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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

Group of Experts for the setting up
of the Emerald Network of Areas of Special Conservation Interest

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Application and development of the Palaearctic habitat classification in the course of the setting up of the Emerald Project

– Malta –

Document established
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1. Amendment to the classification in selected member states engaged in Emerald work

1.1. Malta

Although Maltese habitat units were for the most part covered by the existing Palaearctic database, there was a lack of explicit treatment of Malta, as indicated by the Maltese delegation to the Emerald Network task force. Malta was indeed often treated as part of the Sicilian complex, and its originalities not sufficiently emphasised.

As part of this revision, critical units were discussed in correspondence with Dr. Darrin T. Stevens, Ministry for the Environment, Malta, and a number of documents provided by him. A complete re-examination of all units possibly pertinent to Malta was conducted with the help of these documents and of a survey of recent literature and internet contributions on Malta.

A considerable number of units were completed, reformulated or sometimes created as subunits of existing units, according to the standard Physis procedure for this process. An extract of the Physis Database listing the 449 units certainly or probably present on Malta, together with their descriptive texts, was constructed (Appendix 1). It has been submitted to Dr. Stevens for comments and amendments."

1.2. Iceland

The coverage of Iceland in the Palaearctic database, like that of other Nordic countries, was directly imported from the Nordic Council of Ministers database (Påhlsson, 1994). The transfer only involved the placement of the Nordic habitat units into the Palaearctic hierarchy. However, as aptly indicated by the Icelandic delegation to the Emerald Network task force, the Nordic treatment, and thus the Palaearctic treatment, had a strong Fennoscandian bias and did not adequately emphasize the uniqueness of Icelandic ecosystems. This revision was thus conducted so as to maximize the recognition and visibility of Icelandic habitats that constitute major contributions to the biodiversity of Europe, while preserving unchanged compatibility with the Nordic database.

A three-week visit to Iceland was undertaken in July 2000 to gain first-hand knowledge of Icelandic habitats, establish a contact with the Icelandic Emerald team and assemble relevant documents. A large majority of Icelandic habitat units were seen, documented and photographed. The basis of a cooperation with Dr. Jón Gunnar Ottósson, Icelandic Institute of Natural History, was established.

A complete reexamination of all Palaearctic units possibly pertinent to Iceland was conducted on the basis of the field experience gained, and of documents gathered in Iceland or obtained from the literature and internet contributions on Iceland. A considerable number of units were reformulated and redescribed, sometimes created as subunits of existing units or emphasized by cross-referencing in high-level geomorphological and physiognomic units. An extract of the Physis Database listing the 553 units certainly or probably present on Iceland, together with their descriptive texts, was constructed [Document T-PVS/Emerald (2001) 8]. It has been submitted to Dr. Ottósson for comments and amendments.

1.3. Baltic States

The coverage of the Baltic States within the Palaearctic database is relatively complete, though mostly achieved through proximity with either Poland or Finland. A first effort to complete units through Eastern European sources was conducted. Further cooperation with the Emerald delegations is necessary to complete the inventory and descriptions of the units. An updated copy of the database has been sent to Lithuania.

2. First steps of low order development of the existing framework in Council of Europe Member States for which this development does not exist

2.1. Russian Federation and Ukraine

A first survey of Eastern European vegetation in flora atlases and phytosociological catalogues, as well as of general Eurasian habitat or vegetation descriptive works, has been conducted to construct the upper levels of subdivision of the existing framework, on the basis of distributional sources, an extract of the base containing units certainly or probably present in the Russian Federation or Ukraine has been constructed [Document T-PVS/Emerald (2001) 9] as a basis for further development and amendment.

2.2. Croatia

The Palaearctic classification is already well developed in several of the Council of Europe member States bordering Croatia. The extreme diversity of the habitats of the Balkan peninsula, and in particular, of the Dalmatian coast, and the importance of the contribution of the most specialized habitats to the European diversity makes, however, specific efforts necessary and fairly complex. A first extension of the existing scheme to Croatia has been elaborated on the basis of general Balkan peninsula sources and of a few specific Croatian references. An extract of the base, limited to Croatia, has been composed [Document T-PVS/Emerald (2001) 10] as a basis for further development.

3. Preparation for publication of an updated version of the Palaearctic classification

An updated version of the base, comprising all the above developments, as well as a number of revisions to improve its overall coherence is of use and compatibility with local schemes, is available in electronic form. It will be ready for publication as soon as the consultations initiated are completed, in particular, for Malta and Iceland.

Appendix 1

HABITATS OF MALTA

An extract of the PHYSIS Palaearctic Database

1. COASTAL AND HALOPHYTIC COMMUNITIES

Oceanic, inshore and offshore waters and their open-water and bottom communities; marine communities of the littoral zone and of coastal lagoons, bays, inlets, estuaries and tidal rivers; coastal and azonal interior halophyte or gypsophyte communities of saltmarshes, salt steppes, salt scrubs and gypsum scrubs; coastal sand dunes, sand beaches, shingle beaches, sea cliffs, rocky shores, coastal islets, rock stacks, reefs, banks and shoals; characteristically coastal agrosystems incorporating seminatural elements.

11. OCEAN AND SEAS, MARINE COMMUNITIES

Oceanic and continental shelf waters of the world ocean and its connected seas, their associated open-water and bottom communities, and marine vascular vegetation beds; marine communities of the littoral zone and of coastal lagoons. Included within the Palaearctic realm are the waters of the Northeast Atlantic, of the northern part of the West African Atlantic, south to the latitude of the Cape Verde Islands, of the Arabian Sea and of the eastern and northern Red Sea, of the Mediterranean, of the Baltic Sea, of the Arctic Ocean east of Greenland and west of the Bering Strait, and of the northwest Pacific (Marine Region as used by the IUCN Commission on National Parks and Protected Areas, Kelleher *et al.*, 1995: ii).
(Molinier and Picard, 1959; Nicholson, 1977; Nelson, 1980; Augier, 1982, 1985; Sorokin,1983; Hood, 1983; Kullenberg, 1983; Lofgren, 1984; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Britton and Morton, 1989; Lalli and Parsons, 1995; Schembri, 1999a).

11.1. Open marine waters

Pelagic biocoenoses of the world ocean, its connected seas and coastal lagoons. They can be characterized by their planktonic communities and by the composition of their nektonic or surface-feeding faunas of cephalopods, fish, sea mammals and seabirds.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 9-179).

11.11. Oceanic waters
Waters beyond the continental shelf. In the Palaearctic region they occupy the greatest part of the Arctic, Atlantic and Pacific oceans, of the Barents Sea, the Sea of Okhotsk, the Sea of Japan, the Arabian Sea, the Mediterranean Sea, the Ligurian Sea, the Tyrrhenian Sea, the Ionian Sea, as well as the central part of the Aegean Sea, the Red Sea, the Black Sea, the eastern part of the northern North Sea, the southern Bering Sea. They are absent from the Baltic Sea and the Adriatic Sea.
(Nicholson, 1977; Nelson, 1980; Pautot, 1983: 64-72; Lofgren, 1984: 22-23; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.111. Blue ocean waters
Oceanic waters of tropical and subtropical regions, generally of low productivity and high species diversity. In the Palaearctic, they include oceanic waters of the Atlantic north to about 40°N latitude, of the Mediterranean, the Black Sea, the Red Sea, the Arabian Sea, the Pacific north to about 32°N latitude.
(Nelson, 1980; Lofgren, 1984; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.12. Shelf and slope waters
Waters of the continental shelf, underwater plateau extending from the coast to a depth of about 100 fathoms, beyond which the continental slope falls steeply toward the ocean bottom.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.121. Inshore waters
Waters within the strong influence of land masses, both in terms of physical parameters and of fauna, often arbitrarily defined as waters less than 5 km from low water mark, waters between the continent and islands or islets well in sight of shore, and any seas of depth less than 6 metres. They include the inshore waters of the Eurasian and African continents and their nearshore islands, south to Mauritania in the Atlantic, Egypt in the Red Sea, the Arabian peninsula and Iran in the Indian Ocean, China in the Pacific, and of Greenland, Iceland, the Azores, the Madeiran archipelago, the Canaries, the Cape Verde Islands, Soccotra, the Bonin, Volcano and Marcus islands, the Commander Islands.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.122. Offshore waters
Waters of the continental shelf comprised between the limits of inshore waters and the continental slope.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.1224. Subtropical offshore waters
Continental shelf waters of the subtropical maritime zone.
(Nelson, 1980: 25-28; Lofgren, 1984: 22-23).

11.12242. Mediterranean offshore waters
Offshore waters of the Mediterranean Sea.
(Nelson, 1980: 25-28; Lofgren, 1984: 22-23; Schembri, 1999a).

11.123. Continental slope
Waters situated over the continental slope, the steep descent from the continental shelf to the ocean bottom, an area where upwellings, water mixing or shearing and other anomalies often develop.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.124. Offshore and coastal upwellings
Zones of the continental shelf where the warmer surface water is displaced, allowing cooler water rich in nutrients to rise to the surface, often generating much increased biological productivity.
(Nicholson, 1977; Nelson, 1980; Lofgren, 1984; Augier, 1985; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995).

11.1242. Minor offshore and coastal upwellings
Waters of the continental shelf in which local upwelling conditions are generated by features of the sea floor or the circulation of water masses.

11.125. Shoals
Shallow waters over permanently submerged elevated features of the continental shelf sea-floor, whether shoals, banks or reefs.
(Eisma and Fey, 1982: 50-51).

11.2. Benthic communities

Communities of marine animals and algae occupying the sea floor. Included are all communities of animals and algae of the infralittoral, circalittoral and deeper zones, situated below the level of average low spring tides, or of regular emergence through wind or atmospheric pressure variations. Also included are communities of marine animals and algae occupying the mediolittoral zone, comprised between the low and high tide levels of average spring tides or within the regular range of wind or atmospheric pressure induced sea-level fluctuations, as well as marine assemblies installed in the supralittoral zone, reached only by spray, exceptional waves or exceptional high tides.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Britton and Morton, 1989; Lalli and Parsons, 1995: 183-255; Schembri, 1999a, 1999b).

11.21. Deep sea floor
Bathyal, abyssal, hadal and hydro-thermal benthic communities of the continental slope, the abyssal plain and its features.
(Pautot, 1983; Barnes and Hughes, 1988; Clark, 1990; Francheteau, 1993).

11.211. Bathyal benthic communities
Benthic communities of the continental slope, developed on blue, coral, green or red oceanic muds, and of relatively high diversity.
(Pautot, 1983; Barnes and Hughes, 1988; Clark, 1990).

11.212. Abyssal benthic communities
Benthic communities of abyssal plains and abyssal hills, large relatively level areas of the deep ocean floor, covered by thin layers of biogenic or nonbiogenic oozes.
(Pautot, 1983; Barnes and Hughes, 1988; Clark, 1990).

11.214 . Oceanic ridge benthic communities
Benthic communities occupying raised features of the deep sea-floor; they include assemblages colonizing active or nonactive constructive midocean ridges, as well as those developed on asismic ridges, but with the exception of hydrothermal communities.
(Pautot, 1983: 80-81, 84-85; Barnes and Hughes, 1988; Clark, 1990).

11.22. Sublittoral soft seabeds
Mostly animal communities colonizing soft sediments such as mud, sand or gravel of the infralittoral and circalittoral zones.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Magri, 1999).

11.23. Sublittoral pebbly seabeds
Communities of mostly annual algae and invertebrates developing on pebble deposits of the infralittoral and circalittoral zones.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255).

11.24. Sublittoral rocky seabeds and kelp forests
Varied, strongly stratified communities colonizing underwater cliffs, reefs and rocky continental shelf seabeds.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 52-54; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 54; Bournérias *et al.*, 1987: 70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 86-87; Bournérias *et al.*, 1990: 72-75; Bournérias *et al.*, 1991: 64-68; Bournérias *et al.*, 1992: 65-68; Lalli and Parsons, 1995: 183-255; Schembri, 1999b; Magri, 1999).

11.25. Sublittoral organogenic concretions
Continental shelf colonies of lower plants or animals resulting in concretions and encrustations.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.251. Corallogenic concretions
Communities forming and colonizing corallogenic concretions of calcified red algae in the circalittoral zone of the Mediterranean.
(Molinier and Picard, 1959; Augier, 1982, 1985; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.252. Encrusting algae pavements
Mediterranean communities associated with mediolittoral pavements of encrusting algae (*Lithospermum tortuosum).*
(Molinier and Picard, 1959; Augier, 1982, 1985; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.253. Gastropod and polychaete ledges
Infralittoral ledges built by gastropods or polychaetes.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.254. Mussel beds
Communities of Atlantic, Baltic and Mediterranean mussel beds.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin, 1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988: 107-108, 119; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999a, 1999b).

11.255. Gas vent communities
Communities of bacteria and invertebrates colonizing the vicinity of hot or cold gas seeps of the continental shelf, often forming encrusted tubes or chimneys.
(Barnes and Hughes, 1988).

11.26. Sublittoral cave communities
Communities of marine invertebrates and algae colonizing the bottom and sides of caves (unit 12.7) situated under the sea or the sublittoral part of caves having an entirely, periodically or partly submerged opening.
(Augier, 1982, 1985; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Barnes and Hughes, 1988; Boury-Esnoult *et al.*, 1993).

11.27. Soft sediment littoral communities

Invertebrate and algal communities colonizing soft sediments such as mud, sand or gravel of the intertidal zone.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Magri, 1999; Schembri, 1999b).

11.28. Pebbly shore littoral communities

Communities of mostly annual algae and invertebrates developing on pebble deposits of the intertidal zone.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255).

11.29. Rocky shore littoral communities

Communities of algae, invertebrates and lichens colonizing the mediolittoral and supralittoral zones of rocky shores and cliffs.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.291. Mediolittoral fringe rocks

Cliffs and rocks of the lowest part of the mediolittoral zone, occupied by communities transitional to those of the infralittoral zone.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.292. Lower mediolittoral rocks

Cliffs and rocks of the lower part of the mediolittoral zone, occupied, in particular, by encrusting algae.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.293. Upper mediolittoral rocks

Cliffs and rocks of the higher part of the mediolittoral zone, occupied by communities characterized, in particular, by cirriped crustaceans and soft algae.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.294. Mediolittoral cave and overhang communities

Communities of marine animals and lower plants colonizing mediolittoral overhangs and crevices, and the mediolittoral level of sea-caves (unit 12.7).
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255).

11.295. Mediolittoral rock pools

Permanent saline pools of the mediolittoral zone, fed by flood tides (tide pools).
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255).

11.296. Supralittoral rocks

Cliffs and rocks of the supralittoral spray zone, mostly occupied by lichens such as *Verrucaria*.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin,1983; Bournérias *et al.*, 1983: 50; Bournérias *et al.*, 1984: 44-52; Bournérias *et al.*, 1985: 52-64; Bournérias *et al.*, 1985: 58-61; Bournérias *et al.*, 1986: 49-58; Bournérias *et al.*, 1987: 58-70; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Bournérias *et al.*, 1988: 75-86; Bournérias *et al.*, 1990: 69-72; Bournérias *et al.*, 1991: 58-64; Bournérias *et al.*, 1992: 57-64; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.297. Supralittoral rock pools

Pools of the supralittoral spray zone, of variable salinity, fed by rainwater, spray and occasionally waves.
(Stewart and Church, 1992: 25).

11.2A. Littoral communities of organogenic concretions
Littoral colonies of lower plants or animals resulting in concretions and encrustations.
(Molinier and Picard, 1959; Augier, 1982, 1985; Sorokin, 1983; Bournérias *et al.*, 1983: 27; Mitchell, 1987; Harmelin *et al.*, 1987; Fiala-Médione *et al.*, 1987; Wood, 1988; Barnes and Hughes, 1988; Lalli and Parsons, 1995: 183-255; Schembri, 1999b).

11.3. Sea-grass meadows

Zosteretea marinae, Posidonietea, Halodulo-Thalassietea
Beds of submerged marine vascular vegetation of the oceans, seas and coastal lagoons, except those of brackish seas and lagoons.
(Good, 1974: 256; Heywood, 1978; Barnes and Hughes, 1988).

11.33. Mediterraneo-Pontic *Cymodocea* and *Zostera* beds
Beds of *Cymodocea nodosa, Zostera noltii* or *Zostera marina s.l.* of the Mediterranean and the Black Sea.
(Horvat *et al.*, 1974; Campbell, 1976; Molinier and Martin, 1980; Augier, 1982; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Polunin and Walters, 1985; Bournérias *et al.*, 1991; Britton and Crivelli, 1993: 155-156; Turland *et al.*, 1993; Trpin and Vres, 1995; Coldea, 1997).

11.331. Mediterranean *Cymodocea* beds
Cymodoceion nodosae: Cymodocetum nodosae
Cymodocea nodosa formations of the Mediterranean, permanently submerged in waters down to 10 metres deep, often in sheltered areas behind *Posidonia* reefs, monospecific or associated with either the alga *Caulerpa prolifera* or the phanerogam *Halophila stipulacea.*
(Knapp, 1973: 502; Campbell, 1976; Molinier and Martin, 1980; Augier, 1982; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Polunin and Walters, 1985; Lanfranco, 1989: 51; Britton and Crivelli, 1993: 155-156; Turland *et al.*, 1993: 11; Trpin and Vres, 1995: 36; Hoda *et al.*, 1998: 2; Schembri, 1999b).

11.34. *Posidonia* beds
Posidonion oceanicae
Beds of the Mediterranean and thermo-Atlantic endemic, *Posidonia oceanica,* permanently submerged in waters down to 100 metres deep.
(Wolff, 1968; Knapp, 1973: 502; Horvat *et al.*, 1974: 147; Campbell, 1976; Molinier and Martin, 1980; Augier, 1982; Boudouresque and Meinesz, 1983; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Polunin and Walters, 1985; Harmelin, Vacelet and Pétron, 1987; Fiala-Médione, Pétron and Rives, 1987; Lanfranco, 1989: 50; Britton and Crivelli, 1993: 155-156; Turland *et al.*, 1993: 11; Trpin and Vres, 1995: 72; Hoda *et al.*, 1998: 2; Schembri, 1999b).

11.36. Temperate *Halophila* and *Thalassia* beds
Deep water colonies of *Halophila spp.* or *Thalassia spp.* of the Mediterranean and the Macaronesian Atlantic.
(Dandy, 1980; Augier, 1982; Wildpret de la Torre and del Arco Aguilar, 1987).

11.362. Mediterranean *Halophila* beds
Colonies of *Halophila stipulacea* invading the Mediterranean as a result of the opening of the Suez Canal; they have been reported from continental Greece, the Cyclades, Crete, Rhodes, Samos, the Maltese Islands.
(Augier, 1982; Lanfranco, 1989: 51; Turland *et al.*, 1993: 11; Schembri, 1999a).

11.4. Brackish sea vascular vegetation

Ruppietea maritimae: Ruppietalia maritimae: Ruppion maritimae p.
Beds of submerged or slightly emergent vascular vegetation of brackish seas, sea inlets, estuaries, permanent pools of mud or sand flats, and coastal lagoons.
(Westhoff and den Held, 1975; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ellenberg, 1988; Oberdorfer, 1990; Pott, 1992).

11.41. Marine tasselweed communities
Ruppietea maritimae: Ruppietalia maritimae: Ruppion maritimae
Submerged beds of *Ruppia maritima, Ruppia cirrhosa, Zannichellia pedicellata, Chara spp., Tolypella nidifica* of brackish seas, sea inlets, estuaries, permanent pools of mud or sand flats, and coastal lagoons of the Palaearctic region.
(Kornas, 1960; Wolff, 1968; Zohary, 1973; Westhoff and den Held, 1975; Verhoeven, 1980; Matuszkiewicz, 1984; Géhu, 1984a; Géhu and Géhu-Franck, 1984a; Nordiska ministerradet, 1984; Moore, 1986: 42, 60; Ellenberg, 1988; Oberdorfer, 1990; Schubert and Vent, 1990; Hiscock and Connor, 1991; Palmer *et al.*, 1992; Pott, 1992; Britton and Crivelli, 1993: 156; Hohenester and Welss, 1993; Påhlsson, 1994).

11.412. Tethyan marine tasselweed communities
Submerged beds of *Ruppia maritima* or *Ruppia cirrhosa* and of *Chara spp.* of sea inlets, estuaries, permanent pools of mud or sand flats, and coastal lagoons of the Mediterranean, the Black Sea and the subtropical Atlantic, north to southwestern Iberia, south to 27°N.
(Wolff, 1968; Knapp, 1973: 502; Zohary, 1973; Verhoeven, 1980; Géhu, 1984a; Géhu and Géhu-Franck, 1984a; Britton and Crivelli, 1993: 156; Hohenester and Welss, 1993: 13).

11.4121. Western Tethyan marine tasselweed communities
Ruppietum drepanensis i.a.
Submerged beds of *Ruppia maritima*, including *Ruppia maritima* ssp. *rostellata*, or *Ruppia cirrhosa* (*Ruppia drepanensis, Ruppia spiralis)* and of *Chara spp.* of sea inlets, estuaries, permanent pools of mud or sand flats and coastal lagoons of Mediterranean coasts and of thermo-Atlantic coasts of southwestern Iberia, of norhwestern Africa, south to 27°N, and of the Macaronesian islands.
(Wolff, 1968; Knapp, 1973: 502; Zohary, 1973; Verhoeven, 1980; Babalonas, 1980: 625; Morgan, 1982; Géhu, 1984a; Géhu and Géhu-Franck, 1984a; Lanfranco, 1989: 37; Britton and Crivelli, 1993: 156; Hohenester and Welss, 1993: 13; Trpin and Vres, 1995: 79; Lorenzoni and Paradis, 1996: 157-159, 168, 173; Hoda *et al.*, 1998: 3).

11.43. Coastal brackish water crowfoot communities
Ruppion maritimae: Ranunculetum baudotii
Ranunculus spp.-dominated communities developed in shallow-waters of very low salinity of coastal lagoons, coastal basins and coastal waters of the Palaearctic region, including the Atlantic, North Sea, Baltic Sea, Mediterranean Sea and Black Sea. The most widespread characteristic species is *Ranunculus baudotii*. Locally, other crowfoots may be typical, as, in particular, in the Gulf of Bothnia, *Ranunculus trichophyllus* (*Ranunculus confervoides).*
(Wolff, 1968; Knapp, 1973: 502; Géhu, 1984a; Géhu and Géhu-Franck, 1984a; Nordiska ministerradet, 1984: unit 4.2.2.2 *p.;* Ellenberg, 1988; Oberdorfer, 1990; Schubert and Vent, 1990; Pott, 1992: 63; Britton and Crivelli, 1993: 156; Påhlsson, 1994: unit 4.3.2.2 *p.;* Mossberg *et al.*, 1995: 138).

12. SEA INLETS AND COASTAL FEATURES

Bays and narrow channels of the oceans and their connected seas, including sea lochs or loughs, fiords or fiards, rias and straits but excluding estuaries and lagoons. Detailed habitats can be coded by combining subdivisions of unit 11 with the relevant physiographic subdivisions of unit 12.
(Wood, 1988).

12.1. Open linear coasts

More or less straight coasts, devoid of deep indentations, characteristic of concordant coasts, of soft-sediment coastlines, and of the contour of isolated promontories.
(Clark, 1990).

12.2. Semienclosed coasts

Coastlines of wide, curved indentations of the sea into the land, with a wide or fairly wide opening, including bays and gulfs.
(Clark, 1990).

12.3. Sounds and straits

More or less narrow stretches of water connecting two larger bodies of water; channels between islands and the mainland.
(Clark, 1990).

12.4. Enclosed enbayments

Bodies of water, such as coves, communicating with the sea by a relatively narrow but unobstructed opening.
(Clark, 1990).

12.6. Rias, voes, abers

Funnel-shaped sea inlets formed, in particular, by drowned river valleys, particularly along discordant coasts, as a result of a rise in sea-level.
(Wood, 1988; Clark, 1990; Magri, 1999).

12.7. Sea-caves

Caves situated under the sea or opened to it, at least at high tide. Their marine part harbours benthic communities of units 11.26 and 11.294. They may be connected to terrestrial cave systems (unit 65) or to the underground water network through anchihaline environments (unit 65.451).

12.71. Submerged sea-caves
Sea-caves situated entirely below low-tide level.

12.72. Complex sea-caves
Sea-caves situated in part above low-tide level, comprising mediolittoral (unit 11.294), and, in some cases, supralittoral (units 12.72 x 11.296, 12.72 x 11.297), communities; they may be in contact with, or grade into, terrestrial caves (unit 65), and contain sand or pebble beaches (units 12.72 x 16.1, 12.72 x 17).

13. ESTUARIES AND TIDAL RIVERS

Broadening of rivers entering the oceans or their connected seas and river channels below the tidal limit. Included are all marine or marine-related pelagic and benthic communities, which can be specified by use of subdivisions of unit 11, and all river course and riverbed communities, which can be specified by subdivisions of unit 24. The belts of fringing vegetation are excluded and indicated separately by use of units 53, 44, 15 and their subdivisions.
(Ketchum, 1983).

13.2. Estuaries

Broadening of rivers entering the sea. Detailed habitats can be coded by combining subdivisions of prefix 11 with the relevant physiographic subdivisions of unit 13.2.
(Ketchum, 1983; Dijkema *et al.*, 1984; Britton and Morton, 1989; Einarsson, 1994; Gudmundsson and Kjartansson, 1996; Gastescu and Oltean, 1997).

13.21. Coastal plain estuaries
River-dominated, allochthonous deltaic estuaries formed by rivers accumulating sediments beyond the river mouth, often complex and constituted by many channels, with a salt wedge in the main channel; they are characteristic of microtidal shorelines.
(Ketchum, 1983; Dijkema *et al.*, 1984; Einarsson, 1994; Gudmundsson and Kjartansson, 1996).

14. INTERTIDAL AND LITTORAL FLATS

Extensive, flat or nearly flat, surfaces of sands, muds or rocks of the coasts of the oceans, their connected seas and associated lagoons, submerged for part of every tide or for part of the annual cycle, devoid of terrestrial vascular plants. They are of particular importance as feeding grounds for wildfowl and waders. The diverse intertidal communities of invertebrates and algae that occupy them can be precised by use of the subdivisions of units 11.27 to 11.2A, phanerogamic marine vegetation communities that may be exposed for a few hours in the course of every tide by use of those of unit 11.3, brackish water vegetation of permanent pools by use of those of unit 11.4.
(Fuller, 1982; Soper, 1989; Morrison, 1989; Hollis and Jones, 1991; Britton and Crivelli, 1993).

14.1. Mud flats and sand flats

Sands and muds of the coasts of the oceans, their connected seas and associated lagoons, submerged for part of every tide or for part of the annual cycle, devoid of terrestrial vascular plants, but usually coated by blue algae and diatoms. They are particularly well developed in the Wadden Sea, in the large bays of the North Sea, Atlantic and Channel coasts, in estuaries, in the Mediterranean Gulf of Gabes and along some subtropical coasts, among others, those of Mauritania.
(Fuller, 1982: 21-35; Eisma and Fey, 1982: 13, 43-50; Soper, 1989; Morrison, 1989: 197-201; Hollis and Jones, 1991; Britton and Crivelli, 1993: 134, 144-145).

14.2. Intertidal rock pavements

Bedrock platforms or terraces washed by the tides, broad wave-cut rock platforms situated in the intertidal zone, but nearer low tide, with a more or less plane surface, rough in detail, dotted by tidepools.
(Soper, 1989).

15. SALTMARSHES, SALT STEPPES, SALT SCRUBS

Communities of phanerogamic plants, for the most part halophytes, colonizing sites submerged by high tides at some stage of the annual tidal cycle of oceans and their connected seas. Similar halophyte communities colonizing the fringes and emersed beds of inland permanent or temporary saline, hypersaline or brackish waterbodies, including inland closed seas, lakes, pools, sebkhas, rivers, springs, seeps. By extension, azonal, strongly differentiated, communities developing on habitually dry, alkali, chlorid or gypseous soils of the nemoral, middle Eurasian steppe, Irano-Anatolian, Mediterranean, Saharo-Mediterranean and Macaronesian zones. Zonal communities of the desert and semidesert areas, composed, to varying degrees, of halophytes or gypsophytes, are listed under 7. Some saline communities with strong physionognimic similarity to fresh water ones into which they may merge, have been listed in other sections, together with their freshwater counterparts; it is the case in particular of saline tamarisk stands (44.83 ff.) and of tall helophyte beds (53). More generally, halophile forests and their related thickets have been listed with other forests under 4; in particular mangrove forests and thickets are in 4C.
(Chapman, 1975, 1977a, 1977b; Steers, 1977; Walter, 1977; Phleger, 1977; Daiber, 1977; Beeftink, 1977; Zahran, 1977; Hosokawa *et al.*, 1977; Daubenmire, 1978; Walter and Breckle, 1986, 1991b, 1991c; Adam, 1990; Denny, 1993a; Britton and Crivelli, 1993; Glooschenko *et al.*, 1993; Bliss, 1993; Cramer, 1993; Pott, 1996).

15.1. Annual salt pioneer swards

Thero-Salicornietea, Frankenietea pulverulentae, Saginetea maritimae, Crypsietea aculeatae
Formations composed mostly or prominently of annuals, in particular Chenopodiaceae of genus *Salicornia* or grasses, colonizing periodically inundated muds and sands of marine or interior saltmarshes of the Palaearctic.
(Oberdorfer, 1952, 1990; Duvigneaud, 1967; Holub *et al.*, 1967; Wolff, 1968; Ganchev *et al.*, 1971; Zohary, 1973; Vicherek, 1973; Westhoff and den Held, 1975; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Géhu, Caron and Bon, 1975; Chapman, 1977a: 4; Parent and Burny, 1981; Moravec *et al.*, 1983; Géhu, 1984a, 1984b, 1984c; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984; Drachenfels *et al.*, 1984; Dijkema *et al.*, 1984; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Moravec, 1986; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Pott, 1992; Mucina, 1993d; Julve, 1993; Påhlsson, 1994).

15.11. Glasswort swards
Thero-Salicornietea
Annual glasswort (*Salicornia spp., Microcnemum coralloides)*, seablite (*Suaeda spp.)*, or sometimes saltwort (*Salsola spp.)*, formations colonizing periodically inundated muds of coastal saltmarshes and inland salt-basins of the Palaearctic.
(Oberdorfer, 1952, 1990; Duvigneaud, 1967; Holub *et al.*, 1967; Wolff, 1968; Ganchev *et al.*, 1971; Zohary, 1973; Vicherek, 1973; Westhoff and den Held, 1975; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Géhu, Caron and Bon, 1975; Chapman, 1977a; Parent and Burny, 1981; Moravec *et al.*, 1983; Géhu, 1984a, 1984b, 1984c; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984; Drachenfels *et al.*, 1984; Dijkema *et al.*, 1984; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Lahondère, 1985, 1994; Géhu, 1986; Moravec, 1986; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Pott, 1992; Mucina, 1993d; Julve, 1993; Påhlsson, 1994).

15.113. Mediterranean glasswort swards
Glasswort swards of saltmarshes, lagoons and deltas of the coasts and coastal regions of the Mediterranean and of the subtropical Atlantic, including those of southwestern France, the Iberian peninsula, mediterranean North Africa south to the Oued Tensift at 32°N and mediterraneo-Saharan Africa between 32°N and 27°N.
(Oberdorfer, 1952; Wendelberger, 1965: 255; Wolff, 1968; Le Houérou, 1969; Knapp, 1973: 501-502; Zohary, 1973: 461; Horvat *et al.*, 1974: 151; Chapman, 1977a: 12; Chapman, 1977b: 233; Rivas-Martinez *et al.*, 1980: 9, 43-45; Vanden Berghen, 1981: 16-17; Géhu and Rivas-Martinez, 1984: 35, 37; Géhu, 1984a, 1984b, 1984c, 1986; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Dijkema *et al.*, 1984; Asensi Marfil and Diez Garretas, 1987: 226-227; Alcaraz Ariza and Peinado Lorca, 1987: 275; Costa, 1987: 293; Julve, 1993; Trpin and Vres, 1995: 80; Seliskar, 1998: 11).

15.1133. Mediterranean glasswort-seablite-saltwort swards
Salicornion patulae
Salicornia spp., Suaeda spp., Salsola spp., Halopeplis amplexicaulis swards, often monospecific, occupying muds of coastal saltmarshes of the Mediterranean Sea and of the warm-temperate Atlantic, from central Portugal to 27°N, restricted, in the western Mediterranean basin, to firmer, drier muds with shorter inundation periods than those occupied by the communities of unit 15.1131.
(Oberdorfer, 1952: 335-336; Knapp, 1973: 501-502; Zohary, 1973: 461; Rivas-Martinez *et al.*, 1980: 9, 43-45; Babalonas, 1980: 619-620; Géhu, 1984a: 41; Géhu, 1984c: 134-136, 141; Géhu and Géhu-Franck, 1984a: 54; Géhu *et al.*, 1984b; Géhu, 1986: 184; Asensi Marfil and Diez Garretas, 1987: 226-227; Alcaraz Ariza and Peinado Lorca, 1987: 275; Gamisans, 1991: 104; Zahran and Willis, 1992: 28; Julve, 1993: 40; Lorenzoni *et al.*, 1993: 127, 134-135; Lahondère, 1994: 41, 45; Lorenzoni and Paradis, 1996: 165, 168; Hoda *et al.*, 1998: 3).

15.11331. Upper shore Mediterranean glasswort swards
Salicornion patulae: Suaedo vulgaris-Salicornietum patulae, Suaedo splendentis-Salicornietum ramosissimae i.a.
Glasswort (*Salicornia spp.)* swards occupying muds of coastal saltmarshes of the Mediterranean Sea, including both western and eastern basins, and of the Atlantic, from central Portugal to 27°N, dominated by diploid glassworts, in particular, by the reddening *Salicornia patula*, also by *Salicornia ramosissima* and probably other diplo‹d taxa of the *Salicornia europaea* aggregate, limited in the western Mediterranean basin to firmer, drier muds than those colonized by the tetraploid *Salicornia emerici.*
(Oberdorfer, 1952: 335-336; Demiri, 1962: 75-76; Knapp, 1973: 502; Zohary, 1973: 461; Rivas-Martinez *et al.*, 1980: 9, 43-45; Babalonas, 1980: 619-620; Géhu, 1984a: 41; Géhu, 1984c: 134-136, 141; Géhu and Géhu-Franck, 1984a: 54; Géhu *et al.*, 1984b; Géhu, 1986: 184; Asensi Marfil and Diez Garretas, 1987: 226-227; Alcaraz Ariza and Peinado Lorca, 1987: 275; Gamisans, 1991: 104; Zahran and Willis, 1992: 23, 28; Julve, 1993: 40; Lorenzoni *et al.*, 1993: 127, 134-135; Lahondère, 1994: 41, 45; Lorenzoni and Paradis, 1996: 165, 168; Hoda *et al.*, 1998: 3).

15.11332. Mediterranean annual seablite and saltwort swards
Salicornion patulae: Suaedetum maritimae, Salsoletum sodae
Suaeda spp. or *Salsola spp.*-dominated swards of exposed muds of coastal saltmarshes of the Mediterranean Sea and the warm-temperate Atlantic, mostly characteristic of the eastern Mediterranean basin and of muds on which organic material, in particular detritus of marine phanerogams, has accumulated; more species-rich formations characteristic of more substantial debris accumulations are listed as unit 15.56.
(Oberdorfer, 1952: 335-336; Knapp, 1973: 502; Babalonas, 1980: 619-620; Julve, 1993: 40; Hoda *et al.*, 1998: 3).

15.12. Mediterranean halo-nitrophilous pioneer communities
Frankenietea pulverulentae: Frankenietalia pulverulentae: Frankenion pulverulentae
Formations of halonitrophilous annuals (*Frankenia pulverulenta, Suaeda splendens, Salsola soda, Cressa cretica, Parapholis incurva, Parapholis strigosa, Hordeum marinum, Sphenopus divaricatus, Polypogon maritimus, Spergularia spp., Vella annua)* colonizing salt muds of Mediterranean and thermo-Atlantic coastal regions, of Iberian and North African endoreic basins, susceptible to temporary inundation and extreme drying; they are more species-rich or richer in non-chenopodids than the communities of unit 15.113; they are particularly developed in the Iberian peninsula, secondarily in the large Mediterranean islands, in coastal regions and endoreic basins of North Africa, in southern Italy and Mediterranean France; they occur as irradiations on thermo-Atlantic coasts, notably on the Atlantic coast of France. Somewhat similar communities occur in the steppe zones of Eurasia and their regions of influence, as well as in Saharo-Mediterranean steppes of North Africa; they are included in units 15.14 and 15.15.
(Le Houérou, 1969; Knapp, 1973: 501; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Géhu, 1984a, 1984c; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984; Dijkema *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987; Gamisans, 1991: 98-103; Julve, 1993; Lorenzoni *et al.*, 1993; Lorenzoni and Paradis, 1996).

15.121. Mediterranean *Frankenia pulverulenta* communities
Frankenion pulverulentae: Parapholido-Frankenietum pulverulentae p. i.a.
Halophile and weakly to moderately nitrophile, predominantly non-gramino‹d, communities of annuals developing throughout the period of vegetation on solonchaks of Iberia, the Mediterranean basin and interior North Africa, dominated by *Frankenia pulverulenta,* with *Suaeda splendens, Salsola soda, Cressa cretica, Parapholis incurva, Parapholis strigosa, Hordeum marinum, Sphenopus divaricatus.*
(Knapp, 1973: 501; Castroviejo and Porta, 1975; Vanden Berghen, 1979: 59; Rivas-Martinez *et al.*, 1980: 9, 46-47; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984: 178; Asensi Marfil and Diez Garretas, 1987: 226; Alcaraz Ariza and Peinado Lorca, 1987: 276; Julve, 1993: 39).

15.122. Mediterranean aestival halo-nitrophile grass swards
Frankenion pulverulentae: Parapholi-Frankenietum pulverulentae p., Polypogonetum subspathacei i.a.
Halophile and weakly nitrophile predominantly gramino‹d swards developing usually in early summer on long-inundated solonchaks of Iberia, the western Mediterranean and North Africa, dominated by relatively small grasses, particularly *Sphenopus divaricatus,* also *Parapholis filiformis, Parapholis incurva, Polypogon maritimus* (*Polypogon subspathaceus)* with *Hymenolobus procumbens, Frankenia pulverulenta, Hordeum marinum.*
(Knapp, 1973: 501; Castroviejo and Porta, 1975; Rivas-Martinez *et al.*, 1980: 9, 46-47; Asensi Marfil and Diez Garretas, 1987: 226; Alcaraz Ariza and Peinado Lorca, 1987: 276; Lanfranco, 1989: 45; Gamisans, 1991: 98-99; Julve, 1993: 39; Lorenzoni *et al.*, 1993: 135; Lorenzoni and Paradis, 1996: 158, 164, 178).

15.123. Mediterranean *Cressa* swards
Frankenion pulverulentae: Cressetum creticae
Halophile and weakly to moderately nitrophile aestival and postaestival solonchak communities of coastal, mostly endoreic or percolation, lagoons, coastal saltmarsh ponds and interior endoreic basins of Sicily, the Maltese Islands, Sardinia, Corsica, Iberia, North Africa and, very locally, Mediterranean France, Calabria, Mediterranean western Asia, dominated by the Convolvulaceae *Cressa cretica.*
(Zohary, 1973: 460, 461; Knapp, 1973: 501; Molinier and Martin, 1980: 259; Pignatti, 1982: 385; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984: 178; Lanfranco, 1989: 28; Lorenzoni and Paradis, 1994: 3-24).

15.124. Mediterranean *Hordeum marinum* swards

Frankenion pulverulentae: Hordeo-Salsoletum sodae, Polypogo maritimi-Hordeetum marini, Parapholido strigosae-Hordeetum marini, Hainardio cylindricae-Lophochloetum hispidae p.

Dense halonitrophilous meadows dominated by robust, spring-developing annual grasses, among which *Hordeum marinum* is often prevalent, forming at the upper margin of Iberian and North African endoreic depressions and of Mediterranean and warm-temperate Atlantic saltmarshes.

(Gounot and Schoenenberger, 1967: 276-277; Knapp, 1973: 501; Rivas-Martinez *et al.*, 1980: 9, 48-50; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984: 178; Géhu and Géhu-Franck, 1984a; Asensi Marfil and Diez Garretas, 1987: 226; Gamisans, 1991: 99-100; Julve, 1993: 39).

15.125. Mediterranean nitrophilous solonchak chenopodid mats

Frankenion pulverulentae: Suaedo splendentis-Chenopodietum chenopodoidis, Junco buffonii-Chenopodietum chenopodioidis, Parapholido-Frankenietum pulverulentae suaedetosum splendentis (*"Suaedo splendentis-Salsoletum sodae"*)

Halonitrophilous, often polyspecific, annual communities dominated by Chenopodiaceae (*Chenopodium spp., Suaeda splendens)* colonizing solonchaks of Iberian and North African endoreic basins and of western Mediterranean and warm-temperate Atlantic coasts.

(Knapp, 1973: 501; Castroviejo and Porta, 1975; Rivas-Martinez *et al.*, 1980: 9, 47-48; Ladero *et al.*, 1984; Peinado Lorca *et al.*, 1984: 178; Géhu and Géhu-Franck, 1984a: 58; Alcaraz Ariza and Peinado Lorca, 1987: 275; Julve, 1993: 38-39).

15.126. Mediterranean sea-pearlwort communities

Frankenion pulverulentae (*"Saginetea maritimae"*: *"Saginetalia maritimae"*: *"Saginion mediterraneum"*): *Romuleo-Saginetum, Hymenolobo procumbentis-Saginetum maritimae, Polypogonetum subspathacei, Evacetum rotundatae, Spergulario-Frankenietum laevis, Mesembryanthemetum crystallino-nodiflori*

Formations of annual pioneers, small geophytes and sometimes sparse chamaephytes occupying, in the Mediterranean basin, on thermo-Atlantic shores and around Iberian and North African endoreic basins, sands subject to variable salinity and humidity, notably in the transition zone between salt scrubs and dry grasslands. Dominant species include *Sagina maritima, Spergularia spp., Mesembryanthemum crystallinum, Mesembryanthemum nodiflorum, Evax rotundata, Evax pygmaea;* accompaniers comprise *Romulea bulbocodium, Romulea rollii, Anagallis arvensis, Bellis annua.*

(Wolff, 1968; Knapp, 1973: 501; Alcaraz Ariza and Peinado Lorca, 1987: 276; Lanfranco, 1989: 12; Gamisans, 1991: 80, 98-100; Julve, 1993: 39; Lorenzoni *et al.*, 1993: 135; Paradis and Piazza, 1995: 78, 90; Lorenzoni and Paradis, 1996: 158; Hoda *et al.*, 1998: 3).

15.5. Mediterranean and thermo-Atlantic salt meadows

Juncetalia maritimi, Suaedetea fruticosae p.

Salt meadows of saltmarshes, lagoons and deltas of the coasts and coastal regions of the Mediterranean and of the subtropical Atlantic, including those of southwestern France, the Iberian peninsula, the Macaronesian Islands, mediterranean North Africa south to the Oued Tensift at 32°N and mediterraneo-Saharan Africa between 32°N and 27°N, and of endoreic interior basins of mediterranean Iberia and mediterranean North Africa.

(Braun-Blanquet and Bolos, 1957; Bolos and Molinier, 1958; De Jong, 1965; Wolff, 1968; Bolos, Molinier and Montserrat, 1970; Guinochet and Vilmorin, 1973; Knapp, 1973; Zohary, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975a; Rivas-Martinez and Costa, 1975; Castroviejo and Porta, 1975; Izco and Cirujano, 1975; Chapman, 1977a; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Lahondère, 1982; Géhu and Rivas Martinez, 1984; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Peinado Lorca *et al.*, 1984: 176; Chiappini, 1985a; Asensi Marfil and Diez Garretas, 1987: 226; Peinado Lorca and Rivas-Martinez, 1987; Zahran and Willis, 1992; Britton and Crivelli, 1993; Hohenester and Welss, 1993).

15.51. Mediterranean tall rush saltmarshes

Juncion maritimi, Plantaginion crassifoliae, p., i.a.

Beds of tall *Juncus maritimus, Juncus rigidus* (*Juncus maritimus* var. *arabicus, Juncus arabicus)* or *Juncus acutus* of saline grounds of Mediterranean and thermo-Atlantic coastlands and of endoreic interior basins of mediterranean Iberia and mediterranean North Africa, forming, in particular, in periodically inundated depressions , where they may associate with *Carex extensa, Iris spuria, Gladiolus communis, Aster tripolium, Sonchus maritimus, Sonchus crassifolius* or other elements of units 15.52 and 15.54, and in sandy dunal depressions, where they may alternate with stands of *Schoenus nigricans* or other formations of unit 15.53 .

(Oberdorfer, 1952: 343-344; Braun-Blanquet and Bolos, 1957: 102; De Jong, 1965: 176; Gounot and Schoenenberger, 1967: 277; Knapp, 1973: 500-501; Zohary, 1973; Horvat *et al.*, 1974: 152-153; Chapman, 1977a: 6, 12; Vanden Berghen, 1979, 1981; Babalonas, 1980: 619-623; Peinado Lorca *et al.*, 1984: 176; Géhu *et al.*, 1984b: 446-449; Diaz Gonzales and Fernandez Prieto, 1987: 87; Rivas-Martinez and Costa, 1987: 497; Poldini, 1989: 117; Gamisans, 1991: 107; Zahran and Willis, 1992: 23, 28; Julve, 1993: 43; Hohenester and Welss, 1993: 14; Lorenzoni *et al.*, 1993: 132, 135; Lorenzoni and Paradis, 1996: 157; Seliskar, 1998).

15.511. Euro-Mediterranean coastal tall rush saltmarshes

Juncion maritimi p.: Juncetum maritimi-acuti, Puccinellio-Juncetum maritimi, Soncho-Juncetum maritimi, Caricetum divisae p., Junco-Triglochinetum p. i.a.; Plantaginion crassifoliae, p.

Beds of *Juncus maritimus* or *Juncus acutus* of saltmarshes, periodically inundated saline basins and humid dunal depressions of the Mediterranean and thermo-Atlantic coasts and coastlands of Europe and western Asia.

(Oberdorfer, 1952: 343-344; Demiri, 1962: 76; De Jong, 1965: 176; Zohary, 1973: 284, 461; Horvat *et al.*, 1974: 152-153; Chapman, 1977a: 6, 12; Babalonas, 1980: 619-623; Géhu *et al.*, 1984b: 446-449; Diaz Gonzales and Fernandez Prieto, 1987: 87; Poldini, 1989: 117; Lanfranco, 1989: 41; Julve, 1993: 43; Hohenester and Welss, 1993: 14; Lorenzoni *et al.*, 1993: 132; Ilijanic, 1996: 109; Seliskar, 1998; Hoda *et al.*, 1998: 3).

15.52. Mediterranean short rush-sedge-barley-clover coastal saltmeadows

Trifolion maritimi, Juncion maritimi p.: Junco gerardi-Triglochinetum maritimi, Loto decumbentis-Caricetum divisae i.a.
Humid meadows of low vegetation dominated by *Juncus gerardi, Carex divisa, Carex extensa, Triglochin maritima, Hordeum marinum* or *Trifolium spp.* and *Lotus spp.* of the edges of brackish lagoons of Mediterranean and thermo-Atlantic coasts of Europe, western Asia and North Africa.
(De Jong, 1965: 176; Knapp, 1973: 500; Géhu and Géhu-Franck, 1984a: 56; Diaz Gonzales and Fernandez Prieto, 1987: 87; Lanfranco, 1989: 44, 46; Julve, 1993: 43; Lorenzoni *et al.*, 1993: 131-132; Hoda *et al.*, 1998: 3).

15.53. Mediterranean halo-psammophile meadows
Rlantaginion crassifoliae: Schoeno-Plantaginetum crassifoliae, Junco acuti-Schoenetum nigricantis
Drier, dense formations of sandy soils at the foot of dunes, or between dunes and lagoons of the Mediterranean and thermo-Atlantic coasts of Europe and North Africa, and of the endoreic interior basins of Mediterranean Iberia, with *Plantago crassifolia, Schoenus nigricans, Juncus littoralis, Spartina versicolor* (*Spartina patens, Spartina juncea), Elymus elongatus, Inula crithmoides,* all of which may dominate and form physiognomically distinct, sometimes almost monospecific, facies.
(Braun-Blanquet and Bolos, 1957: 101; Knapp, 1973: 501; Zohary, 1973: 459; Molinier and Martin, 1980: XLIII, 25-26; Géhu and Géhu-Franck, 1984a: 56; Géhu *et al.*, 1984b: 450-453; Peinado Lorca *et al.*, 1984: 176; Rivas-Martinez and Costa, 1987: 497; Gamisans, 1991: 106-107; Lorenzoni *et al.*, 1993: 126-127, 132, 135, 147; Paradis and Piazza, 1993: 244; Lorenzoni and Paradis, 1996: 157).

15.531. Euro-Mediterranean coastal halo-psammophile meadows
Rlantaginion crassifoliae: Schoeno-Plantaginetum crassifoliae p.
Psammo-halophile swards of the foot of dunes and of dune hollows of the Mediterranean and thermo-Atlantic coasts of Europe. *Plantago crassifolia, Schoenus nigricans, Juncus littoralis, Spartina versicolor* (*Spartina patens, Spartina juncea), Scirpus holoschoenus* may associate in communities or dominate stands that occur alone or in mosaics, often interspersed with psammophile tall *Juncus* stands of unit 15.51.
(Molinier and Martin, 1980: XLIII, 25-26; Géhu and Géhu-Franck, 1984a: 56; Géhu *et al.*, 1984b: 450-453; Lorenzoni *et al.*, 1993: 132, 135; Piazza and Paradis, 1994: 70; Hoda *et al.*, 1998: 3).

15.55. Mediterranean coastal-saltmarsh grass swards
Ruccinellion festuciformis: Puccinellio festuciformis-Aeluropetum littoralis, Limonio-Puccinellietum palustris
Dense formations of perennial halophile grasses, in particular, *Puccinellia festuciformis* (*Puccinellia palustris)* or *Aeluropus littoralis,* of Mediterranean coasts and their coastal lagoons.
(Knapp, 1973: 501; Babalonas, 1980: 620-621; Géhu *et al.*, 1984b: 445-446; Lanfranco, 1989: 45; Gamisans, 1991: 106; Julve, 1993: 43).

15.56. Mediterranean saltmarsh driftlines
Thero-Suaedetalia: Thero-Suaedion: Suaedo splendentis-Kochietum hirsutae, Suaedo splendentis-Salsoletum sodae, p.
Communities of annuals forming on accumulations of organic debris in saltmarshes and saline depressions of the Mediterranean and thermo-Atlantic coasts and of endoreic basins of the Mediterranean interior, in particular, of mediterranean Iberia, with *Atriplex hastata, Suaeda splendens, Suaeda maritima, Bassia hirsuta, Salsola soda, Rumex pulcher.*
(Oberdorfer, 1952: 343, 344; Wolff, 1968; Zohary, 1973: 461; Horvat *et al.*, 1974: 151; Chapman, 1977a: 12; Molinier and Martin, 1980; Babalonas, 1980: 619-620; Géhu and Géhu-Franck, 1984a: 59; Géhu *et al.*, 1984b: 402, 457-460; Asensi Marfil and Diez Garretas, 1987: 226; Gamisans, 1991: 97).

15.57. Mediterranean saltmarsh couch-wormwood stands
Agropyro-Artemision coerulescentis i.a.
Formations of *Elymus* or *Artemisia* fringing Mediterranean and interior Iberian saline wetlands.
(Bolos and Molinier, 1958; Wolff, 1968; Bolos, Molinier and Montserrat, 1970; Knapp, 1973: 500-501; Zohary, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975a; Rivas-Martinez and Costa, 1975; Castroviejo and Porta, 1975; Izco and Cirujano, 1975; Lavagne and Moutte, 1977; Molinier and Martin, 1980: XLVIII, 48; Lahondère, 1982; Géhu *et al.*, 1984b; Chiappini, 1985a).

15.571. Mediterranean saltmarsh couch stands
Formations of *Elymus* of Mediterranean and interior Iberian saline wetlands.

15.572. Mediterranean saltmarsh wormwood fringes
Limonio-Artemisietum coerulescentis i.a.
Formations of *Artemisia* fringing Mediterranean and interior Iberian saline wetlands.
(Horvat *et al.*, 1974: 150-152; Géhu *et al.*, 1984b: 446-449, 453; Poldini, 1989: 33; Hoda *et al.*, 1998).

15.58. Mediterranean fine-leaved rush beds
Arthrocnemetalia fruticosi p.: Arthrocnemo glauci-Juncetum subulati p.
Medium-tall *Juncus subulatus* beds, often forming facies within *Arthrocnemum* scrubs of Mediterranean and thermo-Atlantic coasts.
(Gounot and Schoenenberger, 1967: 277; Rivas-Martinez *et al.*, 1980: 50-51, 55-56, 58-59; Géhu *et al.*, 1984b: 437-438; Turland *et al.*, 1993: 10; Lorenzoni *et al.*, 1993: 126, 132, 146; Lorenzoni and Paradis, 1996: 157, 160, 168).

15.6. Mediterraneo-nemoral saltmarsh scrubs

Arthrocnemetea fruticosi
Scrubby formations of woody glassworts (*Arthrocnemum),* seablites (*Suaeda), Halimione, Halocnemum* or *Limoniastrum* of saltmarshes and salt basins of mediterranean and thermo-Atlantic regions of the western Palaearctic, distributed in coastal saltmarshes of the Mediterranean, in endoreic interior basins of Iberia and mediterranean North Africa, and in warm temperate Atlantic coastal saltmarshes of Iberia, mediterranean and Saharo-mediterranean North Africa, the Macaronesian Islands and southwestern France, north locally to the English Channel and the southern North Sea. Scrubby formations of saltmarshes of the temperate coasts of the western Pacific and its connected seas.
(Oberdorfer, 1952; Bolos and Molinier, 1958; Maire, 1962; Wolff, 1968; Bolos *et al.*, 1970; Guinochet and Vilmorin, 1973; Zohary, 1973: 460-461; Horvat *et al.*, 1974; Géhu and Delzenne, 1975; Géhu *et al.*, 1975; Castroviejo and Porta, 1975; Chapman, 1977a; Géhu and Géhu-Franck, 1977; Géhu *et al.*, 1978; Molinier and Martin, 1980; Parent and Burny, 1981; Géhu, 1984a, 1986; Géhu and Rivas-Martinez, 1984; Rivas-Martinez *et al.*, 1984a; Géhu *et al.*, 1984b; Rivas-Martinez and Costa, 1984; Peinado Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Chiappini, 1985a; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Korotkov *et al.*, 1991; Britton and Crivelli, 1993; Hohenester and Welss, 1993: 13).

15.61. Mediterranean saltmarsh scrubs
Arthrocnemetalia fruticosi: Arthrocnemion fruticosi, Arthrocnemion glauci, Suaedion brevifoliae, Limonion ferulacei
Low shrubby expanses of woody glassworts, seablites, sea purslanes or *Halocnemum,* characteristic of temporarily inundated saltmarshes of Mediterranean coasts, southwestern Iberian and northwestern African Atlantic coasts and interior Iberian basins. They can be further subdivided according to dominant species, generally associated with patterns of inundation. *Cistanche lutea* characterises many southern formations.
(Oberdorfer, 1952; Bolos and Molinier, 1958; Maire, 1962; Wolff, 1968; Bolos *et al.*, 1970; Guinochet and Vilmorin, 1973; Zohary, 1973: 461; Horvat *et al.*, 1974; Castroviejo and Porta, 1975; Chapman, 1977a: 4, 5, 12; Géhu and Géhu-Franck, 1977; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Géhu, 1984a, 1986; Géhu and Rivas-Martinez, 1984; Rivas-Martinez *et al.*, 1984a; Géhu *et al.*, 1984b; Rivas-Martinez and Costa, 1984; Peinado Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Chiappini, 1985a; Peinado Lorca and Rivas-Martinez, 1987; Britton and Crivelli, 1993; Seliskar, 1998: 11).

15.612. Shrubby glasswort thickets
Arthrocnemion fruticosi: Arthrocnemenion fruticosi: Puccinellio festuciformis-Arthrocnemetum fruticosi, Cistancho luteae-Arthrocnemetum fruticosi
Stands of robust *Arthrocnemum fruticosum,* capable of forming extensive low, dense thickets in coastal marshes of Mediterranean, southwestern Iberian and northwestern African Atlantic coasts.
(Oberdorfer, 1952; Bolos and Molinier, 1958; Maire, 1962; Wolff, 1968; Bolos *et al.*, 1970; Guinochet and Vilmorin, 1973; Zohary, 1973: 461; Horvat *et al.*, 1974: 151-152; Géhu and Géhu-Franck, 1977; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980: 50-51, 52-53; Babalonas, 1980: 620-621; Géhu, 1984a, 1986; Géhu and Rivas-Martinez, 1984; Rivas-Martinez *et al.*, 1984a; Géhu *et al.*, 1984b; Rivas-Martinez and Costa, 1984; Peinado Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Asensi Marfil and Diez Garretas, 1987: 226; Alcaraz Ariza and Peinado Lorca, 1987: 275; Costa, 1987: 293; Rivas-Martinez and Costa, 1987: 497; Camarda and Valsecchi, 1990: 45; Gamisans, 1991: 105; Britton and Crivelli, 1993; Julve, 1993: 45; Lorenzoni *et al.*, 1993: 127, 133-134; Trpin and Vres, 1995: 22; Ilijanic, 1996: 109; Hoda *et al.*, 1998: 3).

15.613. Glaucous glasswort thickets
Arthrocnemion glauci: Sphenopo-Arthrocnemetum glauci, Inulo crithmoidis-Arthrocnemetum glauci, Arthrocnemo glauci-Juncetum subulati p., Arthrocnemo glauci-Hordeetum maritimi p., Frankenio corymbosae-Arthrocnemetum macrostachyi, Puccinellio convolutae-Arthrocnemetum macrostachyi
Shrubby formations of *Arthrocnemum glaucum.* Along northern Mediterranean shores, they often occupy somewhat drier sites such as shell banks in saline lagoons; in the North African coastal marshes of Cyrenaica, Tripolitana, Tunisia, Algeria and Morocco, they constitute the only *Arthrocnemum* formations.
(Oberdorfer, 1952; Maire, 1962; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 124-126, 149; Géhu and Géhu-Franck, 1977; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980: 50-51, 55-56, 58-59; Géhu, 1984a, 1986; Géhu and Rivas-Martinez, 1984; Rivas-Martinez *et al.*, 1984a; Géhu *et al.*, 1984b; Rivas-Martinez and Costa, 1984; Peinado Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Chiappini, 1985a; Asensi Marfil and Diez Garretas, 1987: 226; Alcaraz Ariza and Peinado Lorca, 1987: 275; Costa, 1987: 293; Rivas-Martinez and Costa, 1987: 497; Camarda and Valsecchi, 1990: 43-45; Gamisans, 1991: 105; Britton and Crivelli, 1993; Julve, 1993: 45; Lorenzoni *et al.*, 1993: 127, 134; Trpin and Vres, 1995: 22; Hoda *et al.*, 1998: 3).

15.614. Shrubby seablite thickets
Arthrocnemenion fruticosi: Halimiono-Suaedetum verae, Cistancho luteae-Suaedetum verae, Elytrigio athericae-Suaedetum verae
Shrubby formations of *Suaeda vera* occupying drier elevations of coastal saltmarshes of Mediterranean, southwestern Iberian and northwestern African Atlantic coasts.
(Rivas-Martinez *et al.*, 1980: 89; Asensi Marfil and Diez Garretas, 1987: 226; Julve, 1993: 45)

15.616. Mediterranean sea-purslane-woody glasswort scrubs
Halimione portulacoides-rich facies within *Arthrocnemum* communities of coastal saltmarshes of Mediterranean, southwestern Iberian and northwestern African Atlantic coasts.
(Babalonas, 1980: 620-621; Lanfranco, 1989: 12).

15.617. Mediterranean *Halocnemum* scrub
Arthrocnemetalia fruticosi: Halocnemion strobilaceae, Arthrocnemion glauci p.
Salt scrubs of Mediterranean coastal saltmarshes dominated by *Halocnemum strobilaceum*, characteristic of arid African coasts, with a few outposts on dry coasts of European peninsulas and islands. Formations of the desert coasts of the Sinai Mediterranean and the Red Sea and of endoreic basins of the Anatolian and North African transition regions between Mediterranean and desert or steppe zones are included under units 15.A and 15.C.
(Zohary, 1973: 386; Knapp, 1973: 498; Babalonas, 1980: 620-621; Vanden Berghen, 1981: 17; Alcaraz Ariza and Peinado Lorca, 1987: 275; Costa, 1987: 293; Zahran and Willis, 1992: 28; Hoda *et al.*, 1998: 3).

15.6171. Euro-Mediterranean *Halocnemum* scrub
Halocnemion strobilaceae; Arthrocnemion glauci: Frankenio corymbosae-Halocnemetum strobilacei, Arthrocnemo-Halocnemetum strobilacei, Limonio-Halocnemetum strobilacei
Rare and local formations dominated by the often sparse clumps of *Halocnemum strobilaceum*, usually associated with *Arthrocnemum glaucum*, sometimes with *Arthrocnemum fruticosum*, limited to southeastern Spain, southern Sardinia, western Sicily, Toscany, Emilia-Romagna, Albania and Greece, apparently extinct in the Maltese Islands.
(Babalonas, 1980: 620-621; Alcaraz Ariza and Peinado Lorca, 1987: 275; Costa, 1987: 293; Conti *et al.*, 1992: 257; Hoda *et al.*, 1998: 3).

15.7. Mediterraneo-Canarian xero-halophile scrubs

Halophile shrub formations of dry ground in low-precipitation areas of the mediterranean zone, in particular, the Iberian peninsula and Sicily, and of the Macaronesian Islands. Xerohalophile scrubs of the steppe zones are listed under unit 15.A, of the desert and semidesert regions under 7.
(Braun-Blanquet and Bolos, 1957; Delvosalle and Duvigneaud, 1962; Freitag, 1971; Bolos, 1973; Polunin and Smythies, 1973; Rivas-Martinez, 1977b; Bellot Rodriquez, 1979; Brullo *et al.*, 1980; Peinado-Lorca *et al.*, 1984: 178; Peinado and Martinez-Parras, 1984; Géhu, 1984a; Géhu and Rivas-Martinez, 1984; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Hohenester and Welss, 1993).

15.72. Mediterranean halo-nitrophilous scrubs
Regano-Salsoletea: Salsolo-Peganetalia: Salsolo-Peganion
Nitrophilous scrubby formations typically of dry soils and arid climates, often greyish-white and semidesert-like, sometimes including taller, denser brushes. They are most frequent in the eastern Iberian peninsula, where characteristic shrubs include *Peganum harmala, Artemisia herba-alba, Lycium intricatum, Capparis ovata* and the Chenopodiaceae *Salsola vermiculata, Salsola genistoides, Salsola verticillata, Suaeda pruinosa, Atriplex halimus, Atriplex glauca, Camphorosma monspeliaca, Anabasis articulata* and *Haloxylon articulatum.*
(Braun-Blanquet and Bolos, 1957; Delvosalle and Duvigneaud, 1962; Freitag, 1971; Bolos, 1973; Polunin and Smythies, 1973; Rivas-Martinez, 1977b; Bellot Rodriquez, 1979; Brullo *et al.*, 1980; Peinado-Lorca *et al.*, 1984: 178; Peinado and Martinez-Parras, 1984; Géhu, 1984a; Géhu and Rivas-Martinez, 1984; Peinado Lorca and Rivas-Martinez, 1987).

15.725. Sicilian halo-nitrophilous scrubs
Halonitrophilous scrubs of southwestern Sicily, with *Salsola verticillata, Suaeda pruinosa, Reaumuria vermiculata, Capparis ovata* and the endemics *Limonium opulentum* and *Herniaria fontanesii* ssp. *empedocleana.*
(Brullo *et al.*, 1980).

15.8. Mediterranean salt steppes

Limonietalia
Associations rich in perennial, rosette-forming *Limonium spp.* or esparto grass, *Lygeum spartum*, occupying, in Mediterranean coastal regions and on the fringes of endoreic interior salt basins of arid mediterranean Iberia and North Africa, soils temporarily permeated (though not inundated) by saline water and subject to extreme summer drying, with formation of salt efflorescences. These formations constitute a Mediterranean equivalent of the more continental formations of 15.A; the communities of Aegean and eastern Mediterranean coastal saltmarshes, included here, and those of interior Anatolia and steppic North Africa, listed under 15.A, are of a somewhat intermediate character.

(Oberdorfer, 1952; Braun-Blanquet and Bolos, 1957; Wolff, 1968; Bolos, 1973; Horvat *et al.*, 1974; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Chapman, 1977a; Peinado-Lorca *et al.*, 1984; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Géhu, 1984a; Rivas-Martinez and Costa, 1984; Peinado Lorca and Rivas-Martinez, 1987).

15.81. Mediterranean sea-lavender salt steppes
Mediterranean salt steppes dominated by rosette-forming species of *Limonium.* Aegean and eastern Mediterranean coastal saltmarsh formations of *Camphorosma monspeliaca* or *Petrosimonia.*
(Oberdorfer, 1952; Braun-Blanquet and Bolos, 1957; Wolff, 1968; Bolos, 1973; Horvat *et al.*, 1974; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Chapman, 1977a; Peinado-Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Géhu, 1984a; Rivas-Martinez and Costa, 1984; Peinado Lorca and Rivas-Martinez, 1987).

15.811. Ibero-Tyrrhenian sea-lavender steppes
Communities of salt basins of Iberia and of northwestern Mediterranean coastal saltmarshes and saline dunal depressions subject to extreme summer drying, dominated by rosette-forming *Limonium.*
(Oberdorfer, 1952; Braun-Blanquet and Bolos, 1957; Wolff, 1968; Bolos, 1973; Horvat *et al.*, 1974; Castroviejo and Porta, 1975; Rivas-Martinez and Costa, 1975; Peinado-Lorca *et al.*, 1984: 176; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Géhu, 1984a; Rivas-Martinez and Costa, 1984; Peinado Lorca and Rivas-Martinez, 1987).

15.8114. Western Mediterranean sea-lavender steppes
Limonion confusi (*Limonion virgati, Statición galloprovincialis)*: *Artemisio gallicae-Limonietum virgati* (*Artemisio-Staticetum virgatae), Limoniasro-Staticetum lychnidifolae p. i.a.*
Limonium steppes of northwestern Mediterranean coastal saltmarshes and saline dunal depressions, recorded from northeastern Iberia, southern continental France, Corsica, Sardinia, Sicily, Lampedusa, the Egadi Islands, with *Limonium oleifolium* (*Limonium virgatum), Limonium girardianum, Limonium narbonense, Limonium binervosum, Limonium auriculae-ursifolium, Limonium diffusum, Limonium duriusculum, Limonium ramosissimum* and a number of threatened narrow endemics, among them *Limonium insulare, Limonium intermedium, Limonium laetum, Limonium lilybaeum, Limonium aegusae, Limonium pachynense, Limonium pseudolaetum, Limonium pulviniforme.*
(Guinochet and Vilmorin, 1973: 344, 341-346; Molinier and Martin, 1980: XLVIII; Pignatti, 1982: 302-319; Lanfranco, 1989: 26; Conti *et al.*, 1992: 296, 298, 306-313; Lorenzoni *et al.*, 1993: 127, 132, 147; Julve, 1993: 45; Corre, 1993: 373-375; Lorenzoni and Paradis, 1996: 157, 161).

16. COASTAL SAND DUNES AND SAND BEACHES

Sand-covered shorelines of the oceans, their connected seas and associated coastal lagoons, fashioned by the action of wind or waves. They include gently sloping beaches and beach-ridges, formed by sands brought by waves, longshore drift and storm waves, as well as dunes, formed by eolian deposits, though sometimes refashioned by waves.
(Vanden Berghen, 1964; Daubenmire, 1978; Rivas-Martinez *et al.*, 1980; Whittow, 1984; Walter and Breckle, 1986, 1991c; Soothill and Thomas, 1987; Clark, 1990; Mayhew and Penny, 1992; van der Maarel, 1993a, 1993b, 1993c, 1993d; Bliss, 1993; Daniels and de Molenaar, 1993; Cramer, 1993; Lundberg and Losvik, 1993; Olsson, 1993; Wojterski, 1993; Hundt and Tietze, 1993; Jensen, 1993; Boorman, 1993; Dijkema *et al.*, 1993; van der Meulen and van der Maarel, 1993; Géhu and Géhu-Franck, 1993a; Izco Sevillano, 1993; Asensi Marfil *et al.*, 1993; Garcia Novo and Merino, 1993; Asensi Marfil and Diez Garretas, 1993; Corre, 1993; Pignatti, 1993; Lovric, 1993a, 1993b, 1993c; Lavrentiades, 1993; Lovric and Uslu, 1993; Randall, 1993; Ayyad and Ghabbour, 1993; Zahran, 1993; Santos Guerra, 1993; Miyawaki and Suzuki, 1993; Archibold, 1995; Pott, 1996).

16.1. Sand beaches

Gently sloping sand-covered shorelines fashioned by wave action along the coasts of the oceans of the Palaearctic region, their connected seas and associated coastal lagoons.

16.11. Unvegetated sand beaches
Sandy beaches of the oceans of the Palaearctic region, their connected seas and associated coastal lagoons, devoid of phanerogamic vegetation. Mediolittoral (intertidal) and supralittoral invertebrate communities listed under 11.27 can be combined with 16.11 to record detailed habitats.
(Augier, 1982).

16.12. Sand beach driftline communities
Cakiletea maritimae i.a.
Formations of the coasts of the Palaearctic region, composed mostly of a few annual species, occupying accumulations of drift material and sands rich in nitrogenous organic matter, usually comprising *Cakile maritima, Salsola kali, Atriplex spp., Polygonum spp.*
(Oberdorfer, 1952: 330-331; Lavrentiades, 1963; Wolff, 1968; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Géhu and Géhu-Franck, 1984a; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Géhu, 1984a, 1985; Ellenberg, 1988; Kolbek *et al.*, 1989; Oberdorfer, 1990; Pott, 1992; Påhlsson, 1994).

16.123. Tethyan sand beach driftline communities

Cakiletea maritimae: Euphorbietalia peplis: Euphorbion peplis p., Thero-Suaedion p.
Annual communities of sand beaches of the Mediterranean, Black Sea and Mediterraneo-Atlantic coasts.
(Oberdorfer, 1952; Lavrentiades, 1963; Wolff, 1968; Horvat *et al.*, 1974; Géhu, 1984a, 1985).

16.1231. Western Tethyan sand beach annual communities
Euphorbion peplis, Thero-Suaedion p.
Annual communities of sand beaches of the Mediterranean and the subtropical Atlantic, between Portugal and the southern limit of the Mediterraneo-Saharan transition zone at 27°N.
(Oberdorfer, 1952; Lavrentiades, 1963; Wolff, 1968; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 107-108, 149; Molinier and Martin, 1980; Babalonas, 1980: 616-617; Rivas-Martinez *et al.*, 1980: 62; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b; Géhu, 1984a, 1985; Asensi Marfil and Diez Garretas, 1987: 225; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 291-292; Turland *et al.*, 1993: 10; Hohenester and Welss, 1993: 14; Paradis and Piazza, 1993: 224, 235, 243; Paradis and Piazza, 1996: 71, 87; Géhu and Biondi, 1996: 182-184; Hoda *et al.*, 1998: 4).

16.12311. Mediterraneo-Atlantic sea rocket communities
Euphorbion peplis: Salsolo-Cakiletum aegyptiacae
Sparse annual communities of weakly to moderately nitrogenated upper levels of sand beaches of the Mediterranean and of the subtropical Atlantic, from southwest Iberia to Safi in northwestern Africa, and in the Canary Islands, dominated by prostrate *Cakile maritima* ssp. *aegyptiaca,* or, in northern areas, *Cakile maritima* ssp. *maritima*, and *Salsola kali.*
(Oberdorfer, 1952; Lavrentiades, 1963; Wolff, 1968; Guinochet and Vilmorin, 1973; Knapp, 1973: 497-498; Zohary, 1973: 154; Horvat *et al.*, 1974: 107-108, 149; Vanden Berghen, 1977: 219; Babalonas, 1980: 616-617; Rivas-Martinez *et al.*, 1980: 62; Vanden Berghen, 1981: 10; Géhu and Géhu-Franck, 1984a; Géhu *et al.*, 1984b: 405-409; Géhu, 1984a, 1985; Asensi Marfil and Diez Garretas, 1987: 225; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 291-292; Turland *et al.*, 1993: 10; Hohenester and Welss, 1993: 14; Paradis and Piazza, 1993: 224, 235, 243; Asensi Marfil and Diez Garretas, 1993: 366; Pignatti, 1993: 381-387; Lavrentiades, 1993: 438; Randall, 1993: 467; Géhu and Géhu-Franck, 1993b: 187; Julve, 1993: 38; Santos Guerra, 1993: 53; Paradis and Piazza, 1996: 71, 87; Géhu and Biondi, 1996: 182-184; Hoda *et al.*, 1998: 4; Lanfranco, 1999a).

16.12313. Mediterraneo-Atlantic sand beach composite communities
Euphorbion peplis: Matricario-Euphorbietum peplis, Cakilo-Xanthietum italici, Salsolo-Xanthietum strumarii, Sporobolo-Centauretum seridis i.a.
Annual communities of sand beaches of the Mediterranean and the subtropical Atlantic dominated by, or rich in, composites, in particular, formations, mostly of the Adriatic and Aegean, dominated by the anthropogenic *Xanthium strumarium* ssp. *italicum,* formations of eastern Iberia dominated by tall knapweeds *Centaurea sonchifolia, Centaurea seridis* ssp. *maritima, Centauria aspera, Centaurea albuferae,* with *Cakile maritima* ssp. *aegyptiaca* and *Sporobolus pungens,* formations of the eastern basin dominated by *Anthemis tomentosa* (*Anthemis muenteriana)* or *Centaurea aegialophila,* communities of the western Mediterranean and the warm temperate Atlantic dominated by *Matricaria maritima.*
(Oberdorfer, 1952: 330-331; Horvat *et al.*, 1974: 123-124; Babalonas, 1980: 616-617; Rivas-Martinez *et al.*, 1980: 62; Géhu and Géhu-Franck, 1984a: 59; Géhu *et al.*, 1984b: 405-409; Costa, 1987: 291; Julve, 1993: 38; Asensi Marfil and Diez Garretas, 1993: 366; Lovric, 1993a: 407; Lavrentiades, 1993: 431-433, 438; Lovric and Uslu, 1993: 452; Turland *et al.*, 1993: 10; Hoda *et al.*, 1998: 4).

16.12314. Mediterraneo-Atlantic sand beach chenopodid communities
Euphorbion peplis: Atriplicetum hastati-tataricae, Salsolo-Euphorbietum i.a.; Thero-Suaedion p.: Suaedo splendentis-Salsoletum sodae, Suaedo splendentis-Kochietum hirsutae i.a.
Strongly nitrophile annual communities of sand beaches of the Mediterranean and of the subtropical Atlantic dominated by chenopodids, in particular, *Atriplex spp., Salsola kali, Salsola soda, Suaeda splendens, Kochia hirsuta.*
(Molinier and Martin, 1980: XLVIII; Babalonas, 1980: 616-617; Rivas-Martinez *et al.*, 1980: 62; Géhu and Géhu-Franck, 1984a: 59; Géhu *et al.*, 1984b: 405-409; Julve, 1993: 38-39; Pignatti, 1993: 381-385; Lavrentiades, 1993: 431-433, 438; Hoda *et al.*, 1998: 4).

16.2. Dunes

Onshore wind-carried sand deposits arranged in cordons of ridges parallel to the coast and often colonised and stabilised by communities of coarse maritime grasses.

16.21. Shifting dunes

Ammophiletea arenariae: Ammophiletalia arenariae: Agropyrion juncei, Ammophilion arenariae, Zygophyllion fontanesii

Mobile sands of the coasts of the boreal, nemoral, steppe, Mediterranean and warm-temperate humid zones, unvegetated or occupied by open grasslands; they may form tall dune ridges or, particularly along the Mediterranean and the Black Sea, be limited to a fairly flat upper beach, still subject in part to inundation.

(Oberdorfer, 1952, 1990; Lavrentiades, 1963; Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Diez *et al.*, 1975; Westhoff and den Held, 1975; Lahondère, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Parent and Burny, 1981; Piotrowska and Stasiak, 1982; Géhu *et al.*, 1984b; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Ellenberg, 1988; Machado, 1989; Pott, 1992; Påhlsson, 1994).

16.211. Embryonic dunes

Agropyrion juncei (*Agropyro-Honkenyion)*

Formations of the coasts of the nemoral, steppe, Mediterranean and warm-temperate humid zones of the Palaearctic region, representing the first stages of dune construction, constituted by ripples or raised sand surfaces of the upper beach or by a seaward fringe at the foot of the tall dunes.

(Oberdorfer, 1952, 1990; Lavrentiades, 1963; Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Diez *et al.*, 1975; Westhoff and den Held, 1975; Lahondère, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980: 62-65; Parent and Burny, 1981; Piotrowska and Stasiak, 1982; Géhu *et al.*, 1984b; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Ellenberg, 1988; Pott, 1992; Påhlsson, 1994).

16.2112. Western Tethyan embryonic dunes

Ammophilion australis: Sporobolenion arenarii, Sporobolo-Elymenion farcti (*Agropyrion juncei)*

Embryonic dunes of the Mediterranean coasts, on which *Elymus farctus* is accompanied by *Sporobolus pungens, Euphorbia peplis, Otanthus maritimus, Medicago marina, Anthemis maritima, Anthemis tomentosa, Eryngium maritimum, Pancratium maritimum.*

(Oberdorfer, 1952; Lavrentiades, 1963; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 107-108, 149-150; Diez *et al.*, 1975; Molinier and Martin, 1980; Babalonas, 1980: 618-619; Géhu *et al.*, 1984b; Géhu, 1985: 19, 25, 40, 56-60; Géhu, 1986; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 289; Rivas-Martinez and Costa, 1987: 497; Gamisans, 1991: 89-90; Turland *et al.*, 1993: 10; Julve, 1993: 40; Géhu and Géhu-Franck, 1993b; Paradis and Piazza, 1996: 75, 87; Géhu and Biondi, 1996: 182, 184-186).

16.21121. Western Tethyan sand couch dunes

Ammophilion australis: Sporobolo-Elymenion farcti (*Agropyrion juncei)*

Embryonic dunes of the Mediterranean coasts dominated by *Elymus farctus* (*Agropyron junceum).*

(Oberdorfer, 1952; Lavrentiades, 1963; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 107-108, 149-150; Diez *et al.*, 1975; Molinier and Martin, 1980; Babalonas, 1980: 618-619; Géhu *et al.*, 1984b; Géhu, 1985: 19, 25, 40, 56-60; Géhu, 1986; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 289; Rivas-Martinez and Costa, 1987: 497; Gamisans, 1991: 89-90; Turland *et al.*, 1993: 10; Julve, 1993: 41; Géhu and Géhu-Franck, 1993b; Piazza and Paradis, 1994: 66, 78; Paradis and Piazza, 1996: 75, 87; Géhu and Biondi, 1996: 182, 184-186).

16.211212. Northern Mediterranean sand couch dunes

Sporobolo-Elymenion farcti (*Agropyrion juncei*): *Echinophoro-Elymetum farcti* (*Agropyretum mediterraneum p.)*

Elymus farctus embryonic dunes of Tyrrhenian, Adriatic and Ionian coasts of Europe, from northeastern Iberia to the western Peloponnese, including the east coast of Corsica, and with outposts in northern Algeria, with *Echinophora spinosa* and *Anthemis maritima.*

(Demiri, 1962: 78-79; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 107-108, 149-150; Molinier and Martin, 1980; Géhu *et al.*, 1984b: 409-412; Géhu, 1985: 19, 25, 40, 56-60; Géhu, 1986; Gamisans, 1991: 89-90; Julve, 1993: 40; Géhu and Géhu-Franck, 1993b: 186; Pignatti, 1993: 380-385; Paradis and Piazza, 1996: 75, 87; Hoda *et al.*, 1998: 4; Lanfranco, 1999b; Schembri, 1999b).

16.21122. Western Tethyan *Sporobolus* dunes

Ammophilion australis: Sporobolenion arenarii, Sporobolo-Elymenion farcti (*Agropyrion juncei)*

Embryonic dunes of Mediterranean and North African Atlantic coasts dominated by *Sporobolus pungens* (*Sporobolus virginicus* ssp. *arenarius, Sporobolus arenarius)* most characteristic of the seaward fringes of embryonic dunes on arid coasts.

(Knapp, 1973: 495; Zohary, 1973: 446; Vanden Bergen, 1977: 219-224; Julve, 1993: 41; Piazza and Paradis, 1994: 66, 78; Géhu and Biondi, 1996: 182, 184-185; Pignatti, 1993: 380; Lovric and Uslu, 1993: 453, 456; Hoda *et al.*, 1998: 4; Lanfranco, 1999b; Schembri, 1999b).

16.21123. Arid Mediterranean embryonic dunes

Ammophilion australis: Sporobolo-Elymenion farcti (*Agropyrion juncei) p.*

Embryonic dunes and upper beaches of the Mediterranean coasts, most characteristic of the eastern Mediterranean, dominated by grasses, sedges or dicots of continental steppic, subdesert or subtropical affinities, adapted to the most severe conditions of aridity.

(Babalonas, 1980: 618-619; Lovric and Uslu, 1993: 453, 456; Randall, 1993: 465).

16.211231. Mediterranean *Cyperus capitatus* dunes

Embryonic dunes and upper beaches of the Mediterranean coasts dominated by *Cyperus capitatus* (*Cyperus kallii),* well developed in particular in the Aegean and the eastern Mediterranean, also present, notably, in Italy, on the Maltese Islands, in Languedoc, extinct in the Bouches-du-Rh"ne.

(Molinier and Martin, 1980: 58; Pignatti, 1982: III, 696-697; Lanfranco, 1989: 46; Lovric and Uslu, 1993: 453, 457).

16.212. White dunes

Ammophilion arenariae, Zygophyllion fontanesii

Mobile dunes forming the seaward cordon or cordons of dune systems of the coasts of the nemoral, steppe, Mediterranean and warm-temperate humid zones of the Palaearctic region.

(Oberdorfer, 1952, 1990; Lavrentiades, 1963; Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Diez *et al.*, 1975; Westhoff and den Held, 1975; Lahondère, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980: 62-65; Parent and Burny, 1981; Piotrowska and Stasiak, 1982; Géhu *et al.*, 1984b; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Ellenberg, 1988; Machado, 1989; Pott, 1992; Påhlsson, 1994; Géhu *et al.*, 1995; Géhu and Biondi, 1996).

16.2122. Western Tethyan white dunes

Ammophilion australis (*Ammophilenion arundinaceae)*

White dunes of the Mediterranean coasts and of the subtropical Atlantic coasts of Iberia and mediterranean North Africa, south to Safi at 32°N, dominated, when vegetated, by the marram grass *Ammophila arenaria* ssp. *arundinacea* (*Ammophila australis)*, accompanied by, among others, *Otanthus maritima, Echinophora spinosa, Eryngium maritimum, Euphorbia paralias, Cutandia maritima, Medicago marina, Anthemis maritima.*

(Oberdorfer, 1952: 332-333; Lavrentiades, 1963; Guinochet and Vilmorin, 1973; Knapp, 1973: 495; Horvat *et al.*, 1974; Diez *et al.*, 1975; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980: 65-67; Babalonas, 1980: 618-619; Géhu *et al.*, 1984b: 412-415; Géhu, 1985: 19, 29, 56-60; Géhu, 1986; Asensi Marfil and Diez Garretas, 1987: 225; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 289-290; Rivas-Martinez and Costa, 1987: 497; Lanfranco, 1989: 25; Gamisans, 1991: 90; Turland *et al.*, 1993: 10; Julve, 1993: 40-41; Géhu *et al.*, 1995: 102-103; Géhu and Biondi, 1996: 189; Paradis and Piazza, 1996: 75, 87; Hoda *et al.*, 1998: 4; Lanfranco, 1999b; Schembri, 1999b).

16.21222. Northern Mediterranean marram grass dunes

Ammophilion australis (*Ammophilenion arundinaceae)*: *Echinophoro spinosae-Ammophiletum australis*

Ammophila arenaria white dunes of Tyrrhenian, Adriatic and Ionian coasts of Europe, from northeastern Iberia to the western Peloponnese, including the east coast of Corsica, with *Medicago marina, Echinophora spinosa, Cutandia maritima, Anthemis maritima, Euphorbia paralias.*

(Lavrentiades, 1963; Horvat *et al.*, 1974; Molinier and Martin, 1980; Géhu *et al.*, 1984b: 412-415; Géhu, 1985: 19, 29, 56-60; Géhu, 1986; Gamisans, 1991: 90; Lanfranco, 1989: 22, 42, 43; Julve, 1993: 40-41; Lavrentiades, 1993: 435-436; Géhu *et al.*, 1995: 102-103; Paradis and Piazza, 1996: 75, 87; Hoda *et al.*, 1998: 4).

16.22. Grey dunes

Helichryso-Crucianelletea i.a.

Fixed or semifixed dunes of the coasts of the boreal, nemoral, steppe, mediterranean and warm-temperate humid zones of the Palaearctic region, with the perennial grasslands, chamaephyte-dotted grasslands, forblands, subshrub or succulent communities that stabilize them and the therophyte communities that may occupy the grassland clearings.

(Oberdorfer, 1952; Zarzycki, 1961; Lavrentiades, 1963; Braun-Blanquet *et al.*, 1972; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Diez *et al.*, 1975; Géhu and Foucault, 1977; Rivas-Martinez, 1977a; Lahondère, 1980; Molinier and Martin, 1980; Parent and Burny, 1981; Piotrowska and Stasiak, 1982; Géhu *et al.*, 1984b; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Chiappini, 1985a; Veri and Pacioni, 1985; Géhu, 1985, 1986; Peinado Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Ellenberg, 1988; Machado, 1989; Oberdorfer, 1990; Pott, 1992; Påhlsson; 1994: unit 4.1.4).

16.223. Mediterraneo-Atlantic grey dune communities

Helichryso-Crucianelletea maritimae: Helichryso-Crucianelletalia maritimae: Crucianellion maritimae: Artemisio crithmifoliae-Armerietum pungentis, Teucrio dunense-Helichrysetum decumbentis, Artemisio crithmifoliae-Armerietum welwitschi, Teucrio-Crucianelletum maritimae, Crucianelletum maritimae, Vulpio-Ephedretum distachyae, Loto-Crucianelletum maritimae, Pycnocomo rutifolii-Crucianelletum maritimae, Crucianello-Armerietum pungentis, Helichryso italici-Ephedretum distachyae, i.a.

Fixed dunes of the western and central Mediterranean and of the thermo-Atlantic coasts of Portugal, southwestern Spain and North Africa, colonized by communities mostly composed of fruticose species, with *Crucianella maritima, Artemisia crithmifolia, Armeria pungens, Armeria welwitschi, Helichrysum decumbens, Helichrysum italicum, Teucrium spp., Ephedra distachya, Pancratium maritimum.*

(Zarzycki, 1961; Braun-Blanquet *et al.*, 1972; Diez *et al.*, 1975; Rivas-Martinez *et al.*, 1980: 68-70; Molinier and Martin, 1980; Géhu *et al.*, 1984b: 415-421; Chiappini, 1985a; Veri and Pacioni, 1985; Géhu, 1985: 41, 55-60; Géhu, 1986; Asensi Marfil and Diez Garretas, 1987: 225; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 290; Rivas-Martinez and Costa, 1987: 497; Gamisans, 1991: 90-96; Julve, 1993: 48; Paradis and Piazza, 1993: 238, 243; Paradis and Piazza, 1996: 87; Hoda *et al.*, 1998: 4).

16.2232. Tyrrhenian *Crucianella* communities

Crucianellion maritimae: Crucianelletum maritimae, Teucrio dunense-Helichrysetum decumbentis (*Teucrio-Crucianelletum maritimae), Loto-Crucianelletum maritimae, Ononido-Scrophularietum minoricensis, Artemisio-Teucretum maritimi, Malcomietum parviflorae, Diantho-Corynephornetum, Vulpio-Ephedretum distachyae, Crucianello-Armerietum pungentis, Pycnocomo rutifolii-Crucianelletum maritimae, Helichryso italici-Ephedretum distachyae, Helichryso italici-Scrophularietum ramosissimae, Scrophulario ramosissimae-Crucianelletum maritimae i.a.*

Fixed dunes of the Mediterranean coasts of Spain, France, Tyhrrenian Italy, Corsica, Sardinia and Sicily, with *Crucianella maritima, Artemisia crithmifolia, Armeria pungens, Helichrysum decumbens, Helichrysum italicum, Teucrium spp., Ephedra distachya, Pancratium maritimum.*

(Zarzycki, 1961; Diez *et al.*, 1975; Molinier and Martin, 1980; Géhu *et al.*, 1984b: 415-421; Chiappini, 1985a; Veri and Pacioni, 1985; Géhu, 1985: 41, 55-60; Géhu, 1986; Alcaraz Ariza and Peinado Lorca, 1987: 274; Costa, 1987: 290; Rivas-Martinez and Costa, 1987: 497; Gamisans, 1991: 90-96; Julve, 1993: 48; Paradis and Piazza, 1993: 238, 243; Asensi Marfil and Diez Garretas, 1993: 364-367; Corre, 1993: 373-375; Pignatti, 1993: 381; Paradis and Piazza, 1996: 87).

18. SEA-CLIFFS AND ROCKY SHORES

Rock exposures adjacent to the oceans, their connected seas and associated coastal lagoons, or separated from them by a narrow shoreline. The faces, ledges and caves of sea-cliffs and the expanses of rocky shore are important as reproduction, resting and feeding sites for seabirds, sea-mammals and a few groups of terrestrial birds, composing regionally distinct assemblies listed under unit 18.1. The presence of major sea-caves can be indicated by addition of codes of unit 12.7. Sea-cliffs may also harbour highly distinctive, specialized aerohaline plant communities with associated terrestrial faunas, listed under unit 18.2. Other terrestrial plant communities may belong to units 62, 61, 31, 32, 33, 34. The mediolittoral (intertidal or wave-washed) and supralittoral (spray) zones are inhabited by rich and diverse communities of invertebrates, fish and algae that have been listed under unit 11.29.
(van der Maarel, 1993a, 1993b, 1993c, 1993d; Bliss, 1993; Daniels and de Molenaar, 1993; Cramer, 1993; Lundberg and Losvik, 1993; Olsson, 1993; Wojterski, 1993; Hundt and Tietze, 1993; Jensen, 1993; Malloch, 1993; Géhu and Géhu-Franck, 1993a; Izco Sevillano, 1993; Asensi Marfil *et al.*, 1993; Asensi Marfil and Diez Garretas, 1993; Corre, 1993; Pignatti, 1993; Lovric, 1993a, 1993b, 1993c; Lavrentiades, 1993; Lovric and Uslu, 1993; Randall, 1993; Sjögren, 1993; Santos Guerra, 1993; Miyawaki and Suzuki, 1993).

18.1. Sea-cliff faces, seaside rocks

Palaearctic hard rock sea-cliffs, their faces, ledges and associated caves, rocky shores and isolated seaside rocks, their associated seabird, sea mammal, wader and, in a few cases, terrestrial passerine, communities. The presence of vascular aerohaline vegetation should be indicated by use of the appropriate code from unit 18.2, that of mediolittoral (intertidal or wave-washed) and supralittoral (spray) zone communities of marine invertebrates, lower vertebrates and algae, by use of codes from unit 11.29. Less salt-influenced communities, in particular of units 62, 61, 31, 32, 33, 34, may contribute to the colonisation of the cliffs.
(Augier, 1982; Löfgren, 1984; Mitchell, 1987; Wood, 1988; Clark, 1990).

18.16. Mediterraneo-Pontic sea-cliffs and rocky shores
Sea-cliffs, their associated faces, ledges and caves, rocky shores and isolated rocks of the Mediterranean Sea and the Black Sea. The endangered *Monachus monachus* depends on their caves for reproduction. *Calonectris diomedea diomedea, Puffinus yelkouan mauretanicus, Puffinus yelkouan yelkouan, Phalacrocorax aristotelis desmarestii, Falco eleonorae, Larus audouinii* are characteristic breeders. Their vascular aerohaline communities, as well as the rock communities of unit 62 that colonize their less salt-influenced reaches, are particularly diverse and rich in endemics. They are indicated by combination of appropriate units of 18.2 and/or 62 with unit 18.16.
(Augier, 1982; Löfgren, 1984).

18.2. Sea-cliff and rocky shore aerohaline communities

Crithmo-Limonietea (*Juncetea maritimi p., Asteretea tripolii p.)*
Palaearctic sea-cliffs, or parts of sea-cliffs, and rocky shores colonized by disjunct assemblages of aerohaline chasmophytes or by more or less closed aerohaline grasslands with associated terrestrial invertebrate and vertebrate faunal communities.

18.22. Tethyan sea-cliff communities
Crithmo-Limonietalia
Vegetated cliffs and rocky shores of the Mediterranean, of the Black Sea and of the subtropical eastern Atlantic.
(Horvat *et al.*, 1974; Géhu, 1984a; Géhu and Géhu-Franck, 1984a: 58-59; Beeftink, 1984: 21; Polunin and Walters, 1985).

18.221. Western Tethyan sea-cliff communities
Crithmo-Limonietalia: Crithmo-Limonion: Limonietum emarginati, Crithmo-Limonietum girardiani, Crithmo-Limonietum dufourei, Crithmo-Helichrysetum decumbentis, Hippocrepido valentinae-Scabiosetum saxatilis, Teucrio flavii-Hippocrepidetum valentinae, Limonietum caprariensis, Crithmo maritimi-Limonietum cordati, Crithmo maritimi-Limonietum articulati (*Crithmo-Limonietum dictyocladi), Crithmo maritimi-Limonietum pseudominuti, Crithmo maritimi-Limonietum obtusifolii, Crithmo maritimi-Limonietum tremolsii, Crithmo maritimi-Lotetum cytisoidis, Armerietum ruscinonensis, Armerio soleirolii-Seseletum praecoci, Thymelaeo-Helichrysetum italici, Asterisco-Helichrysetum microphylli, Crithmo-Limonietum remotispiculi, Crithmo-Limonietum anfracti i.a.*
Aerohaline communities of the cliffs and rocky shores of the Mediterranean, as well as of the southwestern Iberian and northwestern African Atlantic, with *Crithmum maritimum, Plantago subulata, Silene sedoides, Sedum litoreum, Limonium spp., Armeria spp., Euphorbia spp., Daucus spp., Asteriscus maritimus.* Mediterranean sea-cliffs harbour numerous endemics of of extremely local occurrence, in particular, of genus

Limonium, which comprises at least 43 and probably closer to 120-150 Mediterranean cliff species species, many of them restricted to a few stations, and several threatened, such as, for instance, *Limonium remotispiculum* of southern Italy and *Limonium strictisissimum* of Corsica and Caprera.
(Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974: 106-107, 144, 148-149; Brullo *et al.*, 1977; Molinier and Martin, 1980; Pignatti, 1982: 302-319; Géhu, 1984a; Géhu *et al.*, 1984c; Géhu and Géhu-Franck, 1984a: 58-59; Polunin and Walters, 1985; Asensi Marfil and Diez Garretas, 1987: 227; Costa, 1987: 292-293; Rivas-Martinez and Costa, 1987: 497; Poldini, 1989: 35; Gamisans, 1991: 78-88; Conti *et al.*, 1992: 314, 315; Turland *et al.*, 1993: 10; Julve, 1993: 44-45; Foucault, 1993b: 280; Asensi Marfil *et al.*, 1993: 346-347; Garcia Novo and Merino, 1993: 359; Asensi Marfil and Diez Garretas, 1993: 363-364; Corre, 1993: 375-376; Pignatti, 1993: 388-389; Lovric, 1993a: 398-415; Lovric, 1993b: 426-427; Lavrentiades, 1993: 439-440; Lovric and Uslu, 1993: 446-452; Randall, 1993: 470-742; Hoda *et al.*, 1998: 4).

18.2217. Italo-Sicilian sea-cliff communities
Crithmo-Limonietalia: Crithmo-Limonion p.
Aerohaline communities of the cliffs and rocky shores of Calabria, Sicily, the Lipari Islands, the Egadi Islands, Pantelleria, Linosa, Lampedusa and the Maltese Islands, an area including several centers of radiation of endemic sea-lavenders, with *Limonium parvifolium, Limonium cosyrense, Limonium bocconei, Limonium syracusanum, Limonium flagellare, Limonium ponzoi, Limonium tenuiculum, Limonium minutiflorum, Limonium calabrum, Limonium ionicum, Limonium furnarii, Limonium tauromenitanum, Limonium albidum, Limonium panormitanum, Limonium lopadusanum, Limonium hyblaeum, Limonium intermedium, Limonium mazarae, Limonium divaricatum, Limonium zeraphae, Limonium virgatum* var. *majus, Limonium sibthorpianum.*
(Brullo *et al.*, 1977; Pignatti, 1982: II 302-319; Lanfranco, 1989: 26; Pignatti, 1993: 388-389; Schembri, 1999b).

18.22174. Hyblaeo-Maltese sea-cliff communities
Crithmo-Limonietalia: Crithmo-Limonion p.
Aerohaline communities of the cliffs and rocky shores of southeastern Sicily and the Maltese Islands, with the sea-lavenders *Limonium syracusanum, Limonium hyblaeum, Limonium zeraphae*, and with the Maltese endemics *Anthemis urvilleana, Allium lojaconoi*, the Hybleo-Maltese endemics *Desmazeria pignattii* and *Senecio pygmaeus.*
(Pignatti, 1982: II 302-319; Lanfranco, 1989: 26; Pignatti, 1993: 388-389; Schembri, 1999b).

19. ISLETS, ROCK STACKS, REEFS, BANKS, SHOALS

Permanently emerging, periodically uncovered, surface-breaking or near-surface raised features of the oceans, their connected seas and coastal waters, with their associated marine and terrestrial communities. The associated marine habitats can be coded by combining subdivisions of prefix 11 with the relevant physiographic subdivisions of 19, the terrestrial habitats by adding codes from units 3 and 4.
(Barnes and Hughes, 1988; Britton and Morton, 1989; Clark, 1990).

19.1. Lithogenic rock stacks and islets

Small islands in the sea or coastal waters of the Palaearctic region, mostly important as sites for seabird colonies.
(Turland *et al.*, 1993: 10-11).

19.2. Surface and underwater rocks

Palaearctic lithogenic reefs, raised rocky features of the continental shelf and its inshore waters, covered by shallow water or reaching and breaking the surface, or uncovered by tides or strong wave action.

19.3. Barrier islands, spits

Palaearctic spits, barrier beaches, barrier islands, tombolos, features formed of sands and gravels deposited by longshore drift in narrow ridges attached to the land at one end and extending into the sea at the other, or separated from land by channels and lagoons, or linking an offshore island to the coast.
(Géhu, 1985; Clark, 1990).

19.4. Banks and shoals

Deposits of muds, sands or gravels of the continental shelf permanently covered by shallow (banks), or very shallow (shoals), water of the Palaearctic region.
(Clark, 1990).

19.6. Seamounts and guyots

Elevated features of the floor of the oceans and their connected seas (unit 11.214) raising close enough to the surface to create neritic conditions.
(Pautot, 1983: 84-85; Barnes and Hughes, 1988; Clark, 1990).

2. NON-MARINE WATERS

All inland and landlocked waters of natural origin, standing or flowing, saline, brackish or fresh, and the aquatic or amphibious, nonmarine, communities associated with them; seminatural aquatic communities occupying manmade water bodies. Included are coastal lagoons, freshwater lakes, ponds or pools, the waters of athalassal saline, hypersaline or brackish pools, lakes and inland seas, permanent or temporary streams and rivers.

21. COASTAL LAGOONS

Saline or hypersaline waters of the vicinity of the oceans and their connected seas, often formed from sea inlets by silting and cut off from the sea by more or less effective obstacles such as sand or mud banks. The presence of benthic marine invertebrate communities or vegetation can be indicated by combination of codes from units 11.2, 11.3 or 11.4 with the relevant physiographic subdivisions of unit 21; the presence of benthic communities of athalassal affinities can similarly be indicated by addition of codes of units 23.12, 23.13 or 23.14, that of benthic or floating athalassal macrophytes by use of codes of unit 23.2.
(Wood, 1988; Clark, 1990; Hollis and Jones, 1991; Britton and Crivelli, 1993; Einarsson, 1994; Gudmundsson and Kjartansson, 1996).

21.1. Sea-connected lagoons

Coastal lagoons incompletely closed off from the sea, communicating with it through a channel or channels, such as those between barrier islands or around or through a barrier beach.
(Clark, 1990; Gastescu and Oltean, 1997).

21.2. Isolated lagoons

Coastal lagoons closed off from the sea, without communicating channels sufficient to allow significant water passage.
(Clark, 1990).

21.3. Percolation pools

Coastal water bodies fed by the seeping of sea water.
(Clark, 1990).

21.4. Silled or sluiced ponds

Water bodies separated from the sea by sills or sluices that regulate their communication, often limiting it to entry by waves, high tides or storms.
(Clark, 1990).

21.6. Coastal lagoon islets

Small islands in large coastal bodies of saline water, mostly important as sites for waterbird colonies. Associated terrestrial habitats can be indicated by addition of codes from units 3 and 4.
(Clark, 1990).

22. STANDING FRESHWATER

Lakes, ponds and pools of natural origin containing fresh (*i.e.* nonsaline) or slightly brackish water. Seminatural aquatic communities occupying manmade freshwater bodies, including artificially created lakes, reservoirs and canals.
(Ellenberg, 1963, 1988; Nicholson, 1977; Duvigneaud, 1980; Vanden Berghen, 1982; Walter and Breckle, 1986, 1991c; Burgis and Morris, 1987; Lowe-McConnell, 1987; Clark, 1990; Jung, 1990; Denny, 1993a; Britton and Crivelli, 1993).

22.2. Temporary freshwater bodies

Freshwater lakes, ponds, pools, or parts of such freshwater bodies, which become periodically dry, with their associated animal, green algal or lower algal pelagic (units 22.21 - 22.25) and benthic (units 22.26, 22.27) communities. The macrophytic-based amphibious communities that may colonize them are separately listed under unit 22.3, terrestrial communities that may develop during their dry phase under unit 22.5, drawdown resistant euhydrophyte communities under unit 22.2, fringing belts or island rafts of rooted or floating tall emergent vegetation under unit 53. Permanently or almost permanently emerged features supporting terrestrial communities influenced by the presence of the water body are included in unit 22.6. Grasslands, shrublands and woodlands which may at times be inundated but in which semicontinuous formations of grasses, shrubs or trees emerge at all times above the standing water surface are listed under units 37, 3A, 44 and 4A, not under unit 22.2.
(Jung, 1990; Britton and Crivelli, 1993; Semeniuk and Semeniuk, 1995).

22.25. Lime-rich oligo-mesotrophic temporary waterbodies
Temporary lakes and pools with mostly blue to greenish, very clear, waters, poor (to moderate) in nutrients, base-rich (pH often > 7.5).
(Jung, 1990; Schembri, 1989; Lanfranco and Schembri, 1989: 130; Lanfranco, 1999a, 1999b; Schembri, 1999b, 1999c).

22.26. Lake muds, sands and shingles
Unvegetated lake-bottoms or lake-shores temporarily exposed by artificial or natural fluctuations of the water level, often important as feeding grounds for migrating waders. Unvegetated lacustrine beaches, formed by wind or wave action.
(Jung, 1990).

22.27. Temporary waterbody benthic communities
Benthic communities developed in the wet phase of the cycle of temporary lakes and pools.
(Lanfranco, 1999b).

22.3. Amphibious macrophyte communities

Macrophytic communities adapted to an alternance of emergence and complete submersion, colonizing lake bottoms or lake shores subjected to temporary exposure (unit 22.2) and other periodically or occasionally inundated muddy, sandy or stony basins. They include communities of annuals developing during the exposure phase as well as communities of perennials susceptible of temporary total immersion. Communities of prostrate plants adapted to alternances of floating on shallow water and creeping on wet muds are listed under unit 22.432, as shallow water floating communities.

22.34. Mediterraneo-Atlantic amphibious communities
Isoetetalia
Perennial and annual communities of mediterranean, thermo-Atlantic and Macaronesian temporary ponds and river banks.
(Oberdorfer, 1952; Bolos and Molinier, 1958; Braun-Blanquet, 1967a; Wolff, 1968; Aubert and Loisel, 1971; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Bellot Rodriguez, 1979; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Harant and Jarry, 1983; Géhu, 1984a; Peinado Lorca *et al.*, 1984: 175; Ladero *et al.*, 1984; Britton and Crivelli, 1993).

22.341. Short Mediterranean amphibious swards
Isoetetea velatae: Isoetetalia velatae
Formations of Mediterranean, thermo-Atlantic and Macaronesian entirely or partially summer-dry ponds, pools and ditches with *Isoetes spp., Marsilea quadrifolia, Marsilea strigosa, Pilularia globulifera, Pilularia minuta, Mentha pulegium, Lythrum hyssopifolia s.l., Trifolium filiforme, Peplis erecta, Teucrium cravense, Serapias lingua, Juncus bufonius, Juncus capitatus, Juncus pygmaeus, Juncus fasciculatus, Scirpus savii,* sometimes (rocky edges of fast rivulets), *Spiranthes aestivalis* and *Anagallis tenella.*
(Guinochet and Vilmorin, 1973: 54; Géhu, 1984a: 12; Peinado Lorca *et al.*, 1984: 175; Gamisans, 1991; Jahn and Schönfelder, 1995: 23).

22.3411. Terrestrial quillwort communities

Isoetetea velatae: Isoetetalia velatae: Ophioglosso lusitanici-Isoetion histricis p.: Isoetetum durieui, Chamaemelo nobilis-Isoetetum histricis, Romuleo columnae-Isoetetum histricis
Isoetes histrix, Isoetes durieui formations of Mediterranean ephemeral waters.
(Lanfranco, 1989: 8; Gamisans, 1991: 167-169; Julve, 1993: 12).

22.3414. Mediterranean small galingale swards
Mediterranean and thermo-Atlantic formations dominated by *Cyperus fuscus, Cyperus flavescens* or *Cyperus michelianus.*
(Molinier and Martin, 1980: XLII; Lanfranco, 1989: 47).

22.3418. Mediterranean amphibious small herb communities
Formations of Mediterranean temporarily inundated or wet terrain, including karstic pools, often highly ephemereal, dominated by annual small herbs, among which *Elatine spp.* (*Elatine macropoda, Elatine gussonei, Elatine pedunculata*), *Damasonium bourgaei, Nananthea perpusilla, Morisia monanthos, Radiola linoides, Myosurus minimus, Laurentia gasparrinii.*
(Molinier and Martin, 1980: XLII; Pignatti, 1982: II 136-137; Lanfranco, 1989: 24, 36; Gamisans, 1991: 126-127, 219; Lanfranco, 1999a, 1999b).

22.3419. Mediterranean dwarf *Scirpus* swards
Formations of the Mediterranean basin occupying temporarily inundated or wet terrain, dominated by small club-rushes of section *Isolepis* (*Scirpus setaceus, Scirpus pseudosetaceus, Scirpus cernuus).*
(Molinier and Martin, 1980: XLII, 57; Lanfranco, 1989: 47).

22.343. Mediterranean amphibious crypsis swards
Heleochloion
Slighly halophile and nitrophile post-estival vegetation of temporarily inundated terrains, with *Crypsis schoenoides, Crypsis aculeata, Crypsis alopecuroides* and *Centaurium spicatum.*
(Géhu, 1984a: 12; Peinado Lorca *et al.*, 1984: 175; Lanfranco, 1989: 43; Lanfranco, 1999a, 1999b).

22.4. Lacustrine euhydrophyte communities

Communities of permanent or semipermanent fresh or slightly brackish lakes, ponds, pools or canals of the Palaearctic realm formed by free-floating, floating-leaved rooted, or submerged macrophytes and their associated epiphytic biocoenoses. Tall emergent-dominated formations, rooted in the substratum or constituting soil-retaining floating islands, are excluded and listed in unit 53.
(Denny, 1993a).

22.41. Free-floating vegetation
Lemnion minoris, Hydrocharition
Free-floating surface communities of more or less nutrient-rich waters of the Palaearctic realm.
(Ellenberg, 1963, 1988; Bodrogkozy, 1965; Holub *et al.*, 1967; Podbielkowski,1968; Duvigneaud, 1972; Guinochet and Vilmorin, 1973; Krzywanski, 1974; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Noirfalise and Dethioux, 1977; Rivas-Martinez *et al.*, 1980; Vanden Berghen, 1982; Margot, 1983; Moravec *et al.*, 1983; Peinado Lorca *et al.*, 1984: 174; Géhu, 1984a; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ochyra, 1985; Moravec, 1986; Oberdorfer, 1990, 1992a; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Pott, 1992; Schratt, 1993; Påhlsson, 1994).

22.411. Duckweed covers
Lemnion minoris: Lemnetum gibbae, Lemno-Spirodeletum polyrhizae, Lemnetum minoris, Lemnetum trisulcae, Wolffio-Lemnetum gibbae, Wolffietum arrhizae, Lemno-Azolletum carolinianae, Lemno-Azolletum filiculoidis, Riccietum rhenanae, Ricciocarpetum natantis i.a.
Free-floating surface communities of duckweed (*Lemna, Spirodela, Wolffia),* small ferns (*Azolla)* or liverworts (*Riccia, Ricciocarpus)* of Palaearctic waters.
(Lebrun *et al.*, 1949: unit 55; Horvat *et al.*, 1974: 181-182, 221, 272, 404; Moravec *et al.*, 1983: 17-18; Margot, 1983: 209-210; Peinado Lorca *et al.*, 1984: 174; Nordiska ministerradet, 1984: units 6.2.1.3 *p.*, 6.3.2.1 *p.;* Matuszkiewicz, 1984: 57; Scohy *et al.*, 1987: 132; Delescaille, 1987: 68-71; Poldini, 1989: 121, 125; Scohy and Philippart, 1990; Oberdorfer, 1990: 25; Korotkov *et al.*, 1991: 13; Pott, 1992: 39-43, 44; Oberdorfer, 1992a; Schratt, 1993: 31-38; Moureau *et al.*, 1993; Hohenester and Welss, 1993: 13; Påhlsson, 1994: units 6.2.1.3 *p.*, 6.3.2.1 *p.*, 6.5.1.1; Klein *et al.*, 1997; Seliskar, 1998; Hoda *et al.*, 1998: 5).

22.42. Rooted submerged vegetation
Rotamogetonetea pectinati: Potamogetonetalia pectinati: Potamogetonion pectinati (*Potamion)*
Formations of Palaearctic water bodies constituted by submerged, rooted, perennial phanerogams with often emerging flower spikes, in particular entirely immersed pondweeds of genus *Potamogeton.*

(Ellenberg, 1963, 1988; Holub *et al.*, 1967; Duvigneaud, 1972; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Brasseur *et al.*, 1977; Bellot Rodriguez, 1979; Bournérias, 1979, 1984; Margot, 1983; Moravec *et al.*, 1983; Géhu, 1984a; Peinado Lorca *et al.*, 1984; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ochyra, 1985; den Held, 1985; Moravec, 1986; Delescaille, 1987; Oberdorfer, 1990, 1992a; Elias *et al.*, 1991; Palmer *et al.*, 1992; Pott, 1992; Schratt, 1993; Påhlsson, 1994).

22.422. Small pondweed communities

Rotamogetonetea pectinati: Potamogetonetalia pectinati: Potamogetonion pectinati p. (*Parvopotamion)*: *Potamogetonetum mucronati, Potamogetonetum trichoidis, Potamogetonetum filiformis p., Potamogetonetum acutifolii, Potamogetonetum obtusifolii, Potamogetonetum pectinati, Potamogetonetum nitentis, Najadetum minoris, Najadetum marinae, Najadetum intermediae, Elodeetum canadensis, Ranunculo circinati-Myriophylletum spicati, Zannichellietum palustris, Zannichellietum polycarpae; Nymphaeion albae: Hydrilletum verticillati, Potamogeto-Najadetum, Potamogeto-Vallisnerietum, Ceratophyllo-Potamogetonetum crispi i.a.*

Formations of smaller pondweeds, in particular, *Potamogeton crispus, Potamogeton filiformis, Potamogeton pusillus, Potamogeton obtusifolius, Potamogeton berchtoldii, Potamogeton trichoides, Potamogeton acutifolius, Potamogeton pectinatus, Potamogeton nitens, Potamogeton friesii* (*Potamogeton mucronatus), Groenlandia densa*, waterthymes and waterweeds (*Elodea spp., Hydrilla spp., Ottelia spp.),* horned pondweeds (*Zannichellia palustris s.l.),* naiads (*Najas spp.),* tapegrass (*Vallisneria spiralis),* water crowfoots (*Ranunculus circinatus)* that colonize shallower, more sheltered Palaearctic waters. Eurasian formations dominated by usually free-floating hornworts of genus *Ceratophyllum*, in particular by *Ceratophyllum demersum*, are included because of closer ecological and physiognomic similarity with communities of this unit than with those of unit 22.41.

(Lebrun *et al.*, 1949: units 56, 58; Ellenberg, 1963, 1988; Holub *et al.*, 1967; Vanden Berghen, 1969b: 75; Duvigneaud, 1972; Horvat *et al.*, 1974: 182, 222, 272, 404; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Brasseur *et al.*, 1977; Bellot Rodriguez, 1979; Bournérias, 1979; Margot, 1983; Moravec *et al.*, 1983; Géhu, 1984a; Peinado Lorca *et al.*, 1984: 174; Nordiska ministerradet, 1984: unit 6.3.2.2; Matuszkiewicz, 1984: 72-73, 135-138; Bournérias, 1984: 133-135; Ochyra, 1985; den Held, 1985: 43; Moravec, 1986; Van Wijk and Verbeek, 1986; Delescaille, 1987: 70; Scohy *et al.*, 1987; Poldini, 1989: 115, 125-128; Lanfranco, 1989: 37; Scohy and Philippart, 1990; Oberdorfer, 1990: 35; Elias *et al.*, 1991; Korotkov *et al.*, 1991: 16-19; Palmer *et al.*, 1992; Pott, 1992: 57-61; Oberdorfer, 1992a; Schratt, 1993; Moureau *et al.*, 1993; Påhlsson, 1994: unit 6.3.2.2; Schubert *et al.*, 1995: 201-203; Seliskar, 1998; Hoda *et al.*, 1998: 5; Kristinsson, 1998: 178-181; Micevski, 1999).

22.43. Rooted floating vegetation

Rotamogetonetea pectinati: Potamogetonetalia pectinati: Nymphaeion albae, Potamogetonion pectinati p., Ranunculion fluitantis p.; Littorelletea: Littorelletalia: Hydrocotylo-Baldellion p.

Formations of Palaearctic waters dominated by rooted aquatic plants with floating leaves.

(Ellenberg, 1963, 1988; Holub *et al.*, 1967; Zohary, 1973; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Noirfalise and Dethioux, 1977; Brasseur *et al.*, 1977, 1978; Bournérias, 1979, 1984; Bellot Rodriguez, 1979; Margot, 1983; Moravec *et al.*, 1983; Géhu, 1984a; Peinado Lorca *et al.*, 1984; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ochyra, 1985; Moravec, 1986; Oberdorfer, 1990: 35; Elias *et al.*, 1991; Palmer *et al.*, 1992; Oberdorfer, 1992a; Pott, 1992; Schratt, 1993: 71-75; Påhlsson, 1994).

22.432. Shallow-water floating communities

Rotamogetonetea pectinati: Potamogetonetalia pectinati: Ranunculion aquatilis (*Nymphaeion albae p., Ranunculion fluitantis p.)*; *Littorelletea: Littorelletalia: Hydrocotylo-Baldellion p.*

Communities of Palaearctic waters dominated by water starworts (*Callitriche),* water crowfoots (*Ranunculus spp.*, subgenus *Batrachium)* or water violet (*Hottonia palustris),* characteristic mostly of shallow waters with fluctuating water levels, susceptible to occasional drying.

(Ellenberg, 1963, 1988; Holub *et al.*, 1967; Zohary, 1973; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Noirfalise and Dethioux, 1977; Brasseur *et al.*, 1977, 1978; Bournérias, 1979, 1984; Bellot Rodriguez, 1979; Margot, 1983: 210; Moravec *et al.*, 1983: 22-23; Géhu, 1984a; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ochyra, 1985; Moravec, 1986; Oberdorfer, 1990; Elias *et al.*, 1991; Palmer *et al.*, 1992; Oberdorfer, 1992a; Pott, 1992; Schratt, 1993; Påhlsson, 1994).

22.4322. Water starwort communities

Ranunculion aquatilis (*Nymphaeion albae p., Ranunculion fluitantis p.)*: *Veronico beccabungae-Callitrichetum stagnatilis p., Callitrichetum obtusangulae p., Batrachio trichophylli-Callitrichetum cophocarpae p. i.a.*

Communities of shallow stagnant Palaearctic waters with fluctuating water levels, susceptible to drying, dominated by *Callitriche spp.*

(Ellenberg, 1963, 1988; Horvat *et al.*, 1974: 272; Westhoff and den Held, 1975; Rivas-Martinez, 1975c; Noirfalise and Dethioux, 1977; Duvigneaud and Schotsman, 1977: 13-21; Bournérias, 1979, 1984; Margot, 1983: 210; Moravec *et al.*, 1983: 23; Nordiska ministerradet, 1984: units 6.3.2.5, 6.3.2.5a; Matuszkiewicz, 1984: 72; Moravec, 1986; Delescaille, 1987: 70; Lanfranco, 1989: 29; Oberdorfer, 1990: 34-35; Oberdorfer, 1992a; Pott, 1992; Schratt, 1993: 61-62; Påhlsson, 1994: units 6.3.2.5, 6.3.2.5a; Mossberg *et al.*, 1995: 372-373; Kristinsson, 1998: 186-189).

24. RUNNING WATER

All rivers and streams, permanent or temporary, fresh or saline, including rivers, streams, brooks, rivulets, rills, torrents, wadis or oueds, waterfalls, cascades and rapids.
(Ellenberg, 1963, 1988; Whitten and Brooks, 1972; Lelek, 1980; Haslam and Wolseley, 1981; Holmes, 1983; Haslam, 1987; Clark, 1990; Schubert, 1991; Summerfield, 1991; Leser, 1994; Einarsson, 1994; Waugh, 1995; Cummins *et al.*, 1995; Petersen *et al.*, 1995; Ladle and Westlake, 1995; Billen *et al.*, 1995; Sabater *et al.*, 1995; Statzner and Kohmann, 1995; Cattaneo *et al.*, 1995; Bogatov *et al.*, 1995; Dudgeon, 1995; Gudmundsson and Kjartansson, 1996).

24.1. Rivers and streams

Flowing water courses of the Palaearctic region, permanent or temporary, and their associated animal and microscopic algae pelagic and benthic communities. Rivers, streams, brooks, rivulets, rills, torrents, wadis or oueds, waterfalls, cascades and rapids are included. The macrophytic, euhydrophytic communities that colonize them are separately listed under unit 24.4. Features of the river bed, uncovered by low water or permanently emerging, such as gravel, sand, mud or rock islands and bars are listed under units 24.2, 24.3, 24.5 and 24.6. The macrophytic amphibious communities and the terrestrial communities that may develop on them are listed under the relevant sections when specific to watercourses, are otherwise indicated by codes from units 15, 22.3, 3 or 4. The fringing belts of tall or short emergent vegetation are listed under unit 53, the spring vegetation under unit 54.1, the riverside veils of tall herbs and lianas under unit 37.71, riverine arbustive and arborescent vegetation under unit 44. The subdivisions of this unit are based on slope, width and water temperature, according to usual ichthyological practice. Classifications based on flora, such as that of Holmes (1983) for British streams, give broadly similar results. For each of the divisions below, subdivisions can be introduced to take into account regional characteristics, as well as the morphodynamics of the stream, as proposed, for instance, by Malavoi (1989).
(Ellenberg, 1963, 1988; Whitten and Brooks, 1972; Lelek, 1980; Haslam and Wolseley, 1981; Philippart and Vranken, 1983; Holmes, 1983, 1992; Haslam, 1987; Malavoi, 1989; Clark, 1990; Schubert, 1991; Summerfield, 1991; Leser, 1994: 141-142; Einarsson, 1994; Waugh, 1995: 50-89; Cummins *et al.*, 1995; Petersen *et al.*, 1995; Ladle and Westlake, 1995; Billen *et al.*, 1995; Sabater *et al.*, 1995; Statzner and Kohmann, 1995; Cattaneo *et al.*, 1995; Bogatov *et al.*, 1995; Dudgeon, 1995; Gudmundsson and Kjartansson, 1996).

24.11. Springs and rivulets
Gushing springs (rheocrenes), spring basins (limnocrenes), seepages (helocrenes) and crenal streams, rivulets formed in and near the source area of streams, characterized by high stability of temperature, near the annual average of the ground water, best developed in mountain situations. The presence of specialized vegetation associated with the spring is indicated by use of divisions of unit 54.1.
(Schembri, 1989: 76; Schubert, 1991; Leser, 1994: 261).

24.16. Intermittent streams
Palaearctic watercourses of which the flow is interrupted for part of the year, leaving a dry bed or pools; conditions during the period of flow can be indicated by one of the previous codes.
(Whitten and Brooks, 1972; Clark, 1990; Schubert, 1991; Einarsson, 1994: 143; Lanfranco, 1999a, 1999b; Schembri, 1999b, 1999c).

24.5. River muds and silts
Silt and mud deposits of Palaearctic streams, with the communities that occupy them.
(Ellenberg, 1963, 1988; Clark, 1990; Schubert, 1991; Summerfield, 1991; Leser, 1994; Einarsson, 1994; Waugh, 1995; Cummins *et al.*, 1995; Petersen *et al.*, 1995; Ladle and Westlake, 1995; Billen *et al.*, 1995; Sabater *et al.*, 1995; Statzner and Kohmann, 1995; Cattaneo *et al.*, 1995; Bogatov *et al.*, 1995; Dudgeon, 1995; Gudmundsson and Kjartansson, 1996).

24.53. Mediterranean river mud communities
Raspalo-Agrostidion
Nitrophilous annual and perennial grass and sedge formations of the alluvial banks of Mediterranean permanent or temporary water courses, most characteristic of great Mediterranean rivers, with *Paspalum paspalodes, Paspalum vaginatum, Polypogon viridis* (*Agrostis semiverticillata), Cyperus fuscus, Catabrosa aquatica.*
(Guinochet and Vilmorin, 1973; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Alcaraz Ariza and Peinado Lorca, 1987; Lanfranco, 1989: 43).

3. SCRUB AND GRASSLAND

Shrub-, grass- or forb-dominated communities constituting either zonal climax communities under nondesert climates unsuitable for forest, or zoogenic or anthropogenic, regressive or progressive, transitional stages in forest successions on well-drained, seasonally inundatable or poorly drained but nonmarshy soils. Included are deciduous, ericaceous, sclerophyllous or lauriphyllous shrub communities of boreal, temperate, mediterranean,

tropical and high mountain climates, steppes, alpine and other orogenous grasslands, secondary dry, mesophile or humid grasslands and forblands of boreal, temperate, mediterranean and tropical climates, shrub and grass communities of permafrost.

31. TEMPERATE HEATH AND SCRUB

Shrub communities of nemoral affinities. They include winter-deciduous scrubs or brushes of the subarctic, subantarctic, nemoral, steppe, warm-temperate humid and mediterranean zones, ericoid or coniferous scrubs of the subarctic, subantarctic, nemoral, steppe and warm-temperate humid zones and scrubs, heaths, cushion-heaths or brushes of the cold, extrasylvatic or supradesertic altitude belts of subarctic, subantarctic, nemoral, mediterranean and subtropical high mountains. In the Palaearctic realm, Atlantic heaths, high montane and boreomontane heaths and conifer scrubs, subalpine bush communities, oro-Mediterranean and Irano-Turanian tragacanthic communities, deciduous forest and temperate conifer forest recolonisation communities belong to this unit.
(Ellenberg, 1963, 1988; Steindorsson, 1966; Hadac, 1972, 1985a; Gimingham, 1972; Zohary, 1973; Horvat *et al.*, 1974; Ozenda, 1985; Westhoff and den Held, 1975; Noirfalise and Vanesse, 1976; Rivas-Martinez, 1979; Bournérias, 1979, 1984; Specht, 1979a; Gimingham *et al.*, 1979; Vanden Berghen, 1982; Rivas-Martinez *et al.*, 1984b; Polunin and Walters, 1985; Walter and Breckle, 1986, 1991b, 1991c; Webb, 1986; Peinado Lorca and Rivas-Martinez, 1987; Oberdorfer, 1992a, 1992b, 1993a; Wirth, 1993; Påhlsson, 1994).

31.8. Western Palaearctic temperate thickets

Rrunetalia, Cytisetalia scopario-striati, Epilobietea angustifolii
Pre- and postforest formations, mostly deciduous, of Atlantic, sub-Atlantic or subcontinental affinities, characteristic of the western Palaearctic deciduous forest zone, but also colonizing cool, moist or disturbed stations of the mediterranean evergreen forest zone.
(Lebrun *et al.*, 1949; Tüxen and Oberdorfer, 1958; Jakucs, 1960; Ellenberg, 1963, 1988; Zohary, 1973; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Gruber, 1978; Bournérias, 1979, 1984; Soo, 1980; Sanda *et al.*, 1980; Noirfalise *et al.*, 1980; Vanden Berghen, 1982; Moravec *et al.*, 1983; Rivas-Martinez *et al.*, 1984b; Matuszkiewicz, 1984; Peinado Lorca and Rivas-Martinez, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andrés and Valle Gutiérrez, 1987; Peinado Lorca and Martinez Parras, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990, 1992b, 1994; Jonglet, 1990; Salomez, 1990; Gamisans, 1991; Bondev, 1991; Coldea, 1991; Rodwell, 1991a; Wirth, 1993).

31.8A. Tyrrhenian sub-Mediterranean deciduous thickets
Mostly deciduous shrubs and hedges, often tall, luxuriant and rich in lianas, of submediterranean areas and moist stations in mediterranean areas of peninsular Italy, Sicily, Sardinia and Corsica.
(Pignatti, 1982; Chiappini, 1985a, 1985b; Gamisans, 1985, 1991).

31.8A2. Italo-Sicilian sub-Mediterranean deciduous thickets
Mostly deciduous shrubs and hedges of submediterranean areas and moist stations in mediterranean areas of the Italian peninsula and Sicily with *Rubus ulmifolius, Rosa sempervirens, Rosa arvensis, Pyrus amygdaliformis, Pyrus communis, Malus sylvestris, Amelanchier ovalis, Cotoneaster integerrimus, Cotoneaster nebrodensis, Pyracantha coccinea, Crataegus monogyna, Crataegus laciniata, Prunus spinosa, Prunus cocomilia, Prunus mahaleb, Coriaria myrtifolia, Cotinus coggygria, Pistacia terebinthus, Euonymus europaeus, Paliurus spina-christi, Rhamnus catharticus, Lonicera xylosteum, Lonicera etrusca.*

32. SCLEROPHYLLOUS SCRUB
Evergreen sclerophyllous or lauriphyllous shrub communities of mediterranean or warm-temperate humid affinities, occurring mostly in the Mediterranean, Macaronesian, Ponto-Hyrcanian and Sino-Japanese regions as recolonisation and degradation stages of broad-leaved evergreen forests, but irradiating into deciduous forest areas in supra-Mediterranean levels and in parts of the nemoral region, into steppe areas in the Irano-Anatolian and Saharo-Mediterranean zones, and into desert areas in northwest Africa. Included are coarse erme communities of similar structure and genesis and syntopic occurrence.
(Duvigneaud, 1953; Rivas-Goday and Rivas-Martinez, 1968; Knapp, 1973; Zohary, 1973; Rivas-Martinez, 1974a, 1979; Horvat *et al.*, 1974; Daubenmire, 1978; Walter, 1979; Specht, 1979a; di Castri, 1981; Margaris, 1981; Quézel, 1981b; Tomaselli, 1981a, 1981b; Walter and Breckle, 1986, 1991c; Peinado Lorca and Rivas-Martinez, 1987; Dallman, 1998).

32.1. Arborescent matorral

Quercetalia ilicis, Pistacio-Rhamnetalia alaterni i.a.
Pre- or post-forest evergreen sclerophyllous or lauriphyllous communities of mediterranean or warm-temperate humid affinities with a more or less dense, broken or low arborescent cover and with a usually thick, high evergreen shrub stratum. They are mostly degradation or reconstitution stages of the broad-leaved evergreen forests (45) or their substitution, intermediate between them and maquis (32.2 to 32.5); some are substitution stages of thermophilous deciduous (41) or conifer (42) forests.
(Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a).

32.11. Evergreen oak matorral
Mediterranean and sub-Mediterranean arborescent matorral organized around evergreen oaks. Dense, low, coppice-like Mediterranean and sub-Mediterranean woods of evergreen oaks.
(Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; Chiappini, 1985a).

32.113. Calciphile western Mediterranean oak matorral
Arborescent matorral of calcareous substrates of the western Mediterranean dominated by *Quercus ilex*, *Quercus rotundifolia* or *Quercus coccifera.* For *Quercus ilex* or *Quercus rotundifolia* matorrals, detailed habitats can be coded by placing at the fourth, fifth and sixth decimal places of 32.113 the second, third and fourth digits after the decimal point of 45.3 that characterize the corresponding evergreen oak forest. For Italian *Quercus coccifera* formations, use 32.1135.
(Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; Chiappini, 1985a; Lanfranco, 1999a; Schembri, 1999b).

32.12. Olive and lentisc matorral
Thermo-mediterranean or thermo-Canarian arborescent matorrals with *Olea europaea* var. *sylvestris, Olea europaea* ssp. *cerasiformis, Ceratonia siliqua, Pistacia lentiscus, Pistacia atlantica* or *Myrtus communis,* degradation or colonisation stages of forests of unit 45.1.
(Bolos *et al.*, 1970; Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; White, 1983: 158; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Rivas-Martinez and Costa, 1987; Serrada *et al.*, 1988).

32.121. Olive arborescent matorral
Thermo-Mediterranean arborescent matorrals dominated by *Olea europaea* var. *sylvestris,* degradation or colonisation stages of forests of unit 45.11.
(Bolos *et al.*, 1970; Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; White, 1983: 158; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Rivas-Martinez and Costa, 1987; Lanfranco, 1999a; Schembri, 1999b).

32.122. Carob arborescent matorral
Thermo-Mediterranean arborescent matorrals dominated by *Ceratonia siliqua,* degradation or colonisation stages of forests of unit 45.12.
(Lanfranco, 1999a; Schembri, 1999b).

32.123. Lentisc arborescent matorral
Thermo-Mediterranean arborescent matorrals dominated by tall *Pistacia lentiscus.*
(Bolos *et al.*, 1970; Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; White, 1983: 158; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Rivas-Martinez and Costa, 1987; Lanfranco, 1999a; Schembri, 1999b).

32.14. Pine matorral
Mediterranean and sub-mediterranean sclerophyllous brush and scrub dotted by pines. Mixed dominance can be indicated by combination of codes.
(Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; Polunin and Walters, 1985).

32.143. Aleppo pine arborescent matorral
Arborescent matorrals dominated by *Pinus halepensis.*
(Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Quézel, 1981b; Tomaselli, 1981a; Polunin and Walters, 1985; Hoda *et al.*, 1998: 13; Lanfranco, 1999a; Schembri, 1999b).

32.15. Arbor-vitae matorral
Thermo-mediterranean, meso-mediterranean or sub-mediterranean arborescent matorral of North Africa, the Maltese Islands and southern Spain dominated by *Tetraclinis articulata.*
(Quézel and Santa, 1962; Gounot and Schoenenberger, 1967; Le Houérou, 1969; Herbauts, 1973; Knapp, 1973: 481-483; Templado, 1974; Tomaselli, 1981b; White, 1983: 154).

32.153. Maltese arbor-vitae matorral
Thermo-mediterranean or meso-mediterranean arborescent matorral of the Maltese Islands dominated by *Tetraclinis articulata.*
(Knapp, 1973: 481-483; Stevens, 1998, 1999b; Lanfranco, 1999a).

32.18. European laurel matorral
Humid arborescent matorral with tall laurel (*Laurus nobilis)* developed locally in Sardinia, Sicily, the Maltese Islands, Campania, in particular.
(Fenaroli, 1970; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Lanfranco, 1989: 15; Lanfranco, 1999a).

32.2. Thermo-Mediterranean shrub formations

Ristacio-Rhamnetalia alaterni: Oleo-Ceratonion, Asparago-Rhamnion oleoidis, Periplocion angustifoliae, Rhamno-Quercion cocciferae p., Juniperion lyciae p., Ceratonio-Rhamnion: Phlomidetalia purpureae: Anthyllidetalia terniflorae: Calluno-Ulicetalia: Stauracanthenion boivinii, Ericenion umbellatae p.: Lavanduletalia stoechidis: Stauracantho genistoidis-Halimion halimifolii, Ulici argentei-Cistion ladaniferi p.
Shrub formations characteristic of the thermo-Mediterranean zone. Included here are those formations, for the most part indifferent to the siliceous or calcareous nature of the substrate, that reach their greatest extention or optimal development in the thermo-Mediterranean zone. Also included are the numerous, strongly characterized, thermophile formations endemic to the south of the Iberian peninsula, mostly thermo-Mediterranean but sometimes meso-Mediterranean; in their great local diversity they are a western counterpart of, and sometimes approach in appearance, the mostly eastern Mediterranean phryganas, which, however, on account of their strong structural singularity, are listed separately under 33.
(Rechinger, 1951; Rivas-Goday and Rivas-Martinez, 1968; Fenaroli, 1970; Lapraz, 1970, 1973a, 1974, 1977; Freitag, 1971; Zohary, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1974a, 1979; Ozenda *et al.*, 1979; Tomaselli, 1981a, 1981b; Quézel, 1981b; Chiappini, 1985a; Chiappini, 1985b; Veri and Pacioni, 1985; Ferre Bueno *et al.*, 1985; Noirfalise, 1986; Camarda and Valsecchi, 1990; Turland *et al.*, 1993: 7; Jahn and Schönfelder, 1995: 15-19).

32.21. Thermo-Mediterranean brushes, thickets and heath-garrigues
Oleo-Ceratonion, Asparago-Rhamnion, Ceratonio-Rhamnion, Juniperion lyciae p., Rhamno-Quercion cocciferae p.
Lentisc-dominated or lentisc-rich brushes and related formations with *Olea europaea* var. *sylvestris, Pistacia lentiscus, Rhamnus alaternus, Rhamnus lycioides* ssp. *lycioides, Rhamnus lycioides* ssp. *oleoides, Rhamnus lycioides* ssp. *velutinus, Rhamnus lycioides* ssp. *graecus, Myrtus communis, Rubia peregrina, Rubia tenuifolia, Thymus capitatus, Prasium majus, Asparagus stipularis, Asparagus acutifolius, Asparagus albus, Asparagus aphyllus, Cneorum tricoccon, Daphne gnidium, Phillyrea angustifolia, Phillyrea latifolia, Osyris quadripartita, Osyris alba, Bupleurum fruticosum, Bupleurum gibraltarium, Ephedra fragilis, Chamaerops humilis*, various oaks (*Quercus ilex, Quercus rotundifolia, Quercus suber, Quercus coccifera, Quercus fruticosa), Sarcopoterium spinosum, Calicotome villosa, Calicotome spinosa,* widespread in the thermo-Mediterranean zone of the Iberian peninsula (except the arid Iberian Southeast: unit 32.25), of the Balearics, Corsica, Sardinia and Sicily, of continental France and Italy, of peninsular and archipelagic Greece, of Mediterranean Anatolia and the Levant, of North Africa. A few extremely distinctive habitats formed by facies of these formations, distributed throughout large portions of their range, are separated under units 32.22, 32.23 and 32.24. Other characteristic habitats are listed below as subdivisions of unit 32.21.
(Rechinger, 1951; Rivas Goday and Rivas-Martinez, 1968; Bolos *et al.*, 1970; Freitag, 1971; Zohary, 1973; Knapp, 1973: 484; Horvat *et al.*, 1974; Rivas-Martinez, 1974a, 1979; Brullo *et al.*, 1977; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Gamisans, 1985,
1991; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987; Camarda and Valsecchi, 1990; Bondev, 1991; Turland *et al.*, 1993: 7; Jahn and Schönfelder, 1995: 15-19).

32.211. Oleo-lentisc brush
Usually pluri-specific brushes in which *Olea europaea* var. *sylvestris* accompanied by *Pistacia lentiscus* plays a determinant physiognomic role. Almost entirely restricted to the thermo-Mediterranean zone, they are represented by particularly well-developed, extensive stands in southern Iberia, the Balearics, Sardinia, Sicily, southern Greece and the Aegean, Mediterranean Anatolia, Cyprus and the Levant, North Africa. When the characteristic species increase in height they grade into arborescent matorral (unit 32.12).
(Rechinger, 1951; Rivas Goday and Rivas-Martinez, 1968; Bolos *et al.*, 1970; Freitag, 1971; Zohary, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1974a, 1979; Brullo *et al.*, 1977; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Gamisans, 1985, 1991; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987; Rivas-Martinez and Costa, 1987; Lanfranco, 1989: 27; Camarda and Valsecchi, 1990; Turland *et al.*, 1993: 7; Jahn and Schönfelder, 1995: 15-16; Hoda *et al.*, 1998: 13; Lanfranco, 1999a; Schembri, 1999b).

32.212. Thermo-Mediterranean heath-garrigues
Formations dominated by the thermophile, often calciphile, heathers *Erica multiflora* and *Erica manipuliflora*, best developed in the thermo-Mediterranean zones of southern and eastern Spain, the Balearics, Sardinia, Sicily, Pantelleria, southern Italy, southern Greece and the Aegean, Mediterranean Anatolia, Cyprus and coastal Mediterranean North Africa. Western meso-mediterranean formations are listed under unit 32.4B, eastern meso-Mediterranean formations under unit 32.5C.
(Knapp, 1973: 484; Jahn and Schönfelder, 1995: 19).

32.2121. Western *Erica multiflora* heath-garrigues
Usually calciphile *Erica multiflora* formations of the Iberian and Italian peninsulas, the large western Mediterranean islands and coastal Mediterranean North Africa.
(Knapp, 1973: 484; Lanfranco, 1999a; Schembri, 1999b).

32.214. Lentisc brush
Ristacia lentiscus -dominated or -rich formations, widespread and abundant in thermo-Mediterranean and coastal meso-Mediterranean zones of the entire Mediterranean basin; locally, similar formations may appear in warm inland meso-Mediterranean areas. Often low and sometimes very open, the lentisc brush can in favourable situations reach a height of several metres, grading into arborescent matorral (unit 32.123).
(Knapp, 1973: 484; Turland *et al.*, 1993: 7; Paradis and Piazza, 1993: 243; Jahn and Schönfelder, 1995: 16; Lanfranco, 1999a; Schembri, 1999b).

32.215. *Calicotome* brush
Thermo-mediterranean formations physiognomically dominated by the brilliantly flowering *Calicotome villosa* or *Calicotome spinosa*, widespread in European thermo-mediterranean regions, in the Levant, in particular on sandy plains and in presteppic areas, and in North Africa, notably in semi-arid areas of northeastern Tunisia and northeastern Libya.
(Zohary, 1973: 540; Knapp, 1973: 486-487; Turland *et al.*, 1993: 7).

32.216. Laurel thickets
Laurus nobilis thickets of humid or fresh stations of thermo-mediterranean regions, low-growing facies of unit 32.18, noted in particular in Sardinia, Sicily, the Maltese Islands, Campania and Crete.
(Turland *et al.*, 1993: 7; Lanfranco, 1989: 15; Lanfranco, 1999a).

32.217. Coastal *Helichrysum* garrigues
Low formations of *Helichrysum* (*Helichrysum italicum* ssp. *microphyllum*, *Helichrysum italicum* ssp. *italicum)* with spurges (*Euphorbia pithyusa, i.a.)*, *Pistacia lentiscus*, *Camphorosma monspeliaca*, *Artemisia densiflora* or *Thymelaea passerina*, *Thymelaea hirsuta*, *Thymelaea tartonraira* of the immediate vicinity of sea cliffs, forming the transition between cliff vegetations or clifftop phryganas and thermo-Mediterranean brushes; they are particularly characteristic of the large Mediterranean islands.
(Paradis and Piazza, 1993: 238, 243).

32.218. Myrtle thickets
Myrtus communis-dominated brush. Particularly noteworthy formations occur in the Balearics (*Clematidi-Myrtetum)*, in southern Iberia, in Sardinia, in the Aegean, in the eastern Mediterranean coastal regions, in North Africa. Myrtle thickets can in favourable situations reach a height of a few metres, grading into arborescent matorral (unit 32.124).
(Knapp, 1973: 487; Lanfranco, 1989: 24; Turland *et al.*, 1993: 7; Paradis and Piazza, 1993: 243; Hoda *et al.*, 1998: 13).

32.21A. *Phillyrea* thickets
Rhillyrea angustifolia or *Phillyrea media*-dominated formations; they constitute facies, in particular of the southern Iberian *Asparago-Rhamnion* and of the Aegean *Ceratonio-Rhamnion*, notably on Samothrace and Rhodes; they constitute also remarkable coastal formations on Minorca, based on the endemic *Phillyrea media* var. *rodriguezii*, and in Valencia.

32.21A3. Western *Phillyrea* thickets
Rhillyrea angustifolia or *Phillyrea latifolia*-dominated formations of the westerm Mediterranean.

32.21B. Buckthorn-asparagus brushes
Thermo-mediterranean formations in which *Asparagus spp.* and/or *Rhamnus spp.*, in particular *Rhamnus lycioides*, predominate.
(Lanfranco, 1999a; Schembri, 1999b).

32.21C. *Osyris* brushes
Formations dominated by *Osyris alba* or *Osyris tripartita.*

32.21J. Thermo-Mediterranean wormwood brushes
Artemisia arborescens brushes of the Tyrrhenian islands and peninsular Italy, the Iberian peninsula, Mediterranean North Africa, the southern Balkans, Greece and Crete, Mediterranean Asia Minor.

32.21K. Thermo-Mediterranean Jupiter's beard brushes
Anthyllis barba-jovis brushes of thermo-Mediterranean rocky coastal slopes often associated with coastal phrygana and *Euphorbia dendroides* formations, of eastern Spain, Provence, Corsica, Sardinia, Sicily, the Adriatic coast of the Balkan peninsula, mainland Greece and Crete.

32.21L. Coastal dwarf leguminous garrigues
Teucrion mari p.
Local low thermo-Mediterranean formations of calcareous coasts of Corsica, Sardinia, Sicily and the west Mediterranean mainland of Europe and Africa, dominated by leguminous subshrubs of *Dorycnium* or *Coronilla.*
(Camarda and Valsecchi, 1990; Gamisans, 1991).

32.21L2. Thermo-Mediterranean *Coronilla* garrigues
Teucrion mari: Coronilletum valentinae i.a.
Thermo-Mediterranean formations of calcareous coasts of Corsica, Sardinia, Sicily, the Maltese Islands and the west Mediterranean mainland of Europe and Africa, dominated by *Coronilla valentina.*
(Camarda and Valsecchi, 1990: 99-102; Gamisans, 1991: 125-126).

32.22. Tree-spurge formations
Stands of *Euphorbia dendroides,* remarkable tertiary relict of Macaronesian origin; they occur as a facies of the thermo-Mediterranean brushes of the Balearics, Corsica, Sardinia, Sicily, Islas Eolie, Egadi, Pelagi, Pantelleria, Crete, and, very locally, of those of the coasts of northern Catalonia, southeastern France, peninsular Italy and its islands, central Greece, notably on slopes facing the gulf of Corinth, the Peloponnese, the Aegean archipelagoes, Albania and enclaves of the Mediterranean periphery of Anatolia and the Levant. Particularly extensive and robust stands occur in Sicily, Sardinia and Crete where they may extend to relatively high altitudes. Very local formations in Mediterranean North Africa occupy the steep rocky slopes of some coastal capes and isolated inland sites, in Cyrenaica, northern Tunisia (Ichkeul), and in a narrow coastal strip in northern Algeria.
(Rechinger, 1951; Quézel and Santa, 1963; Bolos *et al.*, 1970; Pignatti, 1972; Zohary, 1973; Knapp, 1973: 487-488; Horvat *et al.*, 1974; Brullo *et al.*, 1977; Rivas-Martinez *et al.*, 1980; Ozenda, 1981; Becker *et al.*, 1982; Lopez Gonzalez, 1982; Gamisans, 1985; Chiappini, 1985b; Peinado Lorca and Rivas-Martinez, 1987; Jahn and Schönfelder, 1995: 18; Hoda *et al.*, 1998: 13; Lanfranco, 1999a).

32.24. Palmetto brush
Chamaerops humilis-dominated formations; other thermo-Mediterranean brushes or garrigues rich in the physiognomically important palmetto can be identified by a combination of this code and that of the other appropriate subdivision of unit 32.2. Palmetto brushes are best represented in the coastal areas of southwestern, southern and eastern Iberia, the Balearics, Sicily and its satellite islands and Mediterranean North Africa, with more sporadic occurrences in the Guadalquivir basin, Sardinia, and the Tyrrhenian coasts and islands of peninsular Italy. They are apparently extinct in the wild in the Maltese Islands.
(Quézel and Santa, 1962; Fenaroli, 1970; Knapp, 1973: 485; Ozenda *et al.*, 1979; Reisigl *et al.*, 1980; Tomaselli, 1981a, 1981b; Chiappini, 1985b; Noirfalise, 1986; Lanfranco, 1989: 45).

32.25. Euro-mediterranean pre-desert scrub
Reriplocion angustifoliae, Anthyllidetalia terniflorae
Shrub formations constituting, with the halonitrophilous scrubs (unit 15.724) and the localized gypsum scrubs (unit 15.93), much of the natural and seminatural vegetation of the arid zone of southeastern Spain (Almeria, Murcia, Alicante), a highly distinctive region of unique climatological, biological and landscape character within Europe, extremely rich in African and endemic species. Several of the most remarkable formations remain in only a few undisturbed localities and are gravely at risk. Similar formations occur in the upper arid (Mediterranean arid) zone of North Africa; they are included in unit 32.D11. Outposts of these communities also exist in Sicily, the Egadi islands, the Pelagie islands, the Maltese Islands and Pantelleria.
(Delvosalle and Duvigneaud, 1962; Rivas Goday and Rivas-Martinez, 1968; Brullo *et al.*, 1977; Freitag, 1971; Rivas-Martinez, 1974a; Ozenda *et al.*, 1979; Quézel, 1981a: 89; Pignatti, 1982; Ferre Bueno *et al.*, 1985; Noirfalise, 1986; Le Houérou, 1986; Alcaraz Ariza and Peinado Lorca, 1987).

32.255. Sicilian Channel *Periploca* scrubs
Reriploco-Euphorbietum dendroidis
Summer deciduous shrub formations of *Periploca laevigata* ssp. *angustifolia, Lycium intricatum, Euphorbia dendroides* with *Prasium majus, Pistacia lentiscus, Asparagus acutifolius, Phillyrea angustifolia, Calicotome villosa* of islands of the Sicilian Channel, in particular of the southwestern coast of Pantelleria, of the Maltese Islands and of the Egadi Islands.
(Freitag, 1971; Pignatti, 1982; Lanfranco, 1989: 26; Lanfranco, 1999a).

32.4. Western meso-mediterranean calcicolous garrigues

Rosmarinetalia: Rosmarino-Ericion, Aphyllanthion p.
Shrubby formations, often low, on mostly calcareous soils of the meso- mediterranean zone of the Iberian peninsula, France, Italy and the large western Mediterranean islands. Included here are those formations that reach their optimal development within the meso-mediterranean zone although they often enter the thermo- or

supra-mediterranean levels. The subdivisions proposed are based on the physiognomically most significant dominants; co-dominance can be indicated by use of multiple codes.
(H–bl *et al.*, 1958; Barkman, 1958; Lausi and Poldini, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969, 1970; Fenaroli, 1970; Lapraz, 1970, 1973a, 1973b, 1976, 1984; Costa, 1974; Lavagne and Moutte, 1977; Ozenda *et al.*, 1979; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Ozenda, 1981; Pignatti, 1982; Devaux *et al.*, 1983; Ozenda, 1985; Polunin and Walters, 1985; Dominicis *et al.*, 1985; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Fenaroli, 1985; Fernandez Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Camarda and Valsecchi, 1990).

32.42. Rosemary garrigues
Shrubby formations of the western Mediterranean basin, usually relatively tall, dominated by *Rosmarinus officinalis.*
(H–bl *et al.*, 1958; Barkman, 1958; Lausi and Poldini, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969, 1970; Fenaroli, 1970; Lapraz, 1970, 1973a, 1973b; Costa, 1974; Lavagne and Moutte, 1977; Ozenda *et al.*, 1979; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Ozenda, 1981; Pignatti, 1982; Polunin and Walters, 1985; Dominicis *et al.*, 1985; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Fenaroli, 1985; Fernandez Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Lanfranco, 1989: 30; Camarda and Valsecchi, 1990).

32.43. Cistus garrigues
Shrubby formations of the western Mediterranean basin, mostly meso-Mediterranean, but often also thermo- or supra-Mediterranean, dominated by the low, calciphilous *Cistus albidus* or *Cistus clusii*, or occasionally by indifferent species, usually accompanied by a more varied flora than that of the silicicolous cistus maquis, though sometimes capable of forming dense cistus fields. These can be identified by use of digit 1 in the fourth decimal place, digit 2 being reserved for more varied formations.
(Rivas Goday and Rivas-Martinez, 1968; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Lanfranco, 1999a).

32.433. *C. monspeliensis, C. salvifolius, C. incanus* garrigues
Garrigues of the western Mediterranean basin with *Cistus monspeliensis, Cistus salvifolius* or *Cistus incanus.* Many formations of these species are maquis or maquis-like communities, best listed under 32.3. Some, however, with a pronounced calciphile character and a garrigue structure, can be listed here.
(Rivas Goday and Rivas-Martinez, 1968; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Lanfranco, 1989: 23; Lanfranco, 1999a).

32.44. Spurge garrigues
Shrubby formations of the western Mediterranean basin dominated by bushy or robust perennial *Euphorbia* species.
(Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985, 1991; Camarda and Valsecchi, 1990).

32.441. Spiny spurge garrigues
Euphorbia spinosa or *Euphorbia melitensis* cushion garrigues of very dry soils of the meso- or thermo-Mediterranean zones of southern France, Corsica, Sardinia, Sicily, the Maltese Islands and peninsular Italy.
(Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Lanfranco, 1989: 21-22; Gamisans, 1985, 1991: 211-212; Camarda and Valsecchi, 1990: 118-120; Lanfranco, 1999a).

32.442. Unarmed spurge garrigues
Formations of the western Mediterranean basin dominated by often woody-stocked, clump-forming *Euphorbia* species (e.g. *Euphorbia fragifera, Euphorbia characias).*
(Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982: II, 50; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985, 1991; Lanfranco, 1989: 21; Camarda and Valsecchi, 1990: 115-118).

32.47. Western sage and other labiate garrigues
Garrigues of the western Mediterranean basin of which the main components are labiate shrubs or robust perennials (except *Lavandula* and *Rosmarinus).*
(H–bl *et al.*, 1958; Barkman, 1958; Lausi and Poldini, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969, 1970; Fenaroli, 1970; Costa, 1974; Lavagne and Moutte, 1977; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Fenaroli, 1985; Fernandez Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Camarda and Valsecchi, 1990; Lanfranco, 1999a).

32.471. Thyme, sage, small germander and other labiate garrigues
Characteristically very low, open garrigues of the western Mediterranean basin of which the main components are labiate shrubs of genera *Thymus* (e.g. *Thymus piperella, Thymus funkii, Thymus zygis, Thymus vulgaris, Thymus capitatus, Thymus mastigophorus), Salvia* (e.g. *Salvia lavandulifolia, Salvia officinalis), Teucrium* (e.g. *Teucrium polium, Teucrium marum, Teucrium subspinosum, Teucrium aragonense, Teucrium gnaphalodes, Teucrium chamaedrys, Teucrium montanum), Sideritis* (e.g. *Sideritis scordioides, Sideritis incana), Micromeria* (e.g. *Micromeria fruticosa, Micromeria graeca, Micromeria juliana), Satureja* (e.g. *Satureja montana), Stachys* (e.g. *Stachys glutinosa), Nepeta* (e.g. *Nepeta foliosa) Phlomis* (e.g. *Phlomis fruticosa)* or other genera (except *Lavandula* and *Rosmarinus).*

(H–bl *et al.*, 1958; Barkman, 1958; Lausi and Poldini, 1962; Rivas Goday and Rivas-Martinez, 1968; Archiloque *et al.*, 1969, 1970; Fenaroli, 1970; Costa, 1974; Lavagne and Moutte, 1977; Izco, 1979; Reisigl *et al.*, 1980; Quézel, 1981b; Pignatti, 1982; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Fenaroli, 1985; Fernandez Gonzalez, 1986; Peinado Lorca and Rivas-Martinez, 1987; Lanfranco, 1989: 29-30; Camarda and Valsecchi, 1990; Lanfranco, 1999a).

32.472. Western tree germander garrigues
Garrigues of the western Mediterranean basin dominated by the tall or very tall *Teucrium fruticans.*
(Pignatti, 1982; Lanfranco, 1999a).

32.4A. Composite garrigues
Meso-Mediterranean shrubby formations of the western Mediterranean basin dominated by members of various genera of the family Asteraceae.
(Rivas Goday and Rivas-Martinez, 1968; Izco, 1979; Reisigl *et al.*, 1980; Pignatti, 1982; Polunin and Walters, 1985; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Peinado Lorca and Rivas-Martinez, 1987; Camarda and Valsecchi, 1990).

32.4A1. *Helichrysum, Santolina, Phagnalon* garrigues
Usually low, open garrigues of the western Mediterranean basin formed by dwarf, shrubby composites, often with small grey or whitish leaves and showy yellow bloom, of genera *Helichrysum, Staehelina* (*Staehelina dubia), Phagnalon* (*Phagnalon rupestre), Santolina, Scorzonera.*
(Rivas Goday and Rivas-Martinez, 1968; Izco, 1979; Reisigl *et al.*, 1980; Pignatti, 1982; Polunin and Walters, 1985; Chiappini, 1985a, 1985b; Veri and Pacioni, 1985; Gamisans, 1985; Peinado Lorca and Rivas-Martinez, 1987; Lanfranco, 1989: 35; Camarda and Valsecchi, 1990).

32.9. Ermes

Communities of forbs, grasses and shrubs resulting from over-browsing and over-grazing of garrigues and consisting of unpalatable plants, in particular Liliaceae (*Asphodelus, Urginea),* thistles (*Carthamus, Carlina, Centaurea, Onopordum), Phlomis, Ferula*, especially characteristic of the more arid areas of the Mediterranean basin.
(Le Houérou, 1986; Horvat *et al.*, 1974; Lanfranco, 1999a; Schembri, 1999b).

32.91. Asphodel fields
Communities of degraded terrains of the Mediterranean basin overwhelmingly dominated by facies-forming Liliaceae of genus *Asphodelus.*
(Horvat *et al.*, 1974: 97; Hoda *et al.*, 1998: 11; Lanfranco, 1999a; Schembri, 1999b).

32.92. Thistle fields
Communities of degraded terrains of the Mediterranean basin overwhelmingly dominated by facies-forming thistles, notably of genera *Carthamus, Carlina, Centaurea, Onopordum, Notobasis, Galactites.*
(Le Houérou, 1986; Lanfranco, 1999a; Schembri, 1999b).

32.93. Phlomis brushes
Communities of degraded terrains of the Mediterranean basin overwhelmingly dominated by facies-forming tall labiates of genus *Phlomis.*
(Jahn and Schönfelder, 1995: 19; Hoda *et al.*, 1998: 11).

32.94. Ferula stands
Communities of degraded terrains of the Mediterranean basin dominated by facies-forming tall, robust umbellifers of genus *Ferula.*

32.A. Spanish-broom fields

Thickets and brushes of Spanish broom, *Spartium junceum*, widespread in mediterranean and sub-mediterranean areas of the Mediterranean basin, particularly in western Mediterranean Europe and North Africa.
(Knapp, 1973: 486-487).

33. PHRYGANA

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

(Rechinger, 1951; Molinier and Molinier, 1955; Bolos and Molinier, 1958; Bolos *et al.*, 1970; Davis, 1972, 1975; Zohary, 1973; Horvat *et al.*, 1974; Caniglia *et al.*, 1974; Molinier *et al.*, 1976; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Reisigl *et al.*, 1980; Nimis, 1981; Quézel, 1981b; Pignatti, 1982; Gamisans, 1985, 1991; Géhu *et al.*, 1984a; Chiappini, 1985a, 1985b; Kassioumis, 1988; Camarda and Valsecchi, 1990; Lavrentiades, 1993; Dallman, 1998).

33.1. West Mediterranean clifftop phryganas

Astragalo-Plantaginetum subulatae, Anthyllido-Thymelaeetum hirsutae, Thymelaeo-Helichrysetum, Armerietum ruscinonensis
Rare, extremely local and isolated associations of clifftops and adjacent areas dispersed along the coasts of Provence, Cap Corse, the Straits of Bonifacio, Catalonia (Cabo de Creus) and extreme southwestern Portugal, characterized by the presence of *Astragalus massiliensis* or *Anthyllis hermanniae*, variously accompanied by *Thymelaea hirsuta, Helichrysum italicum, Plantago subulata, Armeria ruscinonensis.*
(Molinier and Molinier, 1955; Bolos and Molinier, 1958; Bolos *et al.*, 1970; Molinier *et al.*, 1976; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Nimis, 1981; Quézel, 1981b; Gamisans, 1985, 1991).

33.13. West-Mediterranean *Anthyllis* phrygana
Clifftop cushion formations of the western Mediterranean basin dominated by *Anthyllis hermanniae*, distributed in particular on Cap Corse and the Maltese Islands.
(Molinier and Molinier, 1955; Gamisans, 1985, 1991; Lanfranco, 1999a).

33.5. *Hypericum* phryganas

Extremely rare, local colonies of hemispherical shrubs of *Hypericum aegyptiacum* forming open phryganas on calcareous rocks by the sea in the Ionian islands, western Crete, Sardinia and Lampedusa.
(Pignatti, 1982).

33.6. Central Mediterranean *Sarcopoterium* phryganas

Very local, impoverished *Sarcopoterium spinosum* formations of Capo St. Elia (southern Sardinian coast), of the Gulf of Taranto (Puglia, Calabria) and of the Maltese Islands.
(Caniglia *et al.*, 1974; Nimis, 1981; Pignatti, 1982; Géhu *et al.*, 1984a; Géhu *et al.*, 1984b: 421-423; Lanfranco, 1989: 18; Schembri, 1999b).

34. STEPPES AND DRY CALCAREOUS GRASSLANDS

Primary and secondary steppes, formations dominated by medium or tall perennnial tuft-forming grasses or suffrutescents, with lacunar ground cover, together with their associated therophyte communities; typical formations, with two periods of dormancy, in large part climactic, are characteristic of a steppe belt in continental Central Eurasia and on the western Asian plateaux, with irradiations in the nemoral zone; physiognomically similar formations, although perhaps largely anthropogenic, and mostly with a single period of dormancy, are widespread in the transition zone between the Mediterranean and Saharo-Sindian domaines and occur locally in the Mediterranean zone. By extension, 34 also includes dry thermophilous, mostly zoogenous, grasslands and thermophile forest fringe formations of the lowland, hill and montane altitudinal levels of the nemoral and Mediterranean zones, on mostly calcareous soils, sands, and decomposed rock surfaces.
(Soo, 1959, 1980; Ellenberg, 1963, 1988; Zohary, 1973; Knapp, 1973; Horvat *et al.*, 1974; Walter, 1974; Rivas-Martinez, 1977a; Wolkinger and Plank, 1981; Brullo, 1985; Polunin and Walters, 1985; Le Houérou, 1986; Walter and Breckle, 1986, 1991c; Peinado Lorca and Rivas-Martinez, 1987; Rieley and Page, 1990; Korotkov *et al.*, 1991; Ripley, 1992a).

34.5. Mediterranean xeric grasslands

Thero-Brachypodietea
Meso- and thermo-Mediterranean xerophile, mostly open, short-grass perennial grasslands rich in therophytes; therophyte communities of oligotrophic soils on base-rich, often calcareous substrates.
(Rechinger, 1951; Duvigneaud, 1953; Molinier, 1957; Vanden Berghen, 1963, 1982; Archiloque *et al.*, 1969; Braun-Blanquet and Braun-Blanquet, 1971; Braun-Blanquet, 1973a; Guinochet and Vilmorin, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Diez Garretas *et al.*, 1977; Sutter, 1977; Jovet and Vilmorin, 1979; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Barbero *et al.*, 1982; Guéry, 1983; Devaux *et al.*, 1983; Terrisse, 1983; Peinado Lorca *et al.*, 1984; Brullo, 1985; Peinado Lorca and Rivas-Martinez, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Korotkov *et al.*, 1991).

34.51. West Mediterranean xeric grasslands

Meso- and thermo-Mediterranean xerophile, short-grass perennial grasslands and therophyte communities of oligotrophic soils on base-rich substrates of Spain, southern France, the large west Mediterranean islands, Italy and Mediterranean North Africa.

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

34.511. Retuse torgrass swards

Brachypodienion retusi (*Brachypodietum retusi)*

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

(Duvigneaud, 1953; Molinier, 1957; Archiloque *et al.*, 1969; Braun-Blanquet, 1973a; Guinochet and Vilmorin, 1973; Rivas-Martinez, 1975c, 1977a; Diez Garretas *et al.*, 1977; Sutter, 1977; Jovet and Vilmorin, 1979; Rivas-Martinez *et al.*, 1980; Molinier and Martin, 1980; Barbero *et al.*, 1982; Devaux *et al.*, 1983; Peinado Lorca *et al.*, 1984; Brullo, 1985; Peinado Lorca and Rivas-Martinez, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Stevens, 1998; Lanfranco, 1999a).

34.513. Mediterranean annual communities of shallow soils

Brachypodietalia distachyae

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

(Rivas-Martinez, 1977a; Molinier and Martin, 1980; Peinado Lorca *et al.*, 1984; Brullo, 1985; Peinado Lorca and Rivas-Martinez, 1987; Lanfranco, 1989: 16, 17, 18, 19; Foucault, 1993b; Lanfranco, 1999a).

34.5135. Sicilian saxicolous annual communities

Rlantagini-Catapodion marini

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

34.5137. Calabro-Sicilian esparto annual communities

Dauco-Catananchion luteae p.

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

34.6. Mediterranean tall-grass and wormwood steppes

Lygeo-Stipetea p. (*Rosmarinetalia p.), Brachypodio-Chrysopogonetea p.*

Meso-, thermo- and sometimes supra-Mediterranean formations of the Mediterranean basin, physiognomically dominated by tall grasses, between which may grow communities of annuals or sometimes chamaephytes. They include silicicolous as well as basiphile formations. In the Mediterranean region proper, they are most characteristic of the Iberian peninsula, of parts of the North African coastal regions and of the Mediterranean rim of Anatolia and the Levant, with local representations in southern Provence, Sardinia, southern peninsular Italy, Sicily and Greece. In the transition regions between the Mediterranean zone and the southern Palaearctic deserts they come to dominate the landscape, forming major steppe belts in the Saharo-Mediterranean transition zone and in Western Asia. Perhaps largely anthropogenic, they are physiognomically and, at least in Asia, to some extent, floristically similar to the continental formations of unit 34.9, but, developed under a Mediterranean climate regime and mostly with a single period of dormancy. They associate with *Artemisia*-dominated steppes, related even more closely to Central Eurasian formations of unit 34.9, but listed here to preserve ecogeographical unity.

(Rechinger, 1951; Braun-Blanquet and Bolos, 1954; Buia, 1957; Molinier, 1957; Delvosalle and Duvigneaud, 1962; Polunin and Smythies, 1973; Zohary, 1973; Costa, 1973, 1974; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Peinado Lorca *et al.*, 1984; Brullo, 1985; Polunin and Walters, 1985; Le Houérou, 1986; Peinado Lorca and Rivas-Martinez, 1987; Asensi Marfil and Diez Garretas, 1987; Martinez Parras and Peinado Lorca, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Walter and Breckle, 1991c; Foucault, 1993b: 271-274).

34.62. Esparto steppes

Lygeum spartum-dominated formations of North Africa, the Ebro basin, the arid Iberian Southeast, the Guadalquivir basin, Sardinia, Sicily, the Maltese Islands, southern Italy and Crete.

(Rechinger, 1951; Braun-Blanquet and Bolos, 1954; Delvosalle and Duvigneaud, 1962; Polunin and Smythies, 1973; Costa, 1973, 1974; Rivas-Martinez, 1975c, 1977a; White, 1983: 229-230; Peinado Lorca *et al.*, 1984; Brullo, 1985; Polunin and Walters, 1985; Le Houérou, 1986; Peinado Lorca and Rivas-Martinez, 1987; Asensi Marfil and Diez Garretas, 1987; Martinez Parras and Peinado Lorca, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987).

34.622. Central Mediterranean esparto steppes

More restricted *Lygeum spartum*-dominated formations of Sardinia, southern Italy, Sicily and the Maltese Islands.

(Rivas-Martinez, 1977a; Brullo, 1985; Polunin and Walters, 1985; Lanfranco, 1999a; Schembri, 1999b).

34.63. Berceales, feathergrass, diss, andropogonid, fescue steppes

Mediterranean tall-grass steppes dominated by tall grasses other than *Stipa tenacissima* or *Lygeum spartum.*

(Rechinger, 1951; Braun-Blanquet and Bolos, 1954; Molinier, 1957; Delvosalle and Duvigneaud, 1962; Polunin and Smythies, 1973; Zohary, 1973; Costa, 1973, 1974; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Peinado Lorca *et al.*, 1984; Brullo, 1985; Polunin and Walters, 1985; Le Houérou, 1986; Peinado Lorca and Rivas-Martinez, 1987; Asensi Marfil and Diez Garretas, 1987; Martinez Parras and Peinado Lorca, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Walter and Breckle, 1991c).

34.634. Andropogonid grass steppes

Lygeo-Stipetea: Hyparrhenietalia hirtae i.a.; Brachypodio-Chrysopogonetea p.

Meso- and thermo-Mediterranean steppes of North Africa, Spain, southern France, Italy and the central Mediterranean islands, Greece, the Balkans and western Asia, constituted by cespitose andropogonid grasses such as *Hyparrhenia hirta, Andropogon distachyos, Heteropogon contortus, Dichanthium insculptum, Dichanthium ischaemum* or *Chrysopogon gryllus.*

(Rechinger, 1951; Braun-Blanquet and Bolos, 1954; Molinier, 1957; Delvosalle and Duvigneaud, 1962; Polunin and Smythies, 1973; Zohary, 1973; Costa, 1973, 1974; Horvat *et al.*, 1974; Rivas-Martinez, 1975c, 1977a; Peinado Lorca *et al.*, 1984; Brullo, 1985; Polunin and Walters, 1985; Le Houérou, 1986; Peinado Lorca and Rivas-Martinez, 1987; Asensi Marfil and Diez Garretas, 1987; Martinez Parras and Peinado Lorca, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Walter and Breckle, 1991c).

34.6343. Central Mediterranean andropogonid grass steppes

Meso- and thermo-Mediterranean steppes of Italy and the central Mediterranean islands constituted by cespitose andropogonid grasses such as *Hyparrhenia hirta, Andropogon distachyos, Heteropogon contortus, Dichanthium insculptum, Dichanthium ischaemum* or *Chrysopogon gryllus.*

(Rivas-Martinez, 1977a; Brullo, 1985; Stevens, 1998; Lanfranco, 1999a; Schembri, 1999b).

34.64. Cane steppes

Meso-, thermo- and sometimes supra-Mediterranean formations of the Mediterranean basin, physiognomically dominated by very tall, robust, canelike grasses of genera *Imperata, Saccharum, Arundo, Hemarthria.*

(Horvat *et al.*, 1974: 143; Stevens, 1998).

34.8. Mediterranean subnitrophilous grasslands
Brometalia rubenti-tectori i.a.
Formations composed mostly of annuals, in particular, grasses of genera *Bromus, Aegilops, Avena, Vulpia,* crucifers and leguminous plants, that occupy considerable expanses of the western, central and eastern meso- and thermo-Mediterranean zones on soils slightly enriched in nitrates. These communities develop as pioneers of bare soils slightly nitrified by aeration or organic addition, along roads, on land-fills and in interstitial spaces of cultivation. They also replace the oligotrophic annual communities included in the Mediterranean xeric grasslands (units 34.51, 34.53) under the influence of pastoral activities. They are widespread as postcultural formations. They evolve through intensive grazing into perennial pastures of the *Poetalia bulbosae* and related communities (unit 34.52), through increased nitrification into ruderal formations (unit 87), through an increase in edaphic humidity into amphibious communities (unit 22.3) and perennial andropogonid steppes (unit 34.634) or Phoenician torgrass swards (unit 34.36). Ligneous recolonization may lead either to halonitrophilous scrubs of the *Salsolo-Peganetalia* (unit 15.17), or to maquis and garrigues of the *Rosmarinetalia, Lavanduletalia* or *Gypsophiletalia* (units 32, 15.19).
(Rechinger, 1951; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Izco, 1977; Peinado Lorca *et al.*, 1984; Herranz Sanz and Gomez Campo, 1986; Ladero Alvarez, 1987; Rivas-Martinez and Costa, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987).

34.81. Mediterranean subnitrophilous grass communities
Taeniathero-Aegilopion geniculatae, Brachypodio-Chrysopogonetea p.
Graminoid formations with *Bromus fasciculatus, Bromus madritensis, Bromus intermedius, Bromus alopecuros, Bromus rubens, Bromus hordeaceus, Bromus tectorum, Aegilops neglecta, Aegilops geniculata, Aegilops triuncialis, Aegilops ventricosa, Taeniatherum caput-medusae, Avena sterilis, Avena barbata, Lagurus ovatus, Lolium rigidum, Vulpia ciliata, Vulpia bromoides, Vulpia geniculata, Lamarckia aurea, Trisetum paniceum, Cynosurus echinatus, Stipa capensis,* and with *Scandix australis, Astragalus scorpioides, Trifolium cherleri, Trifolium hirtum, Trifolium striatum, Trifolium campestre, Trifolium arvense, Trifolium glomeratum, Vicia lutea, Medicago rigidula, Medicago sativa, Medicago littoralis, Melilotus sulcata, Coronilla scorpioides, Filago minima, Paronychia argentea,* particularly widespread in Iberia, southern Italy, the mediterranean Balkans and Greece where they may cover vast expanses of post-cultural or extensive pasture lands, also locally represented in southern France and coastal northern Italy.
(Rechinger, 1951; Horvat *et al.*, 1974; Izco, 1977; Ladero Alvarez, 1987; Rivas-Martinez and Costa, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Martinez Parras *et al.*, 1987; Hoda *et al.*, 1998: 12; Schembri, 1999b).

4. FORESTS

Natural or seminatural communities dominated physiognomically by trees. Included are all natural, near-natural or managed forests and woods, dense or clear, on dry substrates, on permanently or temporarily waterlogged soils or on ground permanently or temporarily inundated by marine or nonmarine waters. By extension, are also included small tree or shrub communities of riverine or marshland sites, as well as plantations of trees within or near their natural area of occurrence, accompanied by seminatural undergrowth.

42. TEMPERATE CONIFEROUS FORESTS

Forests and woodland of native coniferous trees, other than floodplain and mire woods, of the boreal, nemoral, Irano-Turanian, warm-temperate humid and Mediterranean zones; formations dominated by coniferous trees, but comprising broad-leaved evergreen trees, are included.
(Ellenberg, 1963, 1988; Walter, 1974; Ozenda, 1985; Walter and Breckle, 1986, 1991c; Noirfalise, 1987; Peinado Lorca and Rivas-Martinez, 1987; Rieley and Page, 1990; Korotkov *et al.*, 1991; Turkington, 2001).

42.8. Mediterranean pine woods

Mediterranean and thermo-Atlantic forests of thermophilous pines, mostly appearing as substitution or paraclimactic stages of forests of the *Quercetalia ilicis* or *Ceratonio-Rhamnetalia.* Long-established plantations of these pines, within their natural area of occurrence, and with an undergrowth basically similar to that of paraclimactic formations, are included.
(Dallman, 1998).

42.84. Aleppo pine forests
Woods of *Pinus halepensis,* a frequent colonist of thermo- and calcicolous meso-mediterranean scrubs. The distinction between spontaneous forests and long-established formations of artificial origin is often difficult. The latter are thus included here, while recent, obviously artificial groves are not.

(Rechinger, 1943, 1951; Loisel, 1971; Ortuno and Ceballos, 1977; Lavagne and Moutte, 1977; Sfikas, 1978; Molinier and Martin, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Lopez Gonzalez, 1982; Ciaran and Blanco, 1984; Fenaroli, 1984; Polunin and Walters, 1985; Tassi, 1985; Dupias, 1985; Gamisans, 1985; Pratesi and Tassi, 1986; Herranz Sanz and Gomez Campo, 1986; Kassioumis, 1988; Ferioli, 1989; Bournérias *et al.*, 1990; Bournérias *et al.*, 1991; Bournérias *et al.*, 1992).

42.846. Sicilian Aleppo pine woods
Rinus halepensis formations of Sicily and peripheral islands.
(Pignatti, 1982; Fenaroli, 1984; Tassi, 1985; Ferioli, 1989; Lanfranco, 1999a; Schembri, 1999b).

42.8465. Maltese Aleppo pine forests
Rinus halepensis forests of the Maltese Islands. Natural forests, formerly widespread, were cut to extinction. A near-natural self-regenerating woodland, originating from replantation exists on Malta (Buskett). It has a rich undergrowth of *Quercus ilex, Olea europaea* var. *sylvestris, Ceratonia siliqua, Pistacia lentiscus* and other thermomediterranean shrubs, herbs and climbers.
(Lanfranco, 1999a; Schembri, 1999b).

42.A. Western Palaearctic cypress, juniper and yew forests

Woods dominated by *Cupressus sempervirens, Juniperus spp., Platycladus orientalis* or *Taxus baccata* of the nemoral and Mediterranean mountains and hills of western Eurasia and North Africa.

42.A6. Arbor-vitae forests
Forests of *Tetraclinis articulata,* a species restricted to North Africa, southeastern Spain and the Maltese Islands.
(Quézel and Santa, 1962; Gounot and Schoenenberger, 1967; Le Houérou, 1969; Herbauts, 1973; Knapp, 1973: 481-483; Templado, 1974; Tomaselli, 1981b; White, 1983: 154).

42.A63. Maltese arbor-vitae forests
Forests of *Tetraclinis articulata* of the Maltese Islands, extinct in woodland form, only represented by arborescent matorrals of unit 32.153.
(Knapp, 1973: 481-483; White, 1983; Lanfranco, 1989: 9; Stevens, 1998, 1999b; Lanfranco, 1999a; Schembri, 1999b).

44. TEMPERATE RIVERINE AND SWAMP FORESTS AND BRUSH

Tree and shrub vegetation of flood plains, marshes, fens and bogs of the nemoral, boreal, steppic, warm-temperate humid, mediterranean, cold desert and subtropical desert zones. Within the latter two zones and their transition areas, in which most or all tree growth is linked to permanent or temporary water courses or water tables, only the formations that depend on the highest water tables, such as the tamarix communities and those formed by northern riparian trees, have been included in this category, while wadi- or oasis-dependant thorn woodland and palm communities are included in unit 4B.
(Schweinfurth, 1957; Ellenberg, 1963, 1988; Zohary, 1973: 377-378, 385; Horvat *et al.*, 1974; Yon and Tendron, 1981; Ozenda, 1985; Walter and Breckle, 1986; Peinado Lorca and Rivas-Martinez, 1987; Pott, 1996).

44.1. Riparian willow formations
Salicetea purpureae: Salicetalia purpureae (*Populetalia albae p.)*
Salix spp. brush or arborescent formations, lining flowing water and submitted to periodic flooding, developed on recently deposited alluvion. Within the Palaearctic domaine, willow brushes are particularly characteristic of rivers originating in major mountain ranges. Shrubby willow formations also constitute an element of lowland and hill riverine successions in all major biomes, often making the belt closest to the water course. Taller arborescent willow formations often constitute the next belt landwards in riverine successions of lowland western nemoral, eastern nemoral and warm-temperate humid forest regions, and a large part of the less diverse riverine systems of the steppic, mediterranean and cold desert zones.
(Schweinfurth, 1957; Maire, 1961; Ellenberg, 1963, 1988; Zohary, 1973; Horvat *et al.*, 1974; Pedrotti, 1980; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Soo, 1980; Yon and Tendron, 1981; Moravec *et al.*, 1983; Géhu, 1984a; Noirfalise, 1984; Rivas-Martinez *et al.*, 1984b; Nordiska ministerradet, 1984; Matuszkiewicz, 1984; Ozenda, 1985; Walter and Breckle, 1986; Navarro Andres and Valle Gutierrez, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Serrada *et al.*, 1988; Oberdorfer, 1990; Korotkov *et al.*, 1991; Coldea, 1991; Bondev, 1991; Rodwell, 1991a; Grass, 1993; Påhlsson, 1994).

44.12. Lowland and collinar riverine willow scrub
Salicion triandro-viminalis, Salicenion angustifolii, Salicion salvifoliae (*Salicion albae p.)*
Linear shrubby willow (*Salix spp.)* formations of river banks in plains, hills and low mountains of the western nemoral, eastern nemoral, boreal, warm-temperate, mediterranean, steppic and cold desert regions of the Palaearctic, extending to the montane level in the mediterranean region, and to the confines of the subtropical deserts.
(Maire, 1961; Ellenberg, 1963, 1988; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Soo, 1980; Sanda *et al.*, 1980; Yon and Tendron, 1981; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Géhu, 1984a; Noirfalise, 1984; Rivas-Martinez *et al.*, 1984b; Nordiska

ministerradet, 1984: unit 2.2.5.1; Ozenda, 1985; Dupias, 1985; Navarro Andres and Valle Gutierrez, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Martinez Parras *et al.*, 1987; Vigo and Ninot, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Asensi Marfil and Diez Garretas, 1987; Oberdorfer, 1990; Korotkov *et al.*, 1991; Coldea, 1991; Bondev, 1991; Rodwell, 1991a: unit W6c; Grass, 1993; Påhlsson, 1994: unit 2.2.5.1).

44.127. Pedicellated willow scrub
Willow scrub of stream courses of extreme southern Europe and the Maghreb, characterized by the presence of the southwestern Mediterranean and North African *Salix pedicellata.*
(Maire, 1961; Quézel and Santa, 1962; Knapp, 1973: 481; Pignatti, 1982; Chiappini, 1985b; Rivas-Martinez *et al.*, 1987; Asensi Marfil and Diez Garretas, 1987).

44.1273. Sicilian pedicellated willow scrub
Salix pedicellata scrubs of stream courses of Sicily and of the Maltese Islands, where they are represented by a few diminishing, endangered fragments.
(Lanfranco, 1989: 9; Pignatti, 1982; Lanfranco, 1999a; Schembri, 1999b).

44.14. Mediterranean tall willow galleries
Populetalia albae p.
Arborescent willow formations bordering watercourses of mediterranean regions of western Eurasia, willow-dominated belt or facies of the poplar-ash-elm forests.
(Maire, 1961; Knapp, 1973; Zohary, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Lopez, 1976; Francalancia and Orsomando, 1980; Pedrotti, 1980; Rivas-Martinez *et al.*, 1980; Yon and Tendron, 1981; Ozenda, 1985; Navarro Andres and Valle Gutierrez, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Martinez Parras *et al.*, 1987; Vigo and Ninot, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Asensi Marfil and Diez Garretas, 1987; Rallo and Pandolfi, 1988).

44.141. Mediterranean white willow galleries
Riparian forests of the Mediterranean basin dominated by *Salix alba, Salix fragilis* or their relatives.
(Maire, 1961; Knapp, 1973; Zohary, 1973; Horvat *et al.*, 1974; Lopez, 1976; Francalancia and Orsomando, 1980; Pedrotti, 1980; Yon and Tendron, 1981; Pignatti, 1982; Diaz Gonzalez and Fernandez Prieto, 1987; Navarro Andres and Valle Gutierrez, 1987).

44.1412. Eumediterranean white and crack willow galleries
Ropulion albae: Rubo caesi-Populetum albae, Salicetum albae albanicum, i.a.
Salix alba-, Salix fragilis- or *Salix x rubens*-dominated facies of Mediterranean riverine poplar-ash-elm forests developed along rivers of lowland Iberia, southern France, Italy, Dalmatia, Albania, the F.Y.R. of Macedonia, Greece, the Mediterranean islands and Mediterranean Asia Minor; the accompanying cortège does not differ from that of poplar- or ash-dominated facies.
(Zohary, 1973; Horvat *et al.*, 1974: 174, 203, 204; Francalancia and Orsomando, 1980; Pedrotti, 1980; Pignatti, 1982; Diaz Gonzalez and Fernandez Prieto, 1987; Lanfranco, 1989: 9; Hoda *et al.*, 1998: 17; Lanfranco, 1999a).

44.6. Mediterraneo-Turanian riverine forests

Ropulion albae i.a.
Mediterranean and Central Eurasian multi-layered riverine forests with *Populus spp., Ulmus spp., Salix spp., Alnus spp., Acer spp., Tamarix spp., Juglans regia,* lianas. Tall poplars, *Populus alba, Populus caspica, Populus euphratica* (*Populus diversifolia),* are usually dominant in height; they may be absent or sparse in some associations which are then dominated by species of the genera listed above.
(Neumann and Skvortsov, 1969; Murray and Rechinger, 1969; Knapp, 1973; Horvat *et al.*, 1974; Browicz, 1976; Zielinski, 1979; Dierschke, 1980; Yon and Tendron, 1981; Walter and Breckle, 1986: 292, 293, 311; Bondev, 1991).

44.61. Mediterranean riparian poplar forests
Ropulion albae ("*Ropulenion albae"*)
Mediterranean multi-layered riverine forests of base-rich soils submitted to seasonal prolonged inundation with slow drainage, with *Populus alba, Populus nigra, Fraxinus angustifolia, Ulmus minor, Salix alba, Salix spp., Alnus spp.,* lianas and often species of the *Quercetalia ilicis,* distributed in the mediterranean regions of the Iberian peninsula, southern France, the Italic peninsula, the large Tyrrhenian islands, the Hellenic peninsula, the southern Balkan peninsula, North Africa, and their zones of transition to adjacent climatic zones. Formations physiognomically dominated by tall *Populus alba* and/or *Populus nigra* are listed here. The poplars may, however, be absent or sparse in some associations which are then dominated by *Fraxinus angustifolia, Ulmus minor* and/or *Salix spp.* Such ensembles may, depending on their size, be treated as a local manifestation of a complex poplar ensemble, or listed under units 44.63 or 44.141. The poplar forests are usually the tall ligneous vegetation belt closest to the water in riverside catenas.

(Oberdorfer, 1953; Braun-Blanquet and Bolos, 1957; Maire, 1961; Debazac and Mavrommatis, 1971; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Molinier *et al.*, 1976; Lavagne and Moutte, 1977; Girerd, 1978; Dierschke, 1980; Molinier and Martin, 1980; Ozenda, 1981; Yon and Tendron, 1981; Harant and Jarry, 1983; Devaux *et al.*, 1983; Guinochet and Vilmorin, 1973; Peinado Lorca *et al.*, 1984; Darracq *et al.*, 1984; Gamisans, 1985; Dupias, 1985; Chiappini, 1985b; Fernandez Gonzalez, 1986; Asensi Marfil and Diez Garretas, 1987; Navarro Andres and Valle Gutierrez, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Vigo and Ninot, 1987; Martinez Parras *et al.*, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Baudière *et al.*, 1988; Rallo and Pandolfi, 1988; Bondev, 1991).

44.614. Italic poplar galleries
Populetum albae p.
Riparian poplar galleries of rivers and other water bodies of the Italic peninsula, Sicily and the Maltese Islands, with *Populus alba, Populus nigra, Alnus glutinosa, Ulmus minor, Acer campestre, Viburnum lantana, Viburnum opulus, Rhamnus catharticus, Crataegus monogyna, Rubus caesius, Humulus lupulus, Clematis vitalba.*
(Oberdorfer, 1953; Dierschke, 1980; Yon and Tendron, 1981; Rallo and Pandolfi, 1988; Lanfranco, 1989: 10).

44.62. Mediterranean riparian elm forests
"Fraxino angustifoliae-Ulmenion minoris" p.: Aro italici-Ulmetum, Acantho mollis-Ulmetum minoris
Elm-dominated woodlands forming, on eutrophic soils, at the outer, drier, edge of the Mediterranean riparian or lacustrine galleries, constituted by *Ulmus minor* or, in the eastern Mediterranean and on the Maltese Islands, *Ulmus canescens. Populus alba* and *Fraxinus angustifolia* often participate in the tree-layer; *Arum italicum, Ranunculus ficaria, Acanthus mollis, Brachypodium sylvaticum, Elymus caninus, Rubus ulmifolius* are characteristic of the undergrowth. Dense and dark in natural form, these woods have been extremely reduced and degraded by human action. The most characteristic examples to remain are probably those of the Iberian peninsula, although fragments are still recorded in France, Italy, the Maltese Islands, Greece, Asia Minor and North Africa.
(Maire, 1961; Zohary, 1973; Knapp, 1973: 481; Horvat *et al.*, 1974; Rivas-Martinez, 1975c; Lopez, 1976; Lavagne and Moutte, 1977; Molinier and Martin, 1980; Devaux *et al.*, 1983; White, 1983: 150; Peinado Lorca *et al.*, 1984; Fernandez Gonzalez, 1986; Loidi Arregui, 1987; Asensi Marfil and Diez Garretas, 1987; Navarro Andres and Valle Gutierrez, 1987; Vigo and Ninot, 1987; Ladero Alvarez, 1987; Martinez Parras *et al.*, 1987; Aparicio Martinez and Silvestre Domingo, 1987; Baudière *et al.*, 1988; Kassioumis, 1988; Rallo and Pandolfi, 1988; Lanfranco, 1989: 10; Gamisans, 1991: 337, 362; Lanfranco, 1999a; Schembri, 1999b).

44.8. Southern riparian galleries and thickets

Tamarisk, oleander, chaste tree galleries and thickets and similar low ligneous formations of permanent or temporary streams and wetlands of the thermo-Mediterranean zone and southwestern Iberia, and of the most hygromorphic locations within the Saharo-Mediterranean and Saharo-Sindian zones.
(Rechinger, 1951; Delvosalle and Duvigneaud, 1962; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Herbauts, 1973; Horvat *et al.*, 1974; Rivas-Martinez, 1974a; Yon and Tendron, 1981; Lopez Gonzalez, 1982; Peinado *et al.*, 1983; White, 1983; Géhu, 1984a; Izco *et al.*, 1984; Veri and Pacioni, 1985; Chiappini, 1985a, 1985b; Ladero Alvarez, 1987).

44.81. Oleander, chaste tree and tamarisk galleries
Nerio-Tamaricetea
Thickets and galleries of *Nerium oleander, Vitex agnus-castus* or *Tamarix spp.* of the southern parts of the Palaearctic domaine.
(Rechinger, 1951; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Herbauts, 1973: 326; Horvat *et al.*, 1974; Yon and Tendron, 1981; White, 1983; Géhu, 1984a; Izco *et al.*, 1984; Veri and Pacioni, 1985; Chiappini, 1985a, 1985b).

44.812. Chaste tree thickets
Nerion oleandri p.: Vinco majoris-Viticetum agni-casti i.a.
Vitex agnus-castus formations of temporary water courses and other humid sites within, mostly, the thermo-Mediterranean zone. They occur, though uncommonly, in Mediterranean southern and eastern Spain and in the Balearics; they are local and rare in eastern Provence, the Tyrrhenian coast of Italy, Puglia, the gulf of Taranto, Corsica, Sardinia, Sicily and the Maltese Islands. They are frequent in Greece, particularly along the Ionian coasts, where they can constitute dense thickets, uncommon again in the Aegean archipelagoes and Crete. They extend to the southern Balkans, Crimea, Mediterranean Asia Minor, Anatolia and North Africa, including the northern Saharan regions.
(Rechinger, 1951; Quézel and Santa, 1962; Debazac and Mavrommatis, 1971; Lavagne and Moutte, 1971; Zohary, 1973; Knapp, 1973: 487; Horvat *et al.*, 1974: 94, 173; Yon and Tendron, 1981: 49, 51; Pignatti, 1982; Lopez Gonzalez, 1982; White, 1983: 219; Izco *et al.*, 1984; Sfikas, 1984; Gamisans, 1985; Chiappini, 1985a, 1985b; Lanfranco, 1989: 29; Turland *et al.*, 1993: 6, 11; Jahn and Schönfelder, 1995: 17; Hoda *et al.*, 1998: 14).

44.813. Mediterraneo-Macaronesian tamarisk thickets
Formations of *Tamarix spp.*, including *Tamarix gallica, Tamarix africana, Tamarix canariensis, Tamarix parviflora, Tamarix tetrandra, Tamarix dalmatica, Tamarix smyrnensis, Tamarix hampeana, Tamarix boveana,* associated with river banks, wet areas and coastal localities of the Mediterranean basin, of the mediterranean coasts of the Black Sea, of the thermo-Atlantic coasts and lowlands of southwestern Europe and of the Macaronesian Islands.

(Rechinger, 1951; Debazac and Mavrommatis, 1971; Walter, 1974; Horvat *et al.*, 1974; Yon and Tendron, 1981; Géhu, 1984a; Izco *et al.*, 1984; Veri and Pacioni, 1985; Chiappini, 1985a, 1985b; Britton and Crivelli, 1993).

44.8131. West Mediterranean tamarisk thickets
Tamaricion africanae: Tamaricetum gallicae, Polygono equisetiformis-Tamaricetum africanae, Glycirrhizo glabrae-Tamaricetum canariensis, Lycio intricati-Tamaricetum canariensis i.a.
Tamarix gallica, *Tamarix africana* or *Tamarix canariensis* thickets of watercourse galleries, humid depressions and slightly saline coastal flats in Iberia, southern and western France, peninsular Italy, the Balearics, Corsica, Sardinia, Sicily, the Maltese Islands and mediterranean North Africa. The accompanying flora comprises *Scirpus holoschoenus, Saccharum ravennae, Arundo donax, Brachypodium phoenicoides, Piptatherum miliaceum, Asparagus acutifolius, Equisetum ramosissimum, Rubia peregrina, Rubia longifolia, Rubia angustifolia, Dittrichia viscosa.*
(Quézel and Santa, 1962; Pignatti, 1982; Lopez Gonzalez, 1982; Izco *et al.*, 1984; Fenaroli, 1984; Gamisans, 1985; Pratesi and Tassi, 1985; Veri and Pacioni, 1985; Chiappini, 1985a, 1985b; Fernandez Gonzalez, 1986; Alcaraz Ariza and Peinado Lorca, 1987: 276; Ferioli, 1989; Lanfranco, 1989: 23; Britton and Crivelli, 1993: 145, 147, 159, 160; Lanfranco, 1999a; Schembri, 1999b).

45. TEMPERATE BROAD-LEAVED EVERGREEN FORESTS

Temperate forests dominated by broad-leaved sclerophyllous or lauriphyllous evergreen trees, or by palms. They are characteristic of the Mediterranean and warm-temperate humid zones, with a few representatives in the nemoral, Irano-Turanian and Saharo-Sindian zones.
(Schweinfurth, 1957; Fenaroli, 1970; Tomaselli, 1970; Knapp, 1973; Zohary, 1973; Horvat *et al.*, 1974; Ortuno and Ceballos, 1977; Ozenda, 1981, 1985; Quézel, 1981b; Debazac, 1983; Satoo, 1983; Fernandez Gonzalez, 1986; Noirfalise, 1987; Peinado-Lorca and Rivas-Martinez, 1987; Wildpret de la Torre and del Arco Aguilar, 1987; Barneschi, 1988; Rieley and Page, 1990; Dallman, 1998).

45.3. Holm-oak forests

Quercion ilicis
Forests dominated by *Quercus ilex* or *Quercus rotundifolia*, often, but not necessarily, calcicolous.
(Oberdorfer, 1947; Rechinger, 1951; Ocana-Garcia, 1958; Bolos and Molinier, 1958; Kornas, 1959; Horvat, 1962; Jasiewicz, 1963; Amaral Franco, 1965; Archiloque *et al.*, 1969; Fenaroli, 1970; Tomaselli, 1970; Horvat *et al.*, 1974; Lapraz, 1975; Ozenda, 1975, 1979, 1981; Margot and Romain, 1976; Ortuno and Ceballos, 1977; Brullo *et al.*, 1977; Lambinon *et al.*, 1978; Sfikas, 1978; Polunin, 1980; Groppali *et al.*, 1980, 1981, 1983; Quézel, 1981b; Géhu and Géhu-Franck, 1984c; Chiappini, 1985a, 1985b; Dupias, 1985; Veri and Pacioni, 1985; Fenaroli, 1985; Gamisans, 1985; Noirfalise, 1986, 1987; Fernandez Gonzalez, 1986; Peinado-Lorca and Rivas-Martinez, 1987; Barneschi, 1988; Baudière *et al.*, 1988).

45.31. Meso-Mediterranean holm-oak forests
Rich meso-Mediterranean *Quercus ilex* forests, penetrating locally, mostly in ravines, into the thermo-Mediterranean zone. They are often degraded to arborescent matorral (unit 32.11), and some of the types listed below no longer exist in the fully developed forest state relevant to category 45; they have nevertheless been included, both to provide appropriate codes for use in 32.11, and because restoration may be possible.
(Oberdorfer, 1947; Rechinger, 1951; Ocana-Garcia, 1958; Bolos and Molinier, 1958; Kornas, 1959; Horvat, 1962; Jasiewicz, 1963; Amaral Franco, 1965; Fenaroli, 1970; Tomaselli, 1970; Horvat *et al.*, 1974; Lapraz, 1975; Ozenda, 1975, 1981; Margot and Romain, 1976; Ortuno and Ceballos, 1977; Brullo *et al.*, 1977; Lambinon *et al.*, 1978; Sfikas, 1978; Polunin, 1980; Groppali *et al.*, 1980, 1981, 1983; Quézel, 1981b; Chiappini, 1985a, 1985b; Dupias, 1985; Veri and Pacioni, 1985; Fenaroli, 1985; Gamisans, 1985; Noirfalise, 1986, 1987; Fernandez Gonzalez, 1986; Peinado-Lorca and Rivas-Martinez, 1987; Barneschi, 1988).

45.31B. Pantellerian and Maltese holm-oak woodland
Relictual pockets of *Quercus ilex* woodland of Pantelleria and the Maltese Islands.
(Brullo *et al.*, 1977; Lanfranco, 1999a; Schembri, 1999b).

45.31B2. Maltese holm-oak woodland
Quercus ilex woodland of the Maltese Islands, formerly widespread in all islands, now almost extinct in forest form, represented by small copses of old trees in four localities, all on the main island.
(Lanfranco, 1989: 10; Lanfranco, 1999a; Schembri, 1999b).

5. BOGS AND MARSHES

Mire communities, for the most part turfogenic, of sedges, grasses, rushes, bryophytes and their associated species; tall helophyte fringes of water bodies. Complex systems of raised bogs, blanket bogs, rich fens, acidic fens, transition mires, boreal marsh-fens, aapa, palsa and polygon mires characterized by the presence of these communities, but also including formations otherwise typical of sections 22, 31, 37, 44. Spring systems.

53. WATER-FRINGE VEGETATION

Communities of the margins and of the floating rafts of lakes, rivers and brooks, or of eutrophic marshes and swamps, based on sociations of large graminoid, juncoid or broad-leaved plants, for the most part helophytes.
(Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Rivas-Martinez *et al.*, 1980; Nordiska ministerradet, 1984; Walter and Breckle, 1986, 1991c; Peinado Lorca and Rivas-Martinez, 1987; Rieley and Page, 1990; Korotkov *et al.*, 1991; Denny, 1993a; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994; Lu, 1995; Archibold, 1995).

53.1. Reed beds

Rhragmitetea (*Phragmiti-Magnocaricetea)*: *Phragmitetalia: Phragmition australis, Scirpion maritimi* (*Cirsio brachycephali-Bolboschoenion), Oenanthion aquaticae, Phalaridion arundinaceae*
Communities of the margins of Palaearctic lakes, inland seas and sea inlets, rivers and brooks, eutrophic marshes and swamps, based on sociations of tall helophyte Poaceae, *Scirpus, Typha*, horsetails or forbs, usually species-poor and often dominated by one species, growing in stagnant or slowly flowing water of fluctuating depths, and sometimes on waterlogged ground. They are classified according to dominant species which give them a distinctive appearance.
(Jordanoff, 1931; Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Zohary, 1973; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Soo, 1980; Noirfalise *et al.*, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Wheeler, 1980a; Pignatti, 1982; Moravec *et al.*, 1983; Botch and Masing, 1983; Matuszkiewicz, 1984; Rivas-Martinez *et al.*, 1984b; Nordiska ministerradet, 1984; Polunin and Walters, 1985; Wolff, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Costa, 1987; Oberdorfer, 1990; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Steiner, 1992; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994).

53.13. Reedmace beds
Rhragmition australis: Typhetum angustifoliae, Typhetum latifoliae (*Scirpo-Phragmitetum p.), Typhetum laxmannii*
Communities of the margins of Palaearctic lakes, rivers and brooks dominated by *Typha latifolia, Typha angustifolia, Typha domingensis, Typha laxmannii, Typha elephantina* formations, usually extremely species-poor and sometimes almost pure, tolerant of extended periods of dryness, varying conditions of salinity, and of pollution.
(Lebrun *et al.*, 1949: 74; Maire, 1952; Quézel and Santa, 1962; Ellenberg, 1963, 1988; Zohary, 1973; Bournérias, 1979, 1984; Cook, 1980; Soo, 1980; Botch and Masing, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Nordiska ministerradet, 1984; Polunin and Walters, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Costa, 1987; Oberdorfer, 1990; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Korotkov *et al.*, 1991; Zahran and Willis, 1992; Steiner, 1992; Balatova-Tulackova *et al.*, 1993: 87-88; Påhlsson, 1994).

53.134. Southern reedmace beds
Typha domingensis (*Typha angustifolia* ssp. *australis, Typha australis, Typha angustata)*-dominated formations of fresh water and saline habitats, mostly characteristic of North Africa and southern Eurasia.
(Zohary, 1973; Lanfranco, 1989: 46; Zahran and Willis, 1992; Lanfranco, 1999a).

53.14. Medium-tall waterside communities
Oenanthion aquaticae
Communities of the margins of Palaearctic lakes, rivers and brooks dominated by shorter, mostly nongraminoid helophytes emerging from mesotrophic or eutrophic, stagnant or slow-moving, shallow water, and constituting fringes or patches within or alongside reedbeds.
(Golub and Mirkin, 1986; Nordiska ministerradet, 1984; Påhlsson, 1994; Hoda *et al.*, 1998: 6).

53.146. Water dropwort-great yellowcress communities
Oenantho-Rorippetum amphibiae
Communities of the margins of Palaearctic lakes, rivers and brooks, often situated at the edges of reedbeds, rich in *Oenanthe aquatica* or *Rorippa amphibia.*
(Horvat *et al.*, 1974: 183, 273, 404; Moravec *et al.*, 1983: 28; Matuszkiewicz, 1984: 78; Balatova-Tulackova *et al.*, 1993: 119).

53.14A. Common spikerush beds
Eleocharitetum palustris, Butomo-Eleocharitetum palustris, i.a.
Low, often extensive and very homogeneous formations of Palaearctic lakeshores, pools and ditches with strongly fluctuating water regime, dominated by *Eleocharis palustris.*
(Hadac, 1969: 4-6; Moravec *et al.*, 1983: 28; Matuszkiewicz, 1984: 78; Nordiska ministerradet, 1984: unit 5.2.3.6a *p.*, 6.1.2.5; Balatova-Tulackova *et al.*, 1993: 120-121; Påhlsson, 1994: units 4.2.4.1, 5.2.3.6b, *p.*, 6.1.2.5a; Mossberg *et al.*, 1995: 606).

53.15. Water-fringe grass beds
Rhragmition australis
Communities of the margins of Palaearctic lakes, inland seas and sea inlets, rivers and brooks, eutrophic marshes, swamps and ditches dominated by medium or medium-tall helophyte Poaceae of genera *Glyceria, Leersia, Socolochloa* or *Calamagrostis.*
(Jordanoff, 1931; Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Bournérias, 1979, 1984; Soo, 1980; Noirfalise *et al.*, 1980; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Oberdorfer, 1990; Balatova-Tulackova *et al.*, 1993: 88-89; Mossberg *et al.*, 1995: 560).

53.151. Sweetgrass beds
Rhragmition australis
Communities of eutrophic Palaearctic waters, often with variable level, dominated by fairly tall, robust grasses of genus *Glyceria* (section *Hydropoa).*
(Jordanoff, 1931; Lebrun *et al.*, 1949; Ellenberg, 1963, 1988; Bournérias, 1979, 1984; Soo, 1980; Noirfalise *et al.*, 1980; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Oberdorfer, 1990; Balatova-Tulackova *et al.*, 1993: 88-89; Mossberg *et al.*, 1995: 560).

53.1511. Reed sweetgrass beds
Glycerietum maximae
Communities of eutrophic Palaearctic waters dominated by *Glyceria maxima,* rather low, usually constituting strips in or along ditches or small streams, often in grasslands, requiring fairly constant inundation by eutrophic water and with a fairly rich associated flora.
(Lebrun *et al.*, 1949: unit 74; Horvat *et al.*, 1974: 183, 273, 404; Tanghe, 1975: 85; Matuszkiewicz, 1984: 78; Delescaille, 1987: 72; Balatova-Tulackova *et al.*, 1993: 88-89).

53.16. Reed canary-grass beds
Rhragmition: Phalaridetum arundinaceae, Rorippo-Phalaridetum arundinaceae (*Phalaridion arundinaceae p.)*
Communities of the margins of Palaearctic lakes, rivers, brooks and swamps dominated by *Phalaris arundinacea,* pure or mixed with *Phragmites australis,* very tolerant of drying, pollution and perturbance, susceptible of forming the landward belt of reedbeds and often characteristic of degraded systems.
(Lebrun *et al.*, 1949: unit 74; Ellenberg, 1963, 1988; Horvat *et al.*, 1974: 273, 404; Bournérias, 1979, 1984; De Sloover *et al*., 1980: 66-67; Matuszkiewicz, 1984: 79; Diaz Gonzalez and Fernandez Prieto, 1987; Delescaille, 1987: 74; Balatova-Tulackova *et al*., 1993: 107, 116-117; Mossberg *et al.*, 1995: 588; Hoda *et al*., 1998: 6).

53.17. Halophile clubrush beds
Scirpion maritimi: Bolboschoenetum maritimi, Schoenoplectum tabernaemontani, Bolboschoeno-Phragmitetum communis p.
Formations of clubrushes (*Scirpus spp.),* often accompanied by rushes (*Juncus spp.),* fringing, to a depth of 1.5 metres, brackish or saline waters of coastal saltmarshes, coastal lagoons and athalassic saline waterbodies of the Palaearctic region. *Scirpus tabernaemontani* (*Schoenoplectum tabernaemontani),* *Scirpus maritimus* (*Bolboschoenus maritimus),* *Scirpus triqueter, Scirpus litoralis, Scirpus pungens,* with, in particular, *Juncus gerardi* and *Juncus maritimus,* compose various communities in the western Palaearctic; *Scirpus iseensis* is one of the components of eastern Palaearctic formations.
(Lebrun *et al.*, 1949: unit 73; Ellenberg, 1963, 1988; Zohary, 1973; Horvat *et al.*, 1974: 154-155, 222, 273, 404; Soo, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Babalonas, 1980: 623-625; Botch and Masing, 1983; Matuszkiewicz, 1984: 78; Nordiska ministerradet, 1984: units 4.1.4.1 *p.*, 4.2.1.1 *p.*, 6.1.3.6 *p.;* Diaz Gonzales and Fernandez Prieto, 1987: 87; Costa, 1987; Kolbek *et al.*, 1989; Lanfranco, 1989: 47; Oberdorfer, 1990; Korotkov *et al.*, 1991; Balatova-Tulackova *et al.*, 1993: 109-112; Påhlsson, 1994: units 4.2.4.1 *p.*, 4.3.1.1 *p.*, 6.1.3.5 *p.;* Hoda *et al.*, 1998: 6).

53.2. Large sedge communities

Rhragmitetea (*Phragmiti-Magnocaricetea*): *Phragmitetalia: Magnocaricion elatae*
Formations of large Cyperaceae of genera *Carex* or *Cyperus* occupying the edge or the entirety of humid depressions, oligotrophic mires and rich fens of the Palaearctic region, on ground that can be dry for part of the year. They occur, in particular, on the landward side of reedbeds in waterside successions and as colonists of humid depressions on mineral soils, or of acid and alkaline fens.
(Maire, 1957; Ellenberg, 1963, 1988; Zohary, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Bournérias, 1979, 1984; Rivas-Martinez *et al.*, 1980; Soo, 1980; Wheeler, 1980a; Dethioux, 1982; Botch and Masing, 1983; Oberdorfer, 1990; Korotkov *et al.*, 1991; Steiner, 1992; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994).

53.21. Large *Carex* beds
Palaearctic communities of social sedges of genus *Carex,* usually dominated by one species that can be either tussock-forming or bed-forming. They are arranged according to dominant species.
(Ellenberg, 1963, 1988; de Boer, 1974; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984: 229-230; Rivas-Martinez *et al.*, 1980; Soo, 1980; Wheeler, 1980a; Jermy *et al.*, 1982; Pignatti, 1982; Dethioux, 1982; Moravec *et al.*, 1983; Botch and Masing, 1983; Matuszkiewicz, 1984; Rivas-Martinez *et al.*, 1984b; Nordiska ministerradet, 1984; Wolff, 1987; Navarro Andres and Valle Gutierrez, 1987; Asensi Marfil and Diez Garretas, 1987; Costa, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Oberdