranean b.b.

Sr: *Isoëtium*, *Preslion cervinae*, *Agrostion salmanticae*, *Cicendion*, *Cicendio-Solenopsis laurentiae*, *Nanocyperion*, *Verbenion supinae*, *Lythrion tribracteati*.

Note: this Habitat includes also the CB22.32; for not-temporary ponds see H3120.

32 - RUNNING WATER**3220 - Alpine rivers and the herbaceous vegetation along their banks** (113 Sites - 8,893 ha)

Pioneer, herbaceous/suffruticous vegetation, with a prevalence of Alpine species, colonizing pebbly and sandy shores of rivers with “Alpine” regime; these environments are characterized by an alternation of flooding and drying periods.

Sr: *Phalaridion arundinaceae*, *Epilobion fleischeri*.

3230 - Alpine rivers and their ligneous vegetation with *Myricaria germanica* (24 Sites - 931 ha)

Pioneer, discontinuous, short (1-2 m) shrubby vegetation dominated by *Myricaria germanica* (L.) Desv., with an extremely poor herbaceous layer, colonizing silt-rich gravel deposits along rivers with “Alpine” regime; very rare in Italy, mainly distributed in Central Europe.

Sr: *Salicion incanae*.

Note: to be assimilated with a priority Habitat.

3240 - Alpine rivers and their ligneous vegetation with *Salix eleagnos* (153 Sites - 9,291 ha)

Pioneer, woody, willow-dominated vegetation, colonizing the gravelly-sandy shores and bed of rivers with “torrential” regime, with an extremely poor herbaceous layer, standing notable changes in the level of the water table during the year.

Sr: *Salicion incanae*.

Note: in spite of the name, the distribution of this Habitat is not restricted to the Alps.

3250 - Constantly flowing Mediterranean rivers with *Glaucium flavum* (34 Sites - 8,220 ha)

Pioneer, herbaceous/chamaephytic vegetation colonizing gravelly-pebbly shores and bed of rivers

(including braided rivers) facing intense dry periods in summer, in Submediterranean or Mediterranean climatic conditions.

Sr: *Glauclion flavi*, *Xerobromion*, *Euphorbion rigidae*, *Artemisio albae-Saturejion montanae*.

Note: this Habitat includes also CB32.4A1.

3260 - Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (185 Sites - 6,210 ha)

Perennial, herbaceous, species-poor, aquatic macrophytic phanerophytic/bryophytic vegetation, colonizing limpid water in well illuminated river stretches, composed by partially or totally submerged species, sometimes with emerging flowers.

Sr: *Ranunculion fluitantis*, *Ranunculion aquatilis*.

Note: with standing water, see H3150.

3270 - Rivers with muddy banks with *Chenopodium rubri* p.p. and *Bidention* p.p. vegetation (130 Sites - 5,577 ha)

Pioneer, herbaceous, nitrophilous, annual vegetation colonizing the naturally nitrate-rich, periodically flooded river banks, on different types of substrata (from clay, sand and silt to gravel), from plain to submontane belts, with a late-summer/autumn phenology.

Sr: *Bidention tripartitae*, *Chenopodium rubri*.

3280 - Constantly flowing Mediterranean rivers with *Paspalo-Agrostidion* species and hanging curtains of *Salix* and *Populus alba* (110 Sites - 8,963 ha)

Perennial, hygro-nitrophilous, species-poor, dense grasslands, dominated by rhizomatic species, colonizing permanently wet and temporarily flooded soils with a medium to fine granulometry, rich in organic matter, along permanently flowing Mediterranean rivers.

Sr: *Paspalo-Agrostion verticillati*.

Note: with intermittently flowing water, see H3290.

3290 - Intermittently flowing Mediterranean rivers of the *Paspalo-Agrostidion* (53 Sites - 4,437 ha)

This Habitat differs from H3280 only in that it can be found along intermittently flowing Mediterranean rivers, with a dry bed for part of the year, sometimes originating pools hosting vegetation belonging to the class *Potametea*.

Sr: *Paspalo-Agrostion verticillati*.

Note: with permanently flowing water, see H3280.

4 – TEMPERATE HEATH AND SCRUB

This type, the only one not subdivided in subtypes, is represented in Italy only by 5 Habitats (1 with priority status). It is more common in the mountainous areas of

alpine and peninsular regions, the only exception being H4030 (European dry heaths). Absent in Campania and Apulia, it includes some oro-Mediterranean communities commonly found in mountainous areas, both on the largest islands and along the coasts.

40 - TEMPERATE HEATH AND SCRUB

4030 - European dry heaths (128 Sites - 10,288 ha)

Short-sized, shrubby, acidophilic, *Calluna vulgaris* (L.) Hull heaths, often with *Vaccinium* L., *Genista* L., *Erica* L., *Ulex* L. species, in Central-W and N-W-Italy from plain to montane belts, on sandy/silty, nutrient-poor soils, dry or with temporary water slack.

Sr: *Genistion pilosae*, *Cisto salviifolii-Ericion cinereae*, *Telinion monspessulano-linifoliae*, *Sarothamnion scoparii*.

4060 - Alpine and Boreal heaths (248 Sites - 53,353 ha)

Short/dwarf-sized, prostrated, both acidophilic and basophilic, shrubby vegetation dominated by *Erica* L., *Rhododendron* L., *Vaccinium* L., *Rhodothamnus* Rchb., *Loiseleuria* Desv., *Juniperus* L., *Genista* L., *Arctostaphylos* Adanson species, distributed on Alps and Apennine, from the Alpine to Subalpine (occasionally montane) belts.

Sr: *Loiseleurio-Vaccinion*, *Berberidion vulgaris*, *Ericion carneae*, *Daphno oleoidis-Juniperion alpinae*, *Rhododendro-Vaccinion*, *Juniperion nanae*, *Geranion sanguinei*.

Note: *Dryas octopetala*-dominated vegetation should be referred to H6170; for *Pinus mugo* vegetation on carbonatic substrata see H4070.

4070* - Bushes with *Pinus mugo* and *Rhododendron hirsutum* (*Mugo-Rhododendretum hirsuti*) (99 Sites - 44,377 ha)

Prostrate-ascending, dense, 2-3 (5) m tall, dwarf tree vegetation dominated by *Pinus mugo* Turra, with a species-poor understory, typical of the detrital limestone slopes in the Subalpine belt of the Alps and Apennine, sometimes also present at lower altitudes.

Sr: *Erico-Pinion mugo*, *Erico-Fraxinion orni*, *Epipactido atropurpureae-Pinion mugo*, *Juniperion nanae*.

Note: for *Pinus mugo/Rhododendron ferrugineum* vegetation on siliceous substrata see H 4060.

4080 - Sub-Arctic *Salix* spp. scrub (66 Sites - 3,140 ha)

Short-sized vegetation (0.3-2 m) dominated by shrubby willow species, colonizing fresh slopes, long snow-covered, often close to rivers and streams, both on siliceous and carbonatic substrata, in the Subalpine and Alpine belts of the Alps and Apennine, sometimes also at lower altitudes, on scarcely developed soils.

Sr: *Salicion pentandrae*, *Alnion viridis*.

Note: subhygrophilous, willow-rich, *Alnus viridis*-dominated vegetation should be included.

4090 - Endemic oro-Mediterranean heaths with gorse (49 Sites - 16,182 ha)

Dwarf, xerophilous, nanophanerophytic/chamaephytic vegetation dominated by pulvinate, often thorny leguminous species (*Astragalus* L., *Genista* L. etc.), both primary and secondary, colonizing the mountain ridges with bedrock outcrops and primitive soils, in the Mediterranean and (exceptionally) Temperate Bioclimate.

Sr: *Anthyllion hermanniae*, *Teucrium mari*, *Calicotome villosae*-*Genistion tyrrhenae*, *Rumici aetnensis*-*Astragalion siculi*, *Cisto cretici*-*Ericion manipuliflorae*, *Alysson bertolonii* (incl. *Euphorbion ligusticae*), *Cerastio tomentosii*-*Astragalion nebrodensis*, *Seslerion apenninae*, *Phleo ambigu-Bromion erecti*.

5 - SCLEROPHYLLOUS SCRUB (MATORRAL)

This habitat type is subdivided in 4 subgroups: Sub-Mediterranean and temperate scrub (51), Mediterranean arborescent matorral (52), Thermo-Mediterranean and pre-steppe brush (53) and Phrygana (54). A total of 11 Habitats are recognised in Italy, 2 of which have priority status. Worthy of note are H5220* (Arborescent matorral with *Zyziphus*), which is present exclusively in Sicily, and H5410 [West Mediterranean cliff-top phryganas (*Astragalio-Plantaginietum subulatae*)], recorded in Sardinia only.

51 - SUB-MEDITERRANEAN AND TEMPERATE SCRUB

5110 - Stable xerothermophilous formations with *Buxus sempervirens* on rock slopes (*Berberidion p.p.*) (51 Sites - 7,323 ha)

Shrubby, more or less open vegetation dominated by *Buxus sempervirens* L., colonizing calcareous (including ultramafic/basaltic) substrata on dry, stony/rocky slopes, from the plain to montane belts, also including pseudomaquis and scrublands where box may be accompanied by other shrub species.

Sr: *Cisto cretici*-*Ericion manipuliflorae*, *Alysson bertolonii* (incl. *Euphorbion ligusticae*), *Berberidion vulgaris*, *Cytisium sessilifolii*.

5130 - *Juniperus communis* formations on heaths or calcareous grasslands (214 Sites - 24,091 ha)

Shrubby, more or less open, secondary vegetation dominated by *Juniperus communis* L., generally including grassland patches and shrubby cores of juniper (often with *Rosa* L., *Crataegus* L., *Prunus* L. species), mostly on carbonatic substrata, from the hilly to montane belts.

Sr: *Berberidion vulgaris*, *Cytisium sessilifolii* (it may include mosaic patches from *Festuco-Brometea*

on calcareous substrata, from *Calluno-Ulicetea* on siliceous substrata).

Note: for high altitude, dwarf vegetation dominated by *Juniperus communis* L. var. *saxatilis* Pall. [= subsp. *alpina* (Gray) Neill. ex Čelak, = subsp. *nana* (Willd.) Syme] see H4060.

52 - MEDITERRANEAN ARBORESCENT MATORRAL

5210 - Arborescent matorral with *Juniperus* spp. (130 Sites - 48,372 ha)

Mediterranean and sub-Mediterranean, sclerophyllous, dense vegetation organized around arborescent junipers, colonizing steep, often rocky slopes mostly on carbonatic substrata with xero-edaphic conditions.

Sr: *Juniperion turbinatae*, *Oleo-Ceratonion siliquae*.

Note: for *Juniperus phoenicea* L. subsp. *turbinata* (Guss.) Nyman dominated vegetation see H9560*.

5220* - Arborescent matorral with *Zyziphus* (3 Sites - 392 ha)

Xerophilous, thorny, shrubby vegetation dominated by *Zyziphus lotus* (L.) Lam., or other scrub types with *Calicotome infesta* (C. Presl) Guss., *Periploca angustifolia* Labill., *Euphorbia dendroides* L., colonizing various substrata in the Thermo-Mediterranean b.b., only recorded in Sicily.

Sr: *Oleo-Ceratonion siliquae*, *Periplocon angustifoliae*.

5230* - Arborescent matorral with *Laurus nobilis* (25 Sites - 1,086 ha)

Woods and maquis with the tree layer dominated by *Laurus nobilis* L., colonizing sites where peculiar topographic conditions can mitigate both summer aridity and winter frost, from the Meso-Mediterranean to the Meso-Temperate b.b., on highly variable substrata, often located in gorges and small valleys.

Sr: *Populion albae*, *Fraxino orni-Quercion ilicis*, *Lauro nobilis-Quercion virgiliana*.

Note: for laurel-dominated shrublands see H5310.

53 - THERMO-MEDITERRANEAN AND PRE-STEPPE BRUSH

5310 - *Laurus nobilis* thickets (4 Sites - 221 ha)

Shrubby, species-poor vegetation dominated by *Laurus nobilis* L. with other Mediterranean thermophilous shrubs, mainly distributed on rocky calcareous substrata with special micro/topo-climatic or edaphic conditions in both Temperate and Mediterranean Macrobioclimates.

Sr: *Populion albae*, *Fraxino orni-Quercion ilicis*.

Note: for evergreen holm-oak-dominated forests with laurel in the shrubby understory see H9430.

5320 - Low formations of *Euphorbia* close to cliffs (74 Sites - 4,931 ha)

Coastal sub-halophitic low shrubby vegetation (garrigue) dominated by chamaefitic species, colonizing the zone between the sea-exposed cliffs and the Mediterranean maquis/shrublands (with possible expansion inland), with a W-Mediterranean distribution, mainly in the Thermo-Mediterranean b.b.
Sr: *Euphorbion pithyusae*, *Helichryson litorei*, *Antyllidion barba-jovis*.

Note: very rich in rare and localized endemics and therefore to be assimilated with a priority Habitat; for Sardinian endemic garrigues colonizing the cliff tops see H5410.

5330 - Thermo-Mediterranean and pre-desert scrub (384 Sites - 120,473 ha)

Thermo-Mediterranean, discontinuous, garrigue vegetation dominated by shrubs and herbaceous perennials species [including *Ampelodesmos mauritanicus* (Poir.) T. Durand et Schinz - subtype CB 32.23], mainly distributed along the rocky Tyrrhenian and Central-S-Adriatic coasts, sometimes reaching inland areas.

Sr: *Lavandulo angustifoliae-Genistion cinereae*, *Avenulo-Ampelodesmion mauritanici*, *Teucrium mari*, *Calicotomo villosae-Genistion tyrrhenae*, *Oleo-Ceratonion siliquae*, *Periplocion angustifoliae*.

54 - PHRYGANA

5410 - West Mediterranean clifftop phryganas (*Astragalo-Plantaginetum subulatae*) (6 Sites - 223 ha)

W-Mediterranean, short-sized pulvinate garrigue vegetation, rich in rare endemic species [e.g. *Astragalus tragacantha* L. subsp. *terraccianoii* (Vals.) Jeanm., *Centaurea horrida* Badarò], strictly localized on the top of the cliffs and rocky areas in the Thermo-Mediterranean b.b.

Sr: *Euphorbion pithyusae*.

Note: to be assimilated with a priority Habitat.

5420 - *Sarcopoterium spinosum* phryganas (14 Sites - 1,827 ha)

Primary and secondary short-sized pulvinate garrigue vegetation dominated by *Sarcopoterium spinosum* (L.) Spach, colonizing dry and scarcely developed substrata, with a mainly E-Mediterranean distribution, in the Thermo/Meso-Mediterranean b.b.

Sr: *Cisto cretici-Ericion manipuliflorae*, *Cisto eriocephali-Ericion multiflorae*, *Oleo-Ceratonion siliquae*.

5430 - Endemic phryganas of the *Euphorbio-Verbascion* (49 Sites - 17,316 ha)

Thermophilous, edapho-xerophilous, pulvinate, often thorny, shrubby vegetation dominated by chamaephytic/nanophanerophytic species, colonizing

coastal and hilly sites on different types of substrata, with a Central and E-Mediterranean distribution, in the Thermo-Mediterranean b.b.

Sr: *Teucrium mari*.

Note: extremely rare, only partially known.

6 - NATURAL AND SEMI-NATURAL GRASSLAND FORMATIONS

This rich, heterogeneous type contains 5 subgroups: Natural grasslands (61), Semi-natural dry grasslands and scrubland facies (62), Dehesas (63), Semi-natural tall-herb humid meadows (64) and Mesophile grasslands (65). Italy counts 15 Habitats, including 5 with priority status. These habitats are found mainly in the Alps and Apennines, in areas where grazing and cutting practices prevent the vegetation from naturally evolving into woodland communities.

61 - NATURAL GRASSLANDS

6110* - Rupicolous calcareous or basophilic grasslands of the *Alyso-Sedion albi* (184 Sites - 9,886 ha)

Xero-thermophilous, pioneer, discontinuous, therophytic/succulent grasslands rich in lichen and moss species, colonizing mainly calcareous (less frequently volcanogenic or ophiolitic) rocky outcrops, with a wide distribution, mostly from the Meso-Mediterranean to the Supra-Temperate b.b.

Sr: *Alyso alyssoidis-Sedion albi*.

Note: for very poor cover values on siliceous substrata see H8230.

6130 - Calaminarian grasslands of the *Violetalia calaminariae* (7 Sites - 972 ha)

Open, herbaceous/sub-fruticose perennial vegetation, colonizing rocky outcrops or gravel/pebble deposits or even mining spoil-heaps, on substrata particularly rich in heavy metals (e.g. ophiolite), characterized by a highly specialized flora (metallophyte), mainly distributed in N-W-Italy.

Sr: the actually representative alliances of the order *Violetalia calaminariae* in Italy are still to be investigated.

6150 - Siliceous alpine and boreal grasslands (118 Sites - 49,981 ha)

Acidophilic, sometimes discontinuous, hemicryptophytic perennial grasslands, colonizing soils derived from siliceous or decarbonated substrata, often affected by long snow cover, mostly in the Alps and rarely in the N-Apennine, generally at high altitude, in the Oro- and Crioro-Temperate b.b.

Sr: *Festucion variae*, *Agrostion schraderianae*, *Caricion curvulae*, *Salicion herbaceae*, *Nardion strictae* (only for the Crioro-Temperate communities).

6170 - Alpine and subalpine calcareous grasslands

(227 Sites - 130,732 ha)

Calcareous, sometimes discontinuous, hemicryptophytic perennial grasslands, colonizing soils derived from carbonatic, base-rich substrata, often affected by long snow cover, both in the Alps and the Apennine, in the Oro- and Crioro-Temperate b.b. (or lower, with special topo-climatic conditions).
Sr: *Oxytropido-Elynon*, *Seslerion apenninae*, *Caricion ferrugineae*, *Avenion sempervirentis*, *Seslerion albicantis*, *Caricion austroalpinae*, *Caricion firmae*, *Arabidion caeruleae*, *Ononidion cenisiae*, *Ranunculo pollinensis-Nardion strictae*.

Note: for soils rich in heavy metals see H6130.

62 - SEMI-NATURAL DRY GRASSLANDS AND SCRUBLAND FACIES

6210(*) - Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites) (665 Sites - 253,233 ha)

Calcareous, species-rich, from xero- to mesophilous, mainly hemicryptophytic, perennial secondary grasslands, colonizing soils derived from various base-rich substrata, distributed in the Apennine (with endemic syntaxa) and the Alps, from Mesosub-Mediterranean to Supra-Temperate b.b.

Sr: *Xerobromion erecti*, *Phleo ambigu-Bromion erecti*, *Bromion erecti*, *Festuco amethystinae-Bromion erecti*, *Cirsio-Brachypodion pinnati*, *Diplachnion serotinae*.

Note: the order *Festuco-Brometalia* doesn't correspond to any phytosociological syntaxon currently in use: since the Manual EUR/27 explicitly indicates also the order *Festucetalia valesiaca*, the phytosociologic reference must include the whole class *Festuco-Brometea*.

6220* - Pseudo-steppe with grasses and annuals of the *Thero-Brachypodieta* (612 Sites - 187,791 ha)

Small-sized, discontinuous, xero-thermophilous, both annual and perennial grasslands, on various, mostly calcareous, base-rich substrata, in the Thermo-, Meso-, Supra- and Mesosub-Mediterranean b.b., mainly distributed in coastal and subcoastal sectors of peninsular/insular Italy, also reaching inland areas with edapho-xeric conditions.

Sr: *Tuberarion guttatae*, *Thero-Airion*, *Trachynion distachyae*, *Hypochoeridion achyrophori*, *Trifolio subterranei-Periballion*, *Poo bulbosae-Astragalion sesamei*, *Plantaginion serrariae*, *Thero-Brachypodion ramosi*, *Polygonion tenoreani*, *Stipion tenacissimae*, *Moricandio-Lygeion sparti*, *Hyparrhenion hirtae* (incl. *Aristido caerulescentis-Hyparrhenion* and *Saturejo-Hyparrhenion*).

Note: for perennial tall-sized grasslands dominated by *Ampelodesmos mauritanicus* (Poir.) T. Durand et Schinz (CB32.23) see H5330.

6230* - Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) (229 Sites - 45,657 ha)

Dense, mesophilous, perennial grasslands dominated by *Nardus stricta* L., colonizing flat or slightly steep areas with acidic soils derived from siliceous or leached carbonatic substrata, in the Alps and the Apennines, from the Meso to Oro-Temperate b.b.

Sr: *Violion caninae*, *Nardo-Agrostion tenuis*, *Ranunculo pollinensis-Nardion strictae*, *Nardion strictae* (the last only for Subalpine aspects of *Sieversio-Nardetum strictae*).

6240* - Sub-pannonic steppic grasslands (18 Sites - 1,025 ha)

Continental, xeric grasslands, rich in chamaephytic and shrubby species, dominated by *Festuca valesiaca* Schleich. ex Gaudin or *Stipa* L. sp. pl., colonizing very thin humic soils on rocky layers, in windy ridges and exposed sites of the inland Alpine valleys.

Sr: *Cirsio-Brachypodion pinnati*, *Festucion valesiaca*, *Stipo-Poion xerophilae*, *Stipo-Poion carniolicae*.

62A0 - Eastern sub-mediterranean dry grasslands (*Scorzoneretalia villosae*) (20 Sites - 8,242 ha)

Illyrian-Adriatic, xeric grasslands, with a Balkanic imprint and an Eastern distribution, both in NE- and SE-Italy, rich in endemic species particularly in the southernmost areas (Apulia Region), mostly in the Mesosub-Mediterranean b.b.

Sr: *Saturejion subspicatae*, *Centaureion dichroanthae*, *Hippocrepido glaucae-Stipion austroitalicae*, *Hypochoeridion maculatae*, *Scorzonerion villosae*, *Violo pseudogracilis-Bromopsis caprinae*.

63 - SCLEROPHILLOUS GRAZED FORESTS (DEHESAS)

6310 - Dehesas with evergreen *Quercus* spp. (63 Sites - 16,256 ha)

Wooded pastures with sparse evergreen oaks (*Quercus suber* L., *Q. ilex* L., *Q. coccifera* L.), indifferent to the substratum, maintained by the grazing cattle, mainly distributed in the Tyrrhenian areas, from the Thermo- to Supra-Mediterranean b.b.

Sr: *Fraxino orni-Quercion ilicis*, *Juniperion turbinatae*, *Echio plantaginei-Galactition tomentosae*, *Trifolio subterranei-Periballion*.

64 - SEMI-NATURAL TALL-HERB HUMID MEADOWS

6410 - *Molinia* meadows on calcareous, peaty or clayey-siltladen soils (*Molinion caeruleae*) (178 Sites - 7,552 ha)

Nutrient-poor, hayed or grazed meadows, dominated by *Molinia caerulea* (L.) Moench, colonizing more or less moist, clayey/silty or peaty soils, both on siliceous and carbonatic substrata, from plain to timberline, mainly between the Meso- and Supra-Temperate b.b.

Sr: *Molinion coeruleae*, *Juncion acutiflori*.

6420 - Mediterranean tall humid herb grasslands of the *Molinio-Holoschoenion* (119 Sites - 6,986 ha)

Mediterranean rush-beds and other hygrophilous, tall-sized grasslands, able to stand temporary phases of soil aridity, colonizing sandy-clayey soils, mainly distributed in the coastal retro-dune systems but also in inland wet areas.

Sr: *Molinio-Holoschoenion vulgaris*.

6430 - Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (472 Sites - 27,275 ha)

Hygro-nitrophilous, tall-sized vegetation dominated by megaphorb species, mainly colonizing the edge of rivers and mesophilous forests, with a wide altitudinal and climatic range.

Sr: *Rumicion alpini* p.p., *Adenostylion alliariae*, *Calamagrostion arundinaceae*, *Calystegion sepium*, *Petasition officinalis*, *Bromo ramosi-Eupatorion cannabini*, *Aegopodion podagrariae*, *Galio-Alliarion petiolatae*, *Impatienti noli-tangere-Stachyion sylvaticae*, *Conio maculati-Sambucion ebuli*, *Calthion palustris*.

65 - MESOPHILE GRASSLANDS

6510 - Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) (260 Sites - 28,238 ha)

Perennial, mesophilous, regularly mowed and sometimes even grazed, non-intensively fertilized, species-rich meadows and pastures, distributed from the plains to low mountain zone, from the Meso- to Supra-Temperate b.b.

Sr: *Arrhenatherion elatioris*, *Ranunculo neapolitani-Arrhentatherion elatioris*, *Ranunculion velutini*, *Plantaginion cupanii*.

Note: the strongly disturbed, N-rich environments should not be included.

6520 - Mountain hay meadows (153 Sites - 17,146 ha)

Perennial, mesophilous, regularly mowed and sometimes even grazed, species-rich meadows and pastures, distributed on the mountains at higher altitude than H6510, from the Supra- to Oro-Temperate b.b.

Sr: *Polygono-Trisetion*.

7 – RAISED BOGS AND MIRES AND FENS

This type is divided in 3 subgroups, 2 of which are present in Italy: *Sphagnum* acid bogs (71) and Calcareous fens (72). Eight Habitats have been recorded, 4 with priority status. They are found mostly in the Alps and Apennines, in areas where climate and soil water availability allow the development of these plant communities.

71 - SPHAGNUM ACID BOGS

7110* - Active raised bogs (50 Sites - 556 ha)

Actively peat-forming, ombrotrophic (= mainly fed by rainwater) raised bogs, dominated by species of the genus *Sphagnum* L., colonizing acidic, mineral-poor waters, in the Supra-, Oro- and Crioro-Temperate b.b., mainly distributed in the Alps and N-Apennine.

Sr: *Sphagnion medii*, *Caricion davallianae* p.p., *Caricion fuscae* p.p. (the last 2 only in very exceptional cases).

Note: also temporarily inactive bogs should be included.

7120 - Degraded raised bogs still capable of natural regeneration (2 Sites - 1 ha)

Actively peat-forming, ombrotrophic raised bogs, dominated by species of the genus *Sphagnum* L., with the same characteristics as H7110* but where a reversible hydrological, structural or floristic deterioration took place, mostly for anthropogenic causes.

Sr: *Sphagnion medii*, *Caricion fuscae* p.p., *Caricion davallianae* p.p.

7130(*) - Blanket bogs (* if active bog) (not present)

This Habitat has to be excluded from the Italian territory, in spite of former misinterpretations. Fragments of blanket-like bogs, dominated by species of the genus *Sphagnum* L., should be referred to H7110, H7120 or H7140.

7140 - Transition mires and quaking bogs (171 Sites - 4,227 ha)

Mixed ombrotrophic/minerotrophic (= fed both by rain/groundwater) bogs, forming peat deposits and floating mats, generally dominated by bryophytic species, with oligotrophic to mesotrophic waters, in the Supra-, Oro- and Crioro-Temperate b.b., in the Alps, Apennine and Islands (fragments).

Sr: *Caricion davallianae*, *Caricion fuscae*, *Caricion lasiocarpae*.

Note: this Habitat includes also E2.23.

7150 - Depressions on peat substrates of the *Rhynchosporion* (53 Sites - 636 ha)

Pioneer perennial vegetation with *Rhynchospora alba* (L.) Vahl, *R. fusca* (L.) W.T. Aiton, *Drosera intermedia* Hayne, *D. rotundifolia* L. and others, colonizing depressions on peat or sandy bare substrata with oligotrophic waters, in the Supra-, Oro- and Crioro-Temperate b.b.

Sr: *Rhynchosporion albae*.

Note: it should be assimilated with a priority Habitat

7160 - Fennoscandian mineral-rich springs and springfens (not present)

Due to its very precise biogeographic definition, the occurrence of this Habitat in Italy has to be excluded. However, similar vegetation types related to non-calcareous spring environments are indeed present in some Regions (mostly in the Alps but also in Calabria, for instance) and urge for a proper acknowledgement.

72 - CALCAREOUS FENS

7210* - Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (61 Sites - 1,494 ha)

Azonal emergent perennial vegetation dominated by *Cladium mariscus* (L.) Pohl, colonizing the shores of lakes and marsh areas with calcareous water, mainly distributed in the Temperate bioclimatic Region and exceptionally in the Mediterranean.

Sr: *Phragmites communis*, *Scirpus compacti*, *Magnocaricion elatae*.

Note: when dominated by species of *Caricion davallianae* see H7230.

7220* - Petrifying springs with tufa formation (*Cratoneurion*) (110 Sites - 3,483 ha)

Springs and dripping walls with tufa/travertine formation for deposition of calcium carbonate, colonized by bryophytic hygro-hydrophilic vegetation, usually in shady locations in gorges, rocky walls, cliffs, on different types of substrata, with a wide distribution in southern Europe.

Sr: *Cratoneurion commutati*.

7230 - Alkaline fens (187 Sites - 6,425 ha)

Alkaline fens associated with wetland systems, mostly dominated by calcicolous, peat-forming small-sized sedges and brown mosses, growing on permanently flooded soils, with soligenous/topogenous, base-rich water, with a superficial groundwater table, mainly in the Temperate Macrobioclimate.

Sr: *Caricion davallianae*, *Caricion fuscae*.

Note: in the Apennine this Habitat is represented by species-poor fragments.

7240* - Alpine pioneer formations of *Caricion bicoloris-atrofuscae* (24 Sites - 445 ha)

Alpine pioneer perennial sedge vegetation, developed on neutral to sub-acidic, from gravelly to sandy/clayey or even peaty substrata, soaked in cold water, with long-frozen soils, along spring or stream shores, in the Oro- and Crioro-Temperate b.b.

Sr: *Caricion bicoloris-atrofuscae*.

8 – ROCKY HABITATS AND CAVES

This habitat type is divided in 3 subgroups: Scree (81), Rocky slopes with chasmophytic vegetation (82) and Other rocky habitats (83), all of which are found in Italy (a total of 11 Habitats, only 1 with

priority status). If we exclude H8330 (Submerged or partially submerged sea caves) and some sea cliffs, these Habitats are mostly recorded in mountain zones, where screes and rupicolous areas are more common.

81 - SCREE

8110 - Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsetalia ladani*) (147 Sites - 76,167 ha)

Siliceous debris cones and screes colonized by perennial herbaceous, mostly open, pioneer vegetation, with an Alpine and C-Apenninic distribution, mainly in the Oro- and Crioro-Temperate b.b.

Sr: *Galeopsis segetum*, *Androsacion alpinae*, *Allosuro crispi-Athyrium alpestris*, *Festucion dimorphae* (the last only for the association *Achilleo mucronulatae-Saxifragetum aizoidis*).

8120 - Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) (156 Sites - 61,006 ha)

Calcareous, calc-schistic or marly debris cones and mobile screes colonized by perennial herbaceous, mostly open, from meso/xerophytic to meso/hygrophytic, pioneer vegetation, with an Alpine and Apenninic distribution, from the Montane- to Crioro-Temperate b.b.

Sr: *Festucion dimorphae*, *Thlaspietea rotundifolii*, *Drabion hoppeanae*, *Gymnocarpion robertiani*.

Note: in the Apennine it should be assimilated with a priority Habitat.

8130 - Western Mediterranean and thermophilous scree (193 Sites - 16,078 ha)

Warm-exposed screes, debris cones, detritic soils on different types of substrata, colonized by perennial herbaceous, mostly open, thermophilous, pioneer vegetation, with an Alpine and Apenninic distribution.

Sr: *Dryopteridion oreadis*, *Stipion calamagrostis*, *Silenion marginatae*, *Linarion purpureae*.

8160* - Medio-European calcareous scree of hill and montane levels (not present)

Due to its very precise biogeographic definition, the occurrence of this Habitat in Italy (recorded for 14 Sites - 4,178 ha) has to be excluded. In similar environments, the Italian vegetation can be properly referred to H8120 and H8130.

82 - ROCKY SLOPES WITH CHASMOPHYTIC VEGETATION

8210 - Calcareous rocky slopes with chasmophytic vegetation (530 Sites - 160,161 ha)

Calcareous rocky outcrops, walls and slopes, colonized by perennial chasmophytic vegetation, with a wide altitudinal range from the sea level in the Mediterranean Regions to the highest peaks in the

Alps.

Sr: *Campanulion versicoloris*, *Potentillion caulescentis*, *Saxifragion lingulatae*, *Saxifragion australis*, *Androsaco-Drabion tomentosae*, *Violo biflorae-Cystopteridion alpinae*, *Dianthion rupicola*, *Centaureion pentadactylis*, *Caro multiflori-Aurinion megalocarpae*, *Centaureo-Campanulion*, *Asperulion garganicae*, *Centaureo-Micromerion cordatae*, *Polypodion serrati*, *Arenarion balearicae*.

Note: according to Eunis Habitat Classification (Davis et al., 2004) it includes also ultra-basic substrata.

8220 - Siliceous rocky slopes with chasmophytic vegetation (219 Sites - 69,806 ha)

Siliceous, carbonate-poor, rocky outcrops, walls and slopes, colonized by perennial chasmophytic vegetation, with a wide altitudinal range from the sea level in the Mediterranean Regions to the highest peaks in the Alps.

Sr: *Asplenion septentrionalis*, *Androsacion vandellii*, *Saxifragion pedemontanae*, *Potentillion crassinerviae*, *Asplenion serpentini*, *Phagnalo saxatilis-Cheilanthon maderensis*, *Linarion caprariae*, *Pohlio crudae-Asplenion septentrionalis*.

8230 - Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii (142 Sites - 11,807 ha)

Siliceous, carbonate-poor, often actively eroded (especially by wind action) rocky outcrops colonized by perennial, moss- and lichen-rich, pioneer, sparse vegetation with very low cover values, widely distributed in different climatic areas, mostly from the Crioro- to Meso-Temperate b.b.

Sr: *Sedo-Scleranthion biennis*, *Arabidopsidion thalianae*, *Parmelion conspersae*, *Umbilicarion cylindrica*.

Note: this Habitat includes also CB62.3.

8240* - Limestone pavements (77 Sites - 13,921 ha)

Calcareous, flat or sub-horizontal rocky outcrops generally affected by carstic processes, colonized by perennial, often moss- and lichen-rich, pioneer, very open vegetation, with a wide distribution in different climatic areas, mostly from the Crioro- to Meso-Temperate b.b.

Sr: this Habitat has a mainly geomorphological characterization and can involve many different vegetation classes: *Asplenietea trichomanis*, *Mulgedio-Aconitetea*, *Trifolio-Geranietea*, *Kobresio-Seslerietea*, *Festuco-Brometea*, *Rhamno-Prunetea*, *Quercu-Fagetea*, *Salicetea herbaceae*, *Ctenidietea mollusci*, *Neckeretea complanatae*.

83 - OTHER ROCKY HABITATS

8310 - Caves not open to the public (197 Sites -

15,699 ha)

Caves (including groundwater bodies, when present) not available for touristic visits, mainly colonized by endemic specialized animal species and hosting plant communities (with algal, bryophytic, vascular species) only close to their entrance.

Sr: *Adiantion capilli-veneris*, *Violo biflorae-Cystopteridion alpinae*.

8320 - Fields of lava and natural excavations (24 Sites - 7,763 ha)

Environments originated by recent volcanic activity, colonized by pioneer, species-poor, mostly endemic-rich communities, often with nutrient-rich, permeable soils, whose ecological features depend on the site's geological and biogeographical peculiarity.

Sr: *Rumici-Astragalion siculi*, *Parmelion conspersae*, as well as different vegetational aspects to be referred to the classes: *Tuberarietea guttatae*, *Cladonio digitatae-Lepidozietea reptantis*, *Ctenidietea mollusci*, *Campylopodetea vaporarii*, *Grimmieteae alpestris*, *Ceratodonto purpurei-Polytrichetea piliferi*.

Note: the subtype corresponding to CB66.6 "fumarole" should be assimilated with a priority Habitat.

8330 - Submerged or partially submerged sea caves (66 Sites - 2,569 ha)

Caves submerged at least at high tide, with a more or less dark environment, whose walls, vault and bottom are generally colonized by calcicolous or not, more or less sciophilous, algal communities.

Sr: *Lithophyllion stictaeformis*, *Peyssonnelion squamariae*, *Schotterion nicaeensis*, *Ralfsion verrucosae*.

8340 - Permanent glaciers (41 Sites - 30,228 ha)

Glaciers (including the sidewalls), more or less covered by debris, colonized by fungal/algal coenoses.

Sr: the habitat is lacking in phanerogamic vegetation; the algal genera *Chlamydomonas* Ehrenb., *Chloromonas* C. Gobi, several diatoms and the fungal species *Chionaster nivalis* (Bohl.) Wille, *C. bicornis* Kol., *Selenotila nivalis* Lagerh. 1892 can be mentioned.

9 – FORESTS

The last type comprises the forest communities, which are divided in 6 subgroups, 5 of which are present in Italy: Forests of Temperate Europe (91), Mediterranean deciduous forests (92), Mediterranean sclerophyllous forests (93), Temperate mountainous coniferous forests (94) and Mediterranean and Macaronesian mountainous coniferous forests (95). The overall number of Habitats recognised in Italy is 39, 9 of which have priority status. Some are typical of the Apennines, e.g. H9210* (Apennine beech forests with *Taxus* and *Ilex*), H9220* (Apennine beech

forests with *Abies alba* and beech forests with *Abies nebrodensis*) and H9510* (Southern Apennine *Abies alba* forests).

91 - FORESTS OF TEMPERATE EUROPE

9110 - *Luzulo-Fagetum* beech forests (146 Sites - 48,356 ha)

Pure or mixed beech forests, sometimes with conifers, on siliceous carbonate-poor substrata, colonizing oligo-mesotrophic to oligotrophic, acidic soils, with a mainly Alpine (N-Apenninic only for the CB41.171) distribution, from the Meso- to Supra-Temperate b.b.

Sr: *Luzulo-Fagion sylvaticae*.

9120 - Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer (*Quercenion robori-petraeae* or *Ilici-Fagenion*) (3 Sites - 1,786 ha)

Pure or mixed beech forests, sometimes with oaks [*Quercus petraea* (Matt.) Liebl., *Q. robur* L.], colonizing acidic soils, in the W-C-Alps and NW-Apennine, from the Meso- to Supra-Temperate b.b. (the mixed type mainly distributed in the lower belt).

Sr: *Luzulo-Fagion sylvaticae*, *Quercenion roboris*.

9130 - *Asperulo-Fagetum* beech forests (73 Sites - 27,495 ha)

Pure or mixed beech forests, sometimes with fir [*Abies alba* Mill., *Picea abies* (L.) H. Karst.], colonizing eutrophic or meso-eutrophic soils, with a species-rich herb layer, with an Alpine distribution, from the Meso- to Supra-Temperate b.b.

Sr: *Fagion sylvaticae*.

9140 - Medio-European subalpine beech woods with *Acer* and *Rumex arifolius* (15 Sites - 1,557 ha)

Pure or mixed beech forests, sometimes low-growing, often with *Acer pseudoplatanus* L., colonizing fresh slopes or valleys affected by snowsliding and snow accumulation, generally close to the timberline, on wet clay-rich soils, with a rich megaphorbic layer, with Alpine distribution.

Sr: *Fagion sylvaticae*.

9150 - Medio-European limestone beech forests of the *Cephalanthero-Fagion* (94 Sites - 43,669 ha)

Xero-thermophilous, calcicolous beech forests, colonizing steep slopes with thin soils, standing an alternation of wet/dry periods, with Alpine distribution, from the Meso- to Supra-Temperate b.b.

Sr: *Fagion sylvaticae* p.p. (*Cephalanthero-Fagenion*).

9160 - Sub-Atlantic and medio-European oak or oakhornbeam forests of the *Carpinion betuli* (89 Sites - 9,370 ha)

Oak-hornbeam forests colonizing valleys and foothills on hydromorphic, silty-clayey colluvial soils with superficial groundwater table, with *Quercus robur* L., sometimes *Q. petraea* (Matt.) Liebl., and a rich early-flowering geophytic layer, mainly in CW-Po Valley, in the Meso-Temperate b.b.

Sr: *Alnion incanae*, *Carpinion betuli*.

Note: old-growth or particularly species-rich forests should be assimilated with a priority Habitat.

9170 - *Galio-Carpinetum* oak-hornbeam forests (1 Sites - 123 ha)

More or less acidophilic forests dominated by *Quercus petraea* (Matt.) Liebl. with *Carpinus betulus* L., colonizing mature soils on the bottom of Alpine valleys, in the Meso-Temperate b.b., in territories with subcontinental characteristics.

Sr: *Carpinion betuli*.

9180* - *Tilio-Acerion* forests of slopes, screes and ravines (199 Sites - 18,211 ha)

Mesophilous mixed forests with maple, lime, ash, colonizing the bottom of small valleys and humid gorges with moss-rich rocky ground, mainly distributed in the Alps (external ridge) and less frequently in the Apennine, from the Meso- to Supra-Temperate b.b.

Sr: *Tilio platyphylli-Acerion pseudoplatani*, *Lauro nobilis-Tilion platyphylli*, *Tilio-Ostryon carpiniifoliae*.

9190 - Old acidophilous oak woods with *Quercus robur* on sandy plains (14 Sites - 1,179 ha)

Acidophilous forests dominated by *Quercus robur* L. and *Betula pendula* Roth with *Quercus petraea* (Matt.) Liebl., colonizing Mindel fluvio-glacial terraces between the Prealpinic moraines and the high Po Valley with leached, nutrient-poor, acidic soils, in continental-temperate climatic conditions.

Sr: *Quercenion roboris*.

91B0 - Thermophilous *Fraxinus angustifolia* woods (13 Sites - 3,184 ha)

Riparian thermo-hygrophilous forests dominated by Mediterranean ash tree, colonizing moist soils, mainly along the terminal sections of rivers and near the estuaries, in the Meso- and Mesosub-Mediterranean b.b.

Sr: *Populion albae*, *Fraxinon angustifoliae*.

Note: also the forests dominated by *Fraxinus angustifolia* Vahl subsp. *oxycarpa* (Willd.) Franco et Rocha Afonso should be taken into account; for alluvial, long flooded ash forests see H91F0.

91D0* - Bog woodland (47 Sites - 920 ha)

Forested peatlands including forest/shrubland mosaics, on moist, peaty, acidic, oligotrophic soils, with a constantly high water table, often with *Pinus*

mugo Turra, *P. sylvestris* L., *Betula pubescens* Ehrh., distributed in the Alps, in the Supra- and Oro-Temperate b.b.

Sr: *Sphagnion medii*, *Betulion pubescentis*.

91E0* - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (458 Sites - 25,219 ha)

Swampy/riparian forests dominated by species of the genera *Alnus* Mill., *Salix* L., *Fraxinus* L., along the plain, hilly, mountain banks of rivers and lakes, on alluvial, frequently flooded soils, with high water table, mainly in Temperate, sometimes Mediterranean, bioclimatic conditions.

Sr: *Alnion glutinosae*, *Salicion albae*, *Alnion incanae*, *Osmundo-Alnion glutinosae*.

Note: this Habitat includes also CB44.5 and CB44.91.

91F0 - Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (*Ulmunion minoris*) (104 Sites - 9,058 ha)

Riparian, meso-hygrophilous mixed forests colonizing the banks of middle/final stretches of large rivers, clearly pertaining to the river's dynamics even when represented by local slacks, on alluvial, exceptionally flooded, silty/sandy soils.

Sr: *Populion albae*, *Fraxinion angustifoliae*, *Alnion incanae*, *Alno-Quercion roboris*.

91H0* - Pannonian woods with *Quercus pubescens* (71 Sites - 11,670 ha)

Edapho-xerophilous sparse forests dominated by *Quercus pubescens* Willd., rich in Eastern, Submediterranean and C-European species, colonizing the inland valleys of the E-Alps, with a Temperate macrobioclimate, in areas with a continental character.

Sr: *Carpinion orientalis* p.p. (only for *Seslerio autumnalis-Ostryenion carpinifoliae*, *Ostryo-Carpinion orientalis*).

Note: for climatic/biogeographic reasons, it's absent in the Peninsular Regions, where it is replaced by H91AA*.

91K0 - Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*) (46 Sites - 23,832 ha)

SE-Alpine beech forests, sometimes with conifers, with a species-rich herb layer, including many Illyrian and S-European species, colonizing calcareous or flysch substrata, generally on well developed soils, only in the Eastern Alps, mostly in the Supra-Temperate b.b.

Sr: *Aremonio-Fagion sylvaticae* p.p. (only for *Epimedio-Fagenion*, *Lamio orvalae-Fagenion*, *Saxifrago rotundifoliae-Fagenion*, *Ostryo carpinifoliae-Fagenion*)

Note: for the non-Illyric N-C-Apenninic beech forests, also included in *Aremonio-Fagion*, see H9210*.

91L0 - Illyrian oak-hornbeam forests (*Erythronio-Carpinion*) (65 Sites - 12,521 ha)

Mesophilous forests with *Quercus petraea* (Matt.) Liebl., *Q. robur* L., *Q. cerris* L., *Carpinus betulus* L., with a rich early-flowering geophytic layer, colonizing flat/hollow areas, on humic deep soils, in the E-Alps and Apennine, mainly in the Meso-Temperate b.b.

Sr: *Erythronio dentis-canis-Carpinion betuli*, *Physospermo vericillati-Quercion cerris*.

91M0 - Pannonian-Balkan turkey oak-sessile oak forests (78 Sites - 34,042 ha)

Subacidophilic, thermo/mesophilous forests with *Q. cerris* L., *Q. frainetto* Ten., *Q. petraea* (Matt.) Liebl., with an Apenninic, mostly C-S-Tyrrhenian, distribution, both in inland and subcoastal areas, from the Supra-Mediterranean to Meso-Temperate climatic belts.

Sr: *Teucro siculi-Quercion cerridis*.

91AA* - Eastern white oak woods (110 Sites - 29,014 ha)

Sub-Mediterranean and Mediterranean, edapho-xerophilous forests with an Adriatic and C-S-Tyrrhenian distribution dominated by thermophilous oak species [*Quercus virgiliana* (Ten.) Ten., *Q. dalechampii* Ten., *Q. pubescens* Willd.], colonizing different types of substrata in the coastal, subcoastal and Preapenninic territories.

Sr: *Fraxino orni-Quercion ilicis*, *Pino calabricae-Quercion congestae*, *Carpinion orientalis* p.p. (only for *Cytiso sessilifolii-Quercenion pubescentis*, *Lauro nobilis-Quercenion virgiliana*, *Campanulo mediae-Ostryenion carpinifoliae*).

Note: not to be mistaken with H91H0*, which is present only in the continental inner Alpine valleys.

92 - MEDITERRANEAN DECIDUOUS FORESTS

9210* - Apennine beech forests with *Taxus* and *Ilex* (241 Sites - 189,868 ha)

Thermophilous beech forests, often with *Taxus baccata* L. and *Ilex aquifolium* L. in the shrub layer, rich in SE-European (Apennino-Balkan) and Mediterranean species, with a mainly Apenninic distribution, on calcareous, marly or siliceous substrata, mainly in the Supra-Temperate climatic belt.

Sr: *Aremonio-Fagion sylvaticae* p.p. (only for *Cardamino kitaibelii-Fagenion*), *Geranio versicoloris-Fagion sylvaticae*.

9220* - Apennine beech forests with *Abies alba* and beech forests with *Abies nebrodensis* (73 Sites - 27,756 ha)

Mixed beech forests with autochthonous fir species, rich in orophytes and endemics, with a fragmented distribution along the Apennine, mainly in the Supra-Temperate climatic belt, in Sicily also in the Supra- and Oro-Mediterranean.

Sr: *Aremonio-Fagion sylvaticae* (for *Cardamino kitaibelii-Fagenion*), *Luzulo-Fagion* (for *Luzulo pedemontanae-Fagetum sylvaticae* Oberdorfer & Hoffmann 1967 *abietetosum albae* Arrigoni et al. 1998), *Geranio versicoloris-Fagion*, *Berberidion aetnensis* (only for *Pinenion calabricae*), *Pruno prostratae-Juniperion sabinae*.

Note: according to the Habitat name, the Sicilian forests with *Abies nebrodensis* (Lojac.) Mattei must be referred to H9220*; however, they might find a more suitable arrangement in H9510*.

9250 - *Quercus trojana* woods (6 Sites - 41,057 ha)

Meso/xerophilous, thermophilous, subacidophilic forests with *Quercus trojana* Webb and often *Q. virgiliana* (Ten.) Ten., strictly localized in SE-Italy, colonizing red Mediterranean soils, in the Meso-Mediterranean b.b.

Sr: *Fraxino orni-Quercion ilicis*, *Carpinion orientalis* p.p. (for *Lauro nobilis-Quercion virgiliana*).

9260 - *Castanea sativa* woods (348 Sites - 126,919 ha)

Acidophilic forests dominated by *Castanea sativa* Mill. (including plantations for fruit/wood, provided they have a spontaneous, autochthonous herb layer) on oligotrophic, siliceous, neutral to acidic, deep soils, with a wide distribution, from the Mesosub-Mediterranean to Supra-Temperate climatic belt.

Sr: *Carpinion betuli*, *Erythronio dentis-canis-Carpinion betuli*, *Quercion roboris*, *Carpinion orientalis*, *Teucro siculi-Quercion cerridis*, *Erythronio dentis-canis-Quercion petraeae*.

9280 - *Quercus frainetto* woods (not present)

In spite of its name, this Habitat refers to beech-dominated forests with Hungarian oak (corresponding to CB41.1B). Due to misinterpretation, it had been recorded in some Italian Regions (7 Sites - 2,902 ha); however its occurrence has to be excluded from Italy. The Italian *Quercus frainetto* Ten. woods should be referred to H91M0.

92A0 - *Salix alba* and *Populus alba* galleries (385 Sites - 45,899 ha)

Riparian forests dominated by species of the genera *Salix* L. and *Populus* L. distributed along the rivers of the Mediterranean Basin, from the Thermo-Mediterranean to (Sub)Meso-Temperate b.b.

Sr: *Salicion albae*, *Salicion pedicellatae*, *Populion albae*, *Alno-Quercion roboris*.

92C0 - *Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*) (21 Sites - 1,952 ha)

Riparian forests dominated by *Platanus orientalis* L., strictly localized in SW-Italy, colonizing the banks of perennial rivers along narrow, deeply incised valleys, with peculiar warm/humid mesoclimatic conditions, in the Thermo- and Meso-Mediterranean b.b.

Sr: *Platanion orientalis*.

Note: very rare in Italy and therefore to be assimilated with a priority Habitat.

92D0 - Southern riparian galleries and thickets (*Nerio-Tamaricetea* and *Securinegion tinctoriae*) (88 Sites - 6,997 ha)

Riparian tall-sized shrubby vegetation dominated by *Tamarix gallica* L., *T. africana* Poir., *T. canariensis* Willd., standing long dry periods, along torrential rivers (or with a widely changeable flow), on scarcely developed alluvial soils, in the Thermo and Meso-Mediterranean b.b.

Sr: *Rubo-Nerion oleandri*, *Tamaricion africanae*.

93 - MEDITERRANEAN SCLEROPHYLLOUS FORESTS

9320 - *Olea* and *Ceratonia* forests (88 Sites - 14,545 ha)

Arborescent vegetation dominated by *Olea europaea* L. var. *sylvestris* Brot. and *Ceratonia siliqua* L. with other sclerophyllous species, generally extremely localized and fragmented, colonizing different types of substrata in the Thermo and Meso-Mediterranean b.b.

Sr: *Fraxino orni-Quercion ilicis*, *Oleo-Ceratonion siliquae*.

9330 - *Quercus suber* forests (66 Sites - 31,713 ha)

Open forests and woodlands dominated by *Quercus suber* L., with a scarce tree cover and rich herb/shrub layers, mostly on acidic soils, with a W-Mediterranean, especially Tyrrhenian, distribution, mainly in the Meso- (sometimes Mesosub-) Mediterranean b.b.

Sr: *Fraxino orni-Quercion ilicis*, *Ericion arboreae*, *Teucro siculi-Quercion cerridis*.

9340 - *Quercus ilex* and *Quercus rotundifolia* forests (485 Sites - 190,621 ha)

Evergreen forests/maquis dominated by *Quercus ilex* L., colonizing different types of substrata, from carbonatic/siliceous rocks to sands, widely distributed in the Italian Regions, both in the coastal/subcoastal and inland areas, from the Thermo- to Mesosub-Mediterranean (occasionally Meso-Temperate) b.b.

Sr: *Fraxino orni-Quercion ilicis*.

Note: in Italy it includes only CB45.31 and CB45.32.

9350 - *Quercus macrolepis* forests (4 Sites - 130 ha)

Apulian open forests dominated by *Quercus*

ithaburensis Decne. subsp. *macrolepis* (Kotschy) Hedge et Yalt (= *Q. macrolepis* Kotschy), strictly localized in SE-Italy (only few sites in Apulia Region), mainly in the Meso-Mediterranean b.b.

Sr: *Fraxino orni-Quercion ilicis*.

Note: in Italy it includes only CB41.792.

9380 - Forests of *Ilex aquifolium* (12 Sites - 2,132 ha)

Relictual tall-sized shrublands or arborescent vegetation dominated by *Ilex aquifolium* L., sometimes with *Taxus baccata* L., on different (mostly siliceous) substrata, in the Supra-Mediterranean or Supra-Temperate b.b. with prominent oceanic features.

Sr: *Fraxino orni-Quercion ilicis*, *Geranio versicoloris-Fagion*, *Pino calabricae-Quercion congestae*.

94 - TEMPERATE MOUNTAINOUS CONIFEROUS FORESTS

9410 - Acidophilous *Picea* forests of the montane to alpine levels (*Vaccinio-Piceetea*) (153 Sites - 94,819 ha)

Pure or mixed, species-poor forests dominated by *Picea abies* (L.) H. Karst., also with other conifer species, on both carbonatic and siliceous substrata, distributed in the Alps and NW-Apennine, mainly in the Supra- and Oro-Temperate b.b.

Sr: *Piceion abietis*, *Calamagrostio variae-Abietion*.

9420 - Alpine *Larix decidua* and/or *Pinus cembra* forests (155 Sites - 63,974 ha)

Pure or mixed forests dominated by *Larix decidua* Mill. and/or *Pinus cembra* L., sometimes with *Picea abies* (L.) H. Karst. or *Pinus mugo* Turra subsp. *uncinata* (Ramond ex DC.) Domin (= *Pinus uncinata* Ramond ex DC.), distributed only in the Alps, mainly in the Oro- (sometimes Supra-) Temperate b.b.

Sr: *Erico-Pinion mugo*, *Piceion abietis*.

9430(*) - Subalpine and montane *Pinus uncinata* forests (* if on gypsum or limestone) (20 Sites - 2,195 ha)

Open forests or tall-sized shrublands dominated by *Pinus mugo* Turra subsp. *uncinata* (Ramond ex DC.) Domin (= *Pinus uncinata* Ramond ex DC.), with a rich dwarf-scrubby understory, on carbonatic, siliceous or gypsiferous substrata, distributed only in the Alps, in the Supra- and Oro-Temperate b.b.

Sr: *Erico-Pinion mugo*, *Daphno oleoidis-Juniperion alpinae*, *Seslerio caeruleae-Pinion uncinatae*, *Rhododendro-Vaccinion*, *Juniperion nanae*, *Ononido-Pinion*.

95 - MEDITERRANEAN AND MACARONESIAN MOUNTAINOUS CONIFEROUS FORESTS

9510* - Southern Apennine *Abies alba* (14 Sites - 3,874 ha)

Relictual forests dominated by *Abies alba* Mill.

mainly distributed in S- and C-Apennine, occupying the same altitudinal belt of the beech forests, mostly in the Supra-Temperate b.b.

Sr: *Berberidion aetnensis* (for *Pinenion calabricae*), *Aremonio-Fagion*, *Geranio versicoloris-Fagion*.

Note: for the Apenninic beech forests with silver fir, see H9220.

9530* - (Sub-)Mediterranean pine forests with endemic black pines (43 Sites - 12,821 ha)

Heliophilous, pioneer, Apenninic/Alpine forests dominated by species from *Pinus nigra* J.F. Arnold group, standing extreme environments (rocky ridges, sub-vertical walls) with intense edaphic aridity, when compensated by a high atmospheric humidity, mainly on carbonatic but also crystalline or volcanic substrata.

Sr: *Erico-Fraxinion orni*, *Daphno oleoidis-Juniperion alpinae*, *Berberidion aetnensis* (for *Pinenion calabricae*), *Geranio versicoloris-Fagion*.

9540 - Mediterranean pine forests with endemic Mesogeian pines (107 Sites - 32,241 ha)

Mediterranean/thermo-Atlantic sparse forests with *Pinus pinaster* Aiton, *P. pinea* L., *P. halepensis* Mill., *P. brutia* Ten., with a dense sclerophyllic shrub layer, in the Thermo- and Meso-Mediterranean b.b.; old, naturalized plantations of these species should be included.

Sr: *Fraxino orni-Quercion ilicis*, *Oleo-Ceratonion siliquae*, *Ericion arboreae*, *Pinion pineae*.

Note: for pinus forests on coastal dunes see H2270*.

9560* - Endemic forests with *Juniperus* spp. (12 Sites - 594 ha)

Relictual, edapho-xerophilous, tall-sized shrubby vegetation dominated by *Juniperus thurifera* L., with a W-Mediterranean distribution, in Italy only in Piedmont where it colonizes rocky sites, accompanied by *J. phoenicea* L. subsp. *phoenicea* and *J. hemisphaerica* C. Presl.

Sr: *Juniperion thuriferae*.

9580* - Mediterranean *Taxus baccata* woods (11 Sites - 2,840 ha)

Forests dominated by *Taxus baccata* L., often associated with *Ilex aquifolium* L., localized in small areas in a context of deciduous or rarely evergreen forests, with a very restricted distribution in SW-Italy and major islands.

Sr: *Fraxino orni-Quercion ilicis*, *Oleo-Ceratonion siliquae*, *Geranio versicoloris-Fagion sylvaticae*, *Pino calabricae-Quercion congestae*.

Note: for beech forests with yew see H9210*.

95A0 - High oro-Mediterranean pine forests (11 Sites - 2,840 ha)

SE-Mediterranean, relictual, sparse forests dominated by the oromediterranean *Pinus leucodermis* Antoine, with a shrub layer rich in juniper species (often *Juniperus hemisphaerica* C. Presl.), colonizing calcareous/dolomitic rocky substrata, often with poor eroded soils, in sites which benefit from recurring mists.

Sr: *Daphno oleoidis-Juniperion alpinae*.

Note: very rare in Italy and therefore to be assimilated with a priority Habitat; some Authors consider *Pinus leucodermis* Antoine as a variety [*Pinus heldreichii* H. Christ var. *leucodermis* (Antoine) Markgr. ex Fitschen].

Conclusive remarks

The most remarkable aspect of the present paper is the introduction of a standardized, uniform phytosociological reference for all the Annex I Habitats of the 92/43/EEC Directive recognized in the Italian territory. Taking into account the most recent progresses in vegetation science, with a careful link to the National and local biodiversity, it offers a tool

to apply the European law at the territorial scale, translating general supra-national concepts into the peculiar language of the Italian flora, vegetation and landscape.

The alliance proved more and more to be a precious phytosociologic format, with a high interpretative value at a territorial, biogeographic level. It stands as the most suitable syntaxon for ecological analyses at national and regional scale.

By offering a tool for the correct interpretation of the Habitats, the present paper will favour and support a proper application of the “Habitat” Directive, thus supporting and improving the Italian biodiversity conservation and management.

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Appendix 1 - Syntaxonomic scheme

When there is a relation between a syntaxon and a Habitat, the corresponding code is reported in square brackets; this doesn't imply that the whole syntaxon coincides with that Habitat. A well-grounded correspondence should be supported case by case by the expert's interpretation.

CHARETEA FRAGILIS Fukarek & Kraush 1964

CHARETALIA HISPIDAE Sauer & Kraush 1964

Charion fragilis Krausch em. Doll 1989 [1150*] [3140]

Charion vulgaris (Krause & Lang 1977) Krause 1981 [3140]

Charion canescentis Kraush 1964 [1150*] [3140]

NITELLETALIA FLEXILIS Krause 1969

Nitellion flexilis Krause 1969 [3140]

LEMNETEA Tüxen ex O. Bolòs & Masclans 1955

LEMNETALIA MINORIS O. Bolòs & Masclans 1955

Lemnion trisulcae Den Hartog & Segal ex Tüxen & Schwabe in Tüxen 1974 [3150]

Lemno minoris-Hydrocharition morsus-ranae Rivas-Martínez, Fernández-González & Loidi 1999 (= Hydrocharition morsus-ranae Passarge 1996) [3150]

Lemnion minoris Tüxen ex O. Bolòs & Masclans 1955 [3150]

POTAMETEA Klika in Klika & Novák 1941

POTAMETALIA Koch 1926

Potamion (Koch 1926) Libbert 1931 [1150*] [3150]

Nymphaeion albae Oberdorfer 1957 [3150]

Zannichellion pedicellatae Schaminée, Lanjouw & Schipper 1990 em. Pott 1992 [1150*] [3150]

Zannichellion obtusifoliae Brullo & Spampinato 1990 [1150*]

Ranunculion fluitantis Neuhäusl 1959 [3260]

Ranunculion aquatilis Passarge 1964 (= Callitricho-Batrachion Den Hartog & Segal 1964) [3260]

UTRICULARIETALIA MINORIS Den Hartog & Segal 1964

Ceratophyllion demersi Den Hartog & Segal ex Passarge 1996 [3150]

Utricularion vulgaris Den Hartog & Segal 1964 [3150]

RUPPIETEA J.Tüxen 1960

RUPPIETALIA J.Tüxen 1960

Ruppion maritimae Br.-Bl. ex Westhoff in Bennema, Sissingh & Westhoff 1943 [1130] [1150*]

Riellion helicophyllae Cirujano, Velayos & P. García ex Rivas-Martínez, Fernández-González & Loidi 1999 [1150*]

ZOSTERETEA MARINAE Pignatti 1953

ZOSTERETALIA Bèguinot 1941

Zosterion marinae Christiansen 1934 [1110] [1120] [1130] [1140] [1150*] [1160]

LITHOPHYLLETEA Giaccone 1965 emend. Giaccone 1994

LITHOPHYLLETALIA Giaccone 1965

Lithophyllion stictaeformis Giaccone 1965 [1110] [1170] [8330]

RHODYMENIETALIA Boudouresque 1971 emend. Giaccone 1994

Peyssonnelion squamariae Augier e Boudouresque 1975 emend. Giaccone 1994 [1120] [1170] [8330]

Schotterion nicaeensis Boudouresque e Cinelli 1971 emend. Giaccone 1994 [1170] [8330]

CYSTOSEIRETEA Giaccone 1965

CYSTOSEIRETALIA Molinier 1958 em. Giaccone 1994

Cystoseirion crinitae Molinier 1958 [1120] [1150*] [1160] [1170]

Sargassion hornschurchii Giaccone 1973 [1170]

ULVETALIA Molinier 1958

Ulvion laetevirentis Berner 1931 [1150*] [1170]

ENTOPHYSALIDETEA Giaccone 1993

ENTOPHYSALIDETALIA DEUSTAE Ercegovic 1932

Entophysalidion deustae Ercegovic 1932 [1170]

BANGIETALIA FUSCOPURPUREAE Giaccone 1993

Bangion fuscopurpureae Giaccone 1993 [1170]

RALFSIETALIA VERRUCOSAE Giaccone 1993

Ralfsion verrucosae Giaccone 1993 [1170] [8330]

CAULERPETEA Giaccone & Di Martino 1997

CAULERPETALIA Giaccone & Di Martino 1997

Caulerpion Giaccone & Di Martino 1997 [1110] [1120]

BIDENTETEA TRIPARTITAE Tüxen, Lohmeyer & Preising ex von Rochow 1951

BIDENTETALIA TRIPARTITAE Br.-Bl. & Tüxen ex Klika & Hadač 1944

Bidention tripartitae Nordhagen 1940 em. Tüxen in Poli & J. Tüxen 1960 [3270]

Chenopodium rubri (Tüxen ex Poli & J. Tüxen 1960) Kopecký 1969 [3270]

ISOËTO-NANOJUNCETEA Br.-Bl. & Tüxen ex Westhoff, Dijk & Passchier 1946

ISOËTETALIA Br.-Bl. 1936

Isoëtion Br.-Bl. 1936 [3120] [3170*]

Preslion cervinae Br.-Bl. ex Moor 1937 [3120] [3170*]

Agrostion salmanticae Rivas Goday 1958 [3120] [3170*]

Cicendion (Rivas Goday in Rivas Goday & Borja 1961) Br.-Bl. 1967 [3120] [3170*]

Cicendio-Solenopsis laurentiae Brullo & Minissale 1998 [3120] [3170*]

NANOCYPERETALIA fuscii Klika 1935

Nanocyperion Koch ex Libbert 1933 [3130-2] [3170*]

Verbenion supinae Slavnic 1951 1951 (= *Heleochloion* Br.-Bl. ex Rivas Goday 1956, *Heleochloion* Br.-Bl. in Br.-Bl.,

Roussine & Nègre 1952) [3130-2] [3170*]

Lythron tribracteati Rivas Goday & Rivas-Martínez ex Rivas Goday 1970 [3130-2] [3170*]

ISOËTO-LITTORELLETEA Br.-Bl. & Vlieger in Vlieger 1937

LITTORELLETALIA Koch 1926

Eleocharition acicularis Pietsch 1967 [3110] [3130-1]

Isoëtion lacustris Nordhagen 1937 [3110] [3130-1]

Hyperico elodis-Sparganion Br.-Bl. & Tüxen ex Oberdorfer 1957 [3110] [3130-1]

MONTIO-CARDAMINETEA Br.-Bl. & Tüxen ex Klika & Hadač 1944

MONTIO-CARDAMINETALIA Pawl. 1928

Cratoneurion commutati W. Koch 1928 [7220*]

PHRAGMITO-MAGNOCARICETEA Klika in Klika e Novak 1941

PHRAGMITETALIA Koch 1926

Phragmition communis Koch 1926 [7210*]

SCIRPETALIA COMPACTI Hejny in Holub, Hejny, Moravec & Neuhäusl 1967 corr. Rivas-Martínez, Costa, Castroviejo & E. Valdés 1980

Scirpion compacti Dahl & Hadač 1941 corr. Rivas-Martínez, Costa, Castroviejo & E. Valdés 1980 [7210*]

MAGNOCARICETALIA Pignatti 1954

Magnocaricion elatae Koch 1926 [7210*]

NASTURTIO-GLYCERIETALIA Pignatti 1953

Phalaridion arundinaceae Kopechy 1961 [3220]

OXYCOCCO-SPHAGNETEA Br.-Bl. & Tüxen ex Westhoff, Dijk & Passchier 1946

SPHAGNETALIA MEDII Kästner & Flössner 1933 (= *Sphagnetalia magellanici* Kästner & Flössner 1933)

Sphagnion medii Kästner & Flössner 1933 [7110*] [7120] [91D0*]

SCHUCHZERIO-CARICETEA FUSCAE R. Tüxen 1937

CARICETALIA DAVALLIANAE Br.-Bl. 1949

Caricion davallianae Klika 1934 p.p. [7110*] [7120] [7140] [7230]

Caricion bicoloris-atrofuscae Nordhagen 1936 (= *Caricion juncifoliae* Br.-Bl. in Volk 1940, *Caricion atrofusco-saxatilis* Nordhagen 1943) [7240*]

CARICETALIA FUSCAE Koch 1926 em. Br.-Bl. 1949

Caricion fuscae Koch 1926 em. Klika 1934 p.p. [7110*] [7120] [7140] [7230]

SCHUCHZERIETALIA PALUSTRIS Nordhagen 1937

Caricion lasiocarpae Vanden Berghen in Lebrun, Noirfalise, Heinemann & Vanden Berghen 1949 [7140]

Rhynchosporion albae Koch 1926 [7150]

UTRICULARIETEA INTERMEDIO-MINORIS Pietsch 1965

UTRICULARIETALIA INTERMEDIO-MINORIS Pietsch 1965

Sphagno-Utricularion Müller & Görs 1960 [3160]

Scorpidio-Utricularion Pietsch 1965 [3160]

AMMOPHILETEA Br.-Bl. & Tüxen ex Westhoff, Dijk & Passchier 1946

AMMOPHILETALIA AUSTRALIS Br.-Bl. 1933

Ammophilion australis Br.-Bl. 1921 corr. Rivas-Martínez, Costa & Izco in Rivas-Martínez, Lousã, T.E. Díaz, Fernández-González & J.C. Costa 1990 [2110] [2120]

HELICHRYSO STAECHADIS-CRUCIANELLETEA MARITIMAE (Sissingh 1974) Géhu, Rivas-Martínez & Tüxen in Géhu 1975 em. Géhu & Biondi 1994

HELICHRYSOTALIA ITALICI Biondi & Géhu in Géhu & Biondi 1994

Euphorbion pithyusae Biondi & Géhu 1974 [5320] [5410]

Helichryson litorei Biondi 2007 [1240] [5320]

CRUCIANELLETALIA MARITIMAE Sissingh 1974

Crucianellion maritimae Rivas Goday & Rivas-Martínez 1958 [2130*] [2210]

CAKILETEA MARITIMAE Tüxen & Preising ex Br.-Bl. & Tüxen 1952

EUPHORBIETALIA PEPLIS Tüxen 1950

Euphorbion peplis Tüxen 1950 [1210]
Thero-Atriplicion Pignatti 1953 [1210]

CRITHMO-STATICETEA Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
CRITHMO-STATICETALIA Molinier 1934
Crithmo-Staticion Molinier 1934 [1240]
Crucianellion rupestris Brullo & Furnari 1988 [1240]
Erodio corsici-Limonion articulati Gamisans & Muracciole ex Géhu & Biondi 1994 [1240]
SENECIONETALIA CINERARIAE Biondi 2007
Anthyllidion barbae-jovis Brullo & De Marco 1989 [1240] [5320]

JUNCETEA MARITIMI Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
PUCCELLIETALIA DISTANTIS (Soó 1968) Géhu & Rivas-Martínez 1982
Puccinellion distantis Soó 1933 em. Géhu & Rivas-Martínez 1982 [1340*]
JUNCETALIA MARITIMI Br.-Bl. ex Horvatic 1934
Juncion maritimi Br.-Bl. ex Horvatic 1934 [1410]
Plantaginion crassifoliae Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 [1410]
Elytrigio athericae-Artemision coerulescentis (Pignatti 1953) Géhu & Scoppola 1984 corr. Pirone 1995 [1410]

SAGINETEA MARITIMAE Westhoff, Van Leeuwen & Adriani 1962
FRANKENIETALIA PULVERULENTAE Rivas-Martínez ex Castroviejo & Porta 1976
Frankenion pulverulentae Rivas-Martínez ex Castroviejo & Porta 1976 [1310]
SAGINETALIA MARITIMAE Westhoff, Van Leeuwen & Adriani 1962
Saginion maritimae Westhoff, Van Leeuwen & Adriani 1962 [1310]

CRYPsidETEA ACULEATAE Vicherek 1973
CRYPsidETALIA ACULEATAE Vicherek 1973
Crypsidion aculeatae Pignatti 1954 [1310]

SARCOCORNIETEA FRUTICOSAE Br.-Bl. & Tüxen ex A. & O. Bolòs 1950 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002
SARCOCORNIETALIA FRUTICOSAE Br.-Bl. 1933 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002
Sarcocornion fruticosae Br.-Bl. 1933 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 [1130] [1420]
Arthrocnemion macrostachyi Rivas-Martínez 1980 [1130] [1420]
Suaedion verae Rivas-Martínez, Fernández-González & Loidi 1999 [1420] [1430]
LIMONIETALIA Br.-Bl. & O. Bolòs 1958
Limoniastrion monopetali Pignatti 1953 [1420] [1430] [1510*]
Triglochino barrelieri-Limonion glomerati Biondi, Diana, Farris & Filigheddu 2001 [1420] [1510*]
Inulion crithmoidis Brullo & Furnari 1988 [1510*]

SPARTINETEA MARITIMAE Tüxen in Beeftink & Géhu 1973
SPARTINETALIA MARITIMAE Conard ex Beeftink & Géhu 1973
Spartinion maritimae Conard ex Beeftink & Géhu 1973 [1130] [1320]

THERO-SUAEDETEA Rivas-Martínez 1972 (Thero-Salicornietea Tüxen in Tüxen & Oberdorfer ex Géhu & Géhu-Franck 1984 nom. cons. propos. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002)
THERO-SUAEDETALIA Br.-Bl. & O. Bolòs 1958
Salicornion patulae Géhu & Géhu-Franck 1984 [1310]
Microcnemion coralloidis Rivas-Martínez 1984 [1310]
Thero-Suaedion Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 [1310]

ADIANTETEA Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
ADIANTETALIA CAPILLI-VENERIS Br.-Bl. ex Horvatic 1934
Adiantion capilli-veneris Br.-Bl. ex Horvatic 1934 [8310]

ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977 [elements of the class can be present in **8240***]

ANDROSACETALIA VANDELLII Br.-Bl. in Meier & Br.-Bl. 1934 corr. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 (= *Androsacetalia multiflorae* Br.-Bl. in Meier & Br.-Bl. 1934)

Asplenion septentrionalis Oberd. 1938 [**8220**]

Androsacion vandellii Br.-Bl. in Br.-Bl. & Jenny 1926 corr. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 [**8220**]

Saxifragion pedemontanae Barbero & Bono 1967 [**8220**]

Potentillion crassinerviae Gamisans 1968 [**8220**]

Asplenion serpentinei Br.-Bl. e Tüxen ex Eggler 1955 [**8220**]

CHEILANTHETALIA MARANTHO-MADERENSIS Saenz & Rivas-Martínez 1979

Phagnalo saxatilis-Cheilanthion maderensis Loisel 1970 corr. F.J. Pérez, T.E. Díaz, P. Fernández & Salvo 1989 [**8220**]

ASPLENIETALIA PETRARCHAE Br.-Bl. in Meier & Br.-Bl. 1934 nom. mut. propos. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

Linarion caprariae Foggi, Cartei, Pignotti, Signorini, Viciani, Dell'Olmo & Menicagli 2006 [**8220**]

ONOSMETALIA FRUTESCENS Quezel 1964

Campanulion versicoloris Quezel 1964 [**8210**]

POTENTILLETALIA CAULESCENS Br.-Bl. in Br.-Bl. & Jenny 1926

Potentillion caulescens Br.-Bl. & Jenny 1926 [**8210**]

Saxifragion lingulatae Rioux & Quézel 1949 [**8210**]

Saxifragion australis Biondi & Ballelli ex Brullo 1983 [**8210**]

Androsaco-Drabion tomentosae T. Wraber 1970 [**8210**]

VIOLLO BIFLORAE-CYSTOPTERIDETALIA ALPINA F. Casas 1970

Violo biflorae-Cystopteridion alpinae F. Casas 1970 (= *Cystopteridion fragilis* Richard 1972) [**8210**] [**8310**]

ASPLENIETALIA GLANDULOSI Br.-Bl. in Meier & Br.-Bl. 1934

Dianthion rupicolae Brullo & Marcenò 1979 [**8210**]

Centaureion pentadactylis Brullo, Scelsi & Spampinato 2001 [**8210**]

Caro multiflori-Aurinion megalocarpae Terzi & D'Amico 2008 [**8210**]

CENTAUREO KARTSCHIANA-CAMPANULETALIA PYRAMIDALIS Trinajstić ex Di Pietro & Wagensommer 2008

Centaureo-Campanulion Horvatic 1934 [**8210**]

Asperulion gargaricae Bianco, Brullo, E. & S. Pignatti 1988 [**8210**]

ARENARIO BERTOLONI-PHAGNALETALIA SORDIDAE Arrigoni e Di Tommaso 1991

Centaureo-Micromerion cordatae Arrigoni e Di Tommaso 1991 [**8210**]

MULGEDIO-ACONITETEA Hadač & Klika in Klika 1948 (= *Betulo-Adenostyletea* Br.-Bl. & Tüxen 1943) [elements of the class can be present in **8240***]

ADENOSTYLETALIA Br.-Bl. 1930

Rumicion alpini Ruebel ex Klika & Hadač 1944 [**6430**]

Adenostylion alliariae Br.-Bl. 1926 [**6430**]

Salicion pentandrae Br.-Bl. 1967 (= *Salicion waldsteinianae* Oberd. 1978) [**4080**]

Alnion viridis Aichinger 1933 [**4080**]

CALAMAGROSTIETALIA VILLOSAE Pawłowski in Pawłowski, Sokołowski & Wallisch 1928

Calamagrostion arundinaceae (Luquet 1926) Jenik 1961 [**6430**]

ANOMODONTO-POLYPODIETEA CAMBRICI Rivas-Martínez 1975

ANOMODONTO-POLYPODIETALIA O. Bolòs & Vives in O. Bolòs 1957

Polypodion serrati Br.-Bl. in Br.-Bl. Roussine & Nègre 1952 [**8210**]

Arenarion balearicae O. Bolòs & Molinier 1969 [**8210**]

Pohlion crudae-Asplenion septentrionalis Brullo & Siracusa in Brullo et al. 2001 [**8220**]

THLASPIETEA ROTUNDIFOLII Br.-Bl. 1948

ANDROSACETALIA ALPINA Br.-Bl. in Br.-Bl. & Jenny 1926

Galeopsion segetum Oberd. 1957 [**8110**]

Androsacion alpinae Br.-Bl. 1926 [**8110**]

Alloso crisperi-Athyrium alpestris Nordhagen 1936 [**8110**]

Dryopteridion oreadis Rivas-Martínez 1977 corr. Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991 [8130]

EPILOBIETALIA FLEISCHERI Moor 1958

Epilobion fleischeri G. Br.-Bl. & J. Br.-Bl. 1931 [3220]

Glaucion flavi Br.-Bl. ex Tchou 1948 [3250]

STIPETALIA CALAMAGROSTIS Oberd. & Seibert in Oberd. 1977

Stipion calamagrostis Jenny in Br.-Bl. Jenny in Br.-Bl., Roussine & Nègre 1952 [8130]

THLASPIETALIA ROTUNDIFOLII Br.-Bl. in Br.-Bl. & Jenny 1926

Silenion marginatae Lakusic 1966 [8130]

Festucion dimorphae Bonin 1969 (= Linario-Festucion dimorphae Avena & Bruno 1975) [8110 only for the Laga Mountains, see Di Pietro et al. (2001)] [8120]

Thlaspion rotundifolii Jenny-Lips 1930 [8120]

DRABETALIA HOPPEANAE Zollitsch 1968

Drabion hoppeanae Zollitsch 1968 [8120]

POLYSTICHETALIA LONCHITIS Rivas-Martínez, T.E. Díaz, F. Prieto, Loidi & Penas 1984

Gymnocarpion robertiani F. Casas 1970 (= Petasition paradoxii Zollitsch ex Lippert 1966) [8120]

PEGANO-SALSOLETEA Br.-Bl. & O. Bolòs 1958

SALSOLO VERMICULATAE-PEGANETALIA HARMALAE Br.-Bl. & O. Bolòs 1954

Salsolo vermiculatae-Peganion harmalae Br.-Bl. & O. Bolòs 1954 [1430]

Artemision arborescentis Géhu & Biondi 1986 [1430]

STELLARIETEA MEDIAE Tüxen, Lohmeyer & Preising ex von Rochow 1951

THERO-BROMETALIA (Rivas Goday & Rivas-Martínez ex Esteve 1973) O. Bolòs 1975

Echio plantaginei-Galactition tomentosae O. Bolòs & Molinier 1969 [6310]

GALIO-URTICETEA Passarge ex Kopecky 1969

CALYSTEGIETALIA SEPIUM Tüxen ex Mucina 1993 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-Gonzales, Izco, Loidi, Lousã & Penas 2002

Calystegion sepium Tüxen ex Oberdorfer 1957 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-Gonzales, Izco, Loidi, Lousã & Penas 2002 (= Senecionion fluviatilis Tüxen 1950) [6430]

Petasition officinalis Sillinger 1933 [6430]

Bromo ramosi-Eupatorion cannabini O. Bolòs e Masalles in O. Bolòs 1983 [6430]

GALIO APARINES-ALLIARIETALIA PETIOLATAE Görs e Müller 1969 (= Glechometalia hederaceae Tüxen in Tüxen & Brun-Hool 1975)

Aegopodion podagrariae Tüxen 1967 [6430]

Galio-Alliarion petiolatae Oberdorfer & Lohmeyer in Oberdorfer, Görs, Korneck, Lohmeyer, Müller, Philippi & Seibert 1967 [6430]

Impatienti noli-tangere-Stachyion sylvaticae Görs ex Mucina in Mucina, Grabherr & Ellmauer 1993 [6430]

Conio maculati-Sambucion ebuli (Bolòs & Vigo ex Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991) Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 (= Sambucion ebuli Eliás 1986) [6430]

TRIFOLIO-GERANIETEA Th. Müller 1961 [elements of the class can be present in 8240*]

ORIGANETALIA VULGARIS Müller 1962

Geranion sanguinei Tüxen ex Müller 1961 [4060]

CARICI RUPESTRIS-KOBRESIETEA BELLARDII Ohba 1974

ELYNETALIA MYOSUROIDIS Oberdorfer 1957

Oxytropido-Elynion Br.-Bl. (1948) 1949 [6170]

KOBRESIO MYOSUROIDIS-SESLERIETEA CAERULEAE Br.-Bl. 1948 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-Gonzales, Izco, Loidi, Lousã & Penas 2002 (= Festuco-Seslerietea Barbero & Bonin 1969) [elements of the class can be present in 8240*]

SESLERIETALIA TENUIFOLIAE Horvat 1930

Seslerion apenninae Furnari ex Bazzichelli & Furnari 1979 [4090] [6170]

SESLERIETALIA CAERULEAE Br.-Bl. in Br.-Bl. & Jenny 1926

Caricion ferrugineae G. Br.-Bl. & J. Br.-Bl. 1931 [6170]

Avenion sempervirentis Barbero 1968 (= *Avenion montanae* Barbero 1968 p.p.) [6170]

Seslerion albicantis Br.-Bl. in Br.-Bl. & Jenny corr. Oberdorfer 1983 (= *Seslerion coeruleae* Br.-Bl. in Br.-Bl. et. Jenny 1926) [6170]

Caricion austroalpinae Sutter 1962 [6170]

Caricion firmae Gams 1936 [6170]

CARICETEA CURVULAE Br.-Bl. 1948 (= *Juncetea trifidi* Hadac 1946)

FESTUCETALIA SPADICEAE Barbero 1970

Festucion variae Guinochet 1938 [6150]

Agrostion schraderianae Grabherr 1993 [6150]

CARICETALIA CURVULAE Br.-Bl. in Br.-Bl. & Jenny 1926

Caricion curvulae Br.-Bl. in Br.-Bl. & Jenny 1926 [6150]

LOISELEURIO-VACCINIETEA Egglar ex Schubert 1960

EMPETRETALIA HERMAPHRODITI Schubert 1960

Loiseleurio-Vaccinion Br.-Bl. in Br.-Bl. & Jenny 1926 [4060]

SALICETEA HERBACEAE Br.-Bl. 1948 [elements of the class can be present in 8240*]

SALICETALIA HERBACEAE Br.-Bl. in Br.-Bl. & Jenny 1926

Salicion herbaceae Br.-Bl. in Br.-Bl. & Jenny 1926 [6150]

Arabidion caeruleae Br.-Bl. in Br.-Bl. & Jenny 1926 [6170]

TUBERARIETEA GUTTATAE (Br.-Bl. in Br.-Bl., Roussine & Nègre 1952) Rivas-Goday & Rivas-Martínez 1963 nom. mut. propos. in Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 [elements of the class can be present in 8320]

MALCOLMIETALIA Rivas Goday, 1958

Alkanno-Maresion nanae Rivas Goday ex Rivas Goday & Rivas-Martínez 1963 corr. Diez-Garretas Asensi & Rivas-Martínez 2001 [2230]

Laguro ovati-Vulpion membranaceae Géhu & Biondi 1994 [2230]

Maresion nanae Géhu, Biondi, Géhu-Franck & Arnold-Apostolides 1986 [2230]

TUBERARIETALIA GUTTATAE Br.-Bl. in Br.-Bl., Molinier & Wagner 1940 nom. mut. propos. in Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

Tuberarion guttatae Br.-Bl. in Br.-Bl., Molinier & Wagner 1940 nom. mut. propos. in Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 [2240] [6220*]

Thero-Airion Tüxen & Oberdorfer 1958 em. Rivas-Martínez 1978 [6220*]

TRACHYNIETALIA DISTACHYAE Rivas-Martínez 1978

Trachynion distachyae Rivas-Martínez 1978 [2240] [6220*]

Hypochoeridion achyrophori Biondi & Guerra 2008 [6220*]

Hypochoeridenion achyrophori Biondi & Guerra 2008 [6220*]

Ononidenion ornithopodioides Biondi & Guerra 2008 [6220*]

FESTUCO-BROMETEA ERECTI Br.-Bl. & Tüxen ex Klika & Hadač 1944 [elements of the class can be present in 8240*] [elements of the class can originate mosaics with 5130]

BROMETALIA ERECTI Br.-Bl. 1936

Xerobromion (Br.-Bl. & Moor 1938) Moravec in Holub, Hejný, Moravec & Neuhäusl 1967 [3250] [6210(*)]

Phleo ambigu-Bromion erecti Biondi & Blasí ex Biondi, Ballelli, Allegrezza & Zuccarello 1995 [4090] [6210(*)]

Bromion erecti Koch 1926 (= *Mesobromion erecti* Br.-Bl & Moor 1938) [6210(*)]

Festuco amethystinae-Bromion erecti Barbero & Loisel 1971 [6210(*)]

FESTUCETALIA VALESIIACAE Br.-Bl. & Tüxen ex Br.-Bl. 1949

Cirsio-Brachypodion pinnati Hadač & Klika in Klika & Hadač 1944 [6210(*)] [6240*]

Diplachnion serotinae Br.-Bl. 1961 [6210(*)]

Festucion valesiacaе Br.-Bl. 1936 [6240*]

Stipo-Poion xerophilae Br.-Bl. & Tüxen ex Br.-Bl. 1949 [6240*]

Stipo-Poion carniolicae Br.-Bl. 1949 [6240*]

BRACHYPODIO-CHRYSOPOGONETEA Horvatić 1963

SCORZONERO VILLOSAE-CHRYSOPOGONETALIA GRYLLI Horvatić & Horvat in Horvatić 1963 (= *Scorzoneretalia villosae* Horvatić 1973)

Saturejion subspicatae (Horvat 1974) Horvatić 1975 [2130*] [62A0]

Centaureion dichroanthae Pignatti 1952 [62A0]

Hippocrepido glaucae-Stipion austroitalicae Forte & Terzi 2005 in Forte, Perrino & Terzi 2005 [62A0]

Hypochoeridion maculatae Horvatic ex Terzi 2001 [62A0]

Scorzonerion villosae Horvatić 1963 [62A0]

Violo pseudogracilis-Bromopion caprinae Terzi 2011 [62A0]

FESTUCO HYSTRICIS-ONONIDETEA STRIATAE Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

ONONIDETALIA STRIATAE Br.-Bl. 1950

Lavandulo angustifoliae-Genistion cinereae Barbero, Loisel & Quézel 1972 [5330]

Ononidion cenisiae Barbero 1972 [6170]

KOELERIO-CORYNEPHORETEA Klika in Klika & Novák 1941

CORYNEPHORETALIA CANESCENTIS Klika 1934

Koelerion arenariae Tüxen 1937 [2130*]

Corynephorion canescentis Klika 1931 [2330]

POETEA BULBOSAE Rivas Goday & Rivas-Martínez in Rivas-Martínez 1978

POETALIA BULBOSAE Rivas Goday & Rivas-Martínez in Rivas Goday & Ladero 1970

Trifolio subterranei-Periballion Rivas Goday 1964 [6220*] [6310]

Poo bulbosae-Astragalion sesamei Rivas Goday & Ladero 1970 [6220*]

Plantaginion serrariae Galán, Morales & Vicente 2000 [6220*]

SEDO-SCLERANTHETEA Br.-Bl. 1955 em. Th. Müller 1961

SEDO-SCLERANTHETALIA Br.-Bl. 1955

Alyso alyssoidis-Sedion albi Oberdorfer & Müller in Müller 1961 [6110*]

Sedo-Scleranthion biennis Br.-Bl. 1955 [8230]

Arabidopsidion thalianae Passarge 1964 [8230]

LYGEO-STIPETEA Rivas-Martínez 1978 nom. conserv. propos. Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 (art. 52) (syn. Thero-Brachypodietea Br.-Bl. in Br.-Bl., Emberger & Molinier 1947)

LYGEO-STIPETALIA Br.-Bl. & O. Bolòs 1958

Thero-Brachypodion ramosi Br.-Bl. 1925 [2240] [6220*]

Polygonion tenoreani Brullo, De Marco & Signorello 1990 [6220*]

Stipion tenacissimae Rivas-Martínez 1978 [6220*]

Moricandio-Lygeion sparti Brullo, De Marco & Signorello 1990 [6220*]

HYPARRHENIETALIA HIRTAE Rivas-Martínez 1978

Hyparrhenion hirtae Br.-Bl., P. Silva & Rozeira 1956 (incl. *Aristido caeruleo-hyparrhenion hirtae* Brullo, Scelsi & Spampinato 1997 and *Saturejo-Hyparrhenion* O. Bolòs 1962) [6220*]

Avenulo-Ampelodesmion mauritanici Minissale 1994 [5330]

VIOLETEA CALAMINARIAE Br.-Bl. & Tüxen ex Ernst 1965 [= *Violetea calaminariae* Lohmeyer, A. & W. Matuszkiewicz, Merker, Moore, Müller, Oberdorfer, Poli, Seibert, Sukopp, Trautmann, J. Tüxen, Tüxen & Westhoff 1962 (art. 8)]

VIOLETALIA CALAMINARIAE Br.-Bl. & Tüxen 1943 [6130]

MOLINIO-ARRHENATHERETEA Tüxen 1937

ARRHENATHERETALIA Tüxen 1931

Arrhenatherion elatioris Koch 1926 [6510]

Ranunculo neapolitani-Arrhentatherion elatioris Allegrezza & Biondi 2011 [6510]

TRIFOLIO-HORDEETALIA Horvatic 1963

Ranunculion velutini Pedrotti 1976 [6510]*CIRSIETALIA VALLIS-DEMONIS* Brullo & Grillo 1978**Plantaginion cupanii** Brullo & Grillo 1978 [6510]*POO ALPINAE-TRISSETETALIA* Ellmauer & Mucina 1993**Polygono-Trisetion** Br.-Bl. & Tüxen ex Marshall 1947 nom. inv. [6520]*PASPALO-HELEOCHLOETALIA* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952**Paspalo-Polypogonion viridis** Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 nom. mut. propos. Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002 [3280] [3290]*HOLOSCHOENETALIA VULGARIS* Br.-Bl. ex Tchou 1948**Molinio-Holoschoenion** vulgaris Br.-Bl. ex Tchou 1948 [6420]*MOLINIETALIA CAERULEAE* Koch 1926**Calthion palustris** Tüxen 1937 em. Bal.-Tul. 1978 [6430]**Molinion coeruleae** Koch 1926 [6410]**Juncion acutiflori** Br.-Bl. in Br.-Bl. & Tüxen 1952 [6410]

NARDETEA STRICTAE Rivas Goday in Rivas-Goday & Rivas-Martinez 1963

NARDEETALIA STRICTAE Oberd. ex Preising 1949**Nardion strictae** Br.-Bl. 1926 [6150 only for the Alpine communities] [6230* only for the Subalpine aspects of the association Sieversio-Nardetum strictae Lüdi 1948]**Violion caninae** Schwickerath 1944 [6230*]**Nardo-Agrostion tenuis** Sillinger 1933 [6230*]**Ranunculo pollinensis-Nardion strictae** Bonin 1972 [6170] [6230*]

CALLUNO VULGARIS-ULICETEA MINORIS Br.-Bl. & Tüxen ex Klika & Hadač 1944 (= Nardo-Callunetea Oberdorfer 1979) [elements of the class can originate mosaics with 5130]

VACCINIO MYRTILLI-GENISTETALIA PILOSAE R.Schub. 1960**Genistion pilosae** Duvign. 1942 [4030]*ULICETALIA MINORIS* Quantin 1935**Cisto salviifolii-Ericion cinereae** Géhu 1975 [4030]

CISTO LADANIFERI-LAVANDULETEA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

LAVANDULETALIA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940 em. Rivas-Martínez 1968**Anthyllion hermanniae** Klein 1972 [4090]**Teucrium mari** Gamisans & Muracciole 1984 [2260] [4090] [5330] [5430]**Calicotomo villosae-Genistion tyrrhenae** Biondi (1997) 2000 [4090] [5330]**Cistion ladaniferi** Br.-Bl. ex A. & O. Bolòs 1950 [2260]

RUMICI-ASTRAGALETEA SICULI Pignatti & Nimis in E. Pignatti, Pignatti, Nimis & Avanzini 1980

RUMICI-ASTRAGALETALIA SICULI Pignatti & Nimis in E. Pignatti, Pignatti, Nimis & Avanzini 1980**Rumici aetnensis-Astragalion siculi** Poli 1965 [4090] [8320]

CISTO CRETICI-MICROMERIETEA JULIANAE Oberdorfer 1954

CISTO CRETICI-ERICETALIA MANIPULIFLORAE Horvatic 1958**Cisto cretici-Ericion manipuliflorae** Horvatic 1958 (= *Cytisio spinescentis-Saturejion montanae* Pirone & Tammaro 1997 p.p.) [2260] [4090] [5110] [5420]

SCROPHULARIO-HELICHRYSSETEA Brullo, Scelsi & Spampinato 1998

SCROPHULARIO-HELICHRYSSETALIA Brullo 1984**Euphorbion rigidae** Brullo & Spampinato 1990 [3250]**Linarion purpureae** Brullo 1984 [8130]

ROSMARINETEA OFFICINALIS Rivas-Martinez, T.E. Díaz, F. Prieto, Loidi & Penas 2002

ROSMARINETALIA OFFICINALIS Br.-Bl. ex Molinier 1934**Helianthemo italici-Aphyllanthion monspeliensis** Díez-Garretas, Fernández-González & Asensi 1998 (= *Aphyllanthion* Br.-Bl. 1952) [2260]**Rosmarinion officinalis** Br.-Bl. ex Molinier 1934 [2260]

Cisto eriocephali-Ericion multiflorae Biondi 2000 [2260] [5420]

Alysson bertolonii Pignatti 1977 (incl. Euphorbion ligusticae Novak 1987) [4090] [5110]

Artemisio albae-Saturejion montanae Allegrezza, Biondi, Formica & Ballelli 1997 [3250]

ERYSIMO BONANNIANI-JURINETALIA BOCCONEI Brullo 1983

Cerastio tomentosii-Astragalion nebrodensis Pignatti & Nimis in Pignatti, Pignatti, Nimis & Avanzini ex Brullo 1983 [4090]

CYTISETEA SCOPARIO-STRIATI Rivas-Martinez 1975

CYTISO VILLOSI-TELINETALIA MONSPESSULANAE Rivas-Martinez, Galan & Cantò 2002

Telinion monspessulano-linifoliae Rivas-Martinez, Galan & Cantò 2002 [4030]

RHAMNO-PRUNETEA Rivas Goday & Borja ex Tüxen 1962 [elements of the class can be present in 8240*]

PRUNETALIA SPINOSAE Tüxen 1952

Pruno-Rubion ulmifolii O. Bolòs 1954 [2160] [2250*]

Berberidion Br.-Bl. 1950 [2250*] [4060] [5110] [5130]

Cytisium sessilifolii Biondi in Biondi, Allegrezza & Guitian 1988 [5110] [5130]

Sarothamnion scoparii Tüxen ex Oberd. 1957 [4030]

ALNETEA GLUTINOSAE Br.-Bl. & Tüxen ex Westhoff, Dijk & Passchier 1946

ALNETALIA GLUTINOSAE Tüxen 1937

Alnion glutinosae Malcuit 1929 [91E0*]

NERIO-TAMARICETEA Br.-Bl. & O. Bolòs 1957

TAMARICETALIA AFRICANAE Br.-Bl. & O. Bolòs 1958 em. Izco, Fernández-González & A. Molina 1984

Rubo-Nerion oleandri O. Bolòs 1985 [92D0]

Tamaricion africanae Br.-Bl. & O. Bolòs 1958 [92D0]

SALICI PURPUREAE-POPULETEA NIGRAE (Rivas-Martínez & Cantó ex Rivas-Martínez, Báscones, T.E. Díaz, Fernández-González & Loidi 1991) Rivas-Martínez, T.E. Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

SALICETALIA PURPUREAE Moor 1958

Salicion incanae Aich. 1933 [3230] [3240]

Salicion albae Soó 1930 [91E0*] [92A0]

Salicion pedicellatae (Ubaldi 2003) Poldini, Vidali & Ganis 2011 [92A0]

POPULETALIA ALBAE Br.-Bl. ex Tchou 1948

Populion albae Br.-Bl. ex Tchou 1948 [5230*] [5310] [91B0] [91F0] [92A0]

Fraxinion angustifoliae Pedrotti ex Biondi & Casavecchia in Biondi, Casavecchia & Pesaresi 2010 [91B0] [91F0]

Alnion incanae Pawłowski in Pawłowski, Sokołowski & Wallisch 1928 (= Alno-Ulmion Br.-Bl. & Tüxen 1943, Alno-Ulmion Br.-Bl. & Tüxen ex Tchou 1948 em. Müller & Görs 1958) [9160] [91E0*] [91F0]

Osmundo-Alnion glutinosae (Br.-Bl., P. Silva & Rozeira 1956) Dierschke & Rivas-Martínez in Rivas-Martínez 1975 [91E0*]

Alno-Quercion roboris Horvat 1950 [91F0] [92A0]

Platanion orientalis I. & V. Karpati 1961 [92C0]

ERICO-PINETEA Horvat 1959

ERICO-PINETALIA Horvat 1959

Erico-Pinion mugo Leibundgut 1948 nom. inv. [4070*] [9420] [9430*]

Erico-Fraxinion orni Horvat 1959 nom. inv. prop. Theurillat et al. 2004 (= Orno-Ostryion Tomazic 1940 p.p., Fraxino orni-Ostryion carpinifoliae Tomazic 1940 *sensu* Wallnöfer in Mucina, Grabherr & Wallnöfer 1993 p.p.) [4070*] [9530*]

RHODODENDRO HIRSUTI-ERICETALIA CARNEAE Grabherr, Greimler & Mucina in Grabherr & Mucina 1993

Ericion carnea Rubel ex Grabherr, Greimler & Mucina 1993 [4060]

JUNIPERO SABINAE-PINETEA SYLVESTRIS Rivas-Martínez 1965 nom. inv. propos. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

JUNIPERO SABINAE-PINETALIA SYLVESTRIS Rivas-Martínez 1965 nom. inv. propos. Rivas-Martínez, Díaz, Fernández-González, Izco, Loidi, Lousã & Penas 2002

Juniperion thuriferae Rivas-Martínez 1969 [9560*]

Epipactido atropurpureae-Pinion mugo Stanisci 1997 [4070*]

Daphno oleoidis-Juniperion alpinae Stanisci 1997 [4060] [9430*] [9530*] [95A0]

JUNIPERETALIA HEMISPHERICAE Rivas-Martínez & J.A. Molina in Rivas-Martínez, Fernández-González & Loidi 1999

Pruno prostratae-Juniperion sabiniae Rivas-Martínez & J.A. Molina in Rivas-Martínez, Fernández-González & Loidi 1999 [9220*]

Berberidion aetnensis Brullo, Giusso & Guarino 2001 [9220*] [9510*] [9530*]

Pinenion calabricae Brullo, Giusso & Guarino 2001 [9220*] [9510*] [9530*]

QUERCETEA ILICIS Br.-Bl. ex A. & O. Bolòs 1950

QUERCETALIA ILICIS Br.-Bl. ex Molinier 1934 em. Rivas-Martínez 1975

Fraxino orni-Quercion ilicis Biondi, Casavecchia & Gigante 2003 (incl. *Erico-Quercion ilicis* Brullo, Di Martino & Marcenò 1977) [5230*] [5310] [6310] [91AA*] [9250] [9320] [9330] [9340] [9350] [9380] [9540] [9580*]

Fraxino orni-Quercenion ilicis Bacchetta, Bagella, Biondi, Farris, Filigheddu & Mossa 2004 [5230*] [5310] [6310] [91AA*] [9250] [9320] [9330] [9340] [9350] [9380] [9540] [9580*]

Clematido cirrhosae-Quercenion ilicis Bacchetta, Bagella, Biondi, Farris, Filigheddu & Mossa 2004 [5230*] [5310] [6310] [91AA*] [9320] [9330] [9340] [9380] [9540] [9580*]

PISTACIO LENTISCI-RHAMNETALIA ALATERNI Rivas Martínez 1975

Juniperion turbinatae Rivas-Martínez 1975 corr. 1987 [2250*] [2260] [2270*] [5210] [6310]

Oleo-Ceratonion siliquae Br.-Bl. ex Guinochet & Drouineau 1944 em. Rivas-Martínez 1975 [2270*] [5210] [5220*] [5330] [5420] [9320] [9540] [9580*]

Periplocion angustifoliae Rivas-Martínez 1975 [5220*] [5330]

Ericion arboreae (Rivas-Martínez ex Rivas-Martínez, Costa & Izco 1986) Rivas-Martínez 1987 [9330] [9540]

Pinion pineae Feinbrun 1959 [9540]

QUERCO-FAGETEA Br.-Bl. & Vlieger in Vlieger 1937 [elements of the class can be present in 8240*]

FAGETALIA SYLVATICAE Pawłowski in Pawłowski, Sokołowski & Wallisch 1928

Fagion sylvaticae Luquet 1926 [9130] [9140] [9150]

Cephalanthero-Fagenion Tüxen in Tüxen & Oberd. 1958 [9150]

Luzulo-Fagion sylvaticae Lohmeyer & Tüxen 1954 [9110] [9120] [9220* for Luzulo pedemontanae-Fagetum sylvaticae Oberdorfer & Hoffmann 1967 abietetosum albae Arrigoni et al. 1998]

Aremonio-Fagion sylvaticae (Horvat 1938) Török, Podani & Borhidi 1989 [91K0] [9210*] [9220*] [9510*]

Epimedio-Fagenion Marinček, Mucina, Zupančič, Poldini, Dakskobler & Accetto 1993 [91K0]

Lamio orvalae-Fagenion Borhidi ex Marinček, Mucina, Zupančič, Poldini, Dakskobler & Accetto 1993 [91K0]

Saxifrago rotundifoliae-Fagenion Marinček, Poldini & Zupančič ex Marinček, Mucina, Zupančič, Poldini, Dakskobler & Accetto 1993 [91K0]

Ostryo carpinifoliae-Fagenion Borhidi 1963 [91K0]

Cardamino kitaibelii-Fagenion Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni 2002 [9210*] [9220*]

Geranio versicoloris-Fagion sylvaticae Gentile 1970 [9210*] [9220*] [9380] [9510*] [9530*] [9580*]

Doronico orientalis-Fagenion sylvaticae (Ubaldi, Zanotti, Puppi, Speranza & Corbetta ex Ubaldi 1995) Di Pietro, Izco & Blasi 2004 [9210*] [9220*] [9380] [9530*] [9580*]

Lamio flexuosi-Fagenion sylvaticae Gentile 1970 [9210*] [9220*] [9510*]

Carpinion betuli Issler 1931 [9160] [9170] [9260]

Erythronio dentis-canis-Carpinion betuli (Horvat 1958) Marinček in Wallnöfer, Mucina & Grass 1993 [91L0] [9260]

Pulmonario apenninae-Carpinion betuli Biondi, Casavecchia, Pinzi, Allegrezza & Baldoni 2002 [91L0] [9260]

Physospermo verticillati-Quercion cerris Biondi, Casavecchia & Biscotti 2008 [91L0]

Tilio platyphylli-Acerion pseudoplatani Klika 1955 [9180*]

Ostryo carpinifoliae-Tilienion platyphylli Košir, Čarni & Di Pietro 2008 [9180*]

Lauro nobilis-Tilion platyphylli Biondi, Casavecchia & Biscotti 2008 [9180*]

QUERCETALIA ROBORIS Tüxen 1931

Quercion roboris Malcuit 1929 [= *Quercion robori-petraeae* Br.-Bl. 1932 (syntax. syn.)] [9120] [9190] [9260]

QUERCETALIA PUBESCENTI-PETRAEAE Klika 1933

Pino calabricae-Quercion congestae Brullo, Scelsi, Siracusa & Spampinato 1999 [91AA*] [9380] [9580*]

Paeonio morisii-Quercenion ichnusae Bacchetta, Biondi, Farris, Filigheddu & Mossa 2004 [9380]

Carpinion orientalis Horvat 1958 [5230*] [91H0*] [91AA*] [9250] [9260]

Cytiso sessilifolii-Quercenion pubescentis Ubaldi 1995 [91AA*]
Seslerio autumnalis-Ostryenion carpinifoliae Blasi, Di Pietro & Filesi 2004 [91H0*]
Ostryo-Carpinenion orientalis Poldini 1982 [91H0*]
Lauro nobilis-Quercenion virgiliana Ubaldi 1988 (1995) corr. Biondi, Casavecchia & Pesaresi 2010 [5230*] [91AA*]
[9250]

Campanulo mediae-Ostryenion carpinifoliae Ubaldi 1995 [91AA*]
Teucrio siculi-Quercion cerridis Ubaldi (1988) 1995 em. Scoppola & Filesi 1995 [91M0] [9260] [9330]
Teucrio siculi-Quercenion cerridis Blasi, Di Pietro & Filesi 2004 [91M0] [9260] [9330]
Ptilostemono stricti-Quercenion cerridis Bonin & Gamisan 1977 [91M0] [9260] [9330]
Tilio-Ostryon carpinifoliae Brullo, Scelsi & Spampinato 2001 [9180*]
Erythronio dentis-canis-Quercion petraeae Ubaldi (1988) 1990 [9260]

VACCINIO-PICEETEA Br.-Bl. in Br.-Bl., Sissingh & Vlieger 1939
PICEETALIA ABIETIS Pawłowski in Pawłowski, Sokołowski & Wallisch 1928 (= Vaccinio-Piceetalia Br.-Bl. in Br.-Bl. et al. 1939)

Betulion pubescentis Lohmeyer & Tüxen in Tüxen ex Oberd. 1957 [91D0*]
Piceion abietis Pawłowski in Pawłowski, Sokołowski & Wallisch 1928 [9410] [9420]
Calamagrostio variae-Abietion Horvat 1962 [9410]
Seslerio caeruleae-Pinion uncinatae Vigo 1974 [9430*]
VACCINIO-JUNIPERETALIA NANAE Rivas-Martínez & Costa 1998
Rhododendro-Vaccinion Br.-Bl. ex G. & J. Br.-Bl. 1931 [4060] [9430*]
Juniperion nanae Br.-Bl. in Br.-Bl., Sissingh & Vlieger 1939 [4060] [4070*] [9430*]

PULSATILLO-PINETEA Oberd. in Oberd. Görs, Korneck, Lohmeyer, Müller, Philippi & Seibert 1967(= PYROLO-PINETEA Korneck 1974 p.p.)

ASTRAGALO MONSPESSULANI-PINETALIA SYLVESTRIS Oberdorfer in Theurillat, Aeschmann, Küpfer & Spichiger 1995
Ononido-Pinion Br.-Bl. & Richard 1950 [9430*]

RHIZOCARPETEA GEOGRAPHICI Wirth 1972
ASPICILIETALIA GIBBOSAE Wirth 1972 em. Llimona & Egea 1987
Parmelion conspersae Hadaè 1944 [8230] [8320]
UMBILICARIETALIA CYLINDRICA Wirth 1972
Umbilicarium cylindricae Gams 1927 [8230]

NECKERETEA COMPLANATAE Marst. 1986 (= Tortulo-Homalothecietea sericei Hertel 1974 p.p.) [elements of the class can be present in 8240*]

CLADONIO DIGITATAE-LEPIDOZIETEA REPTANTIS Ježek & Vondráček 1962 [elements of the class can be present in 8320]

CTENIDIETEA MOLLUSCI Hübschmann ex Grcić 1980 [elements of the class can be present in 8240*] [elements of the class can be present in 8320]

CAMPYLOPODETEA VAPORARII Brullo, Privitera & Puglisi ex Brullo, Privitera & Puglisi 2006 [elements of the class can be present in 8320]

GRIMMIETEA ALPESTRIS Hadač & Vondráček in Ježek & Vondráček 1962 [elements of the class can be present in 8320]

CERATODONTO PURPUREI-POLYTRICHETEA PILIFERI Mohan 1978 [elements of the class can be present in 8320]

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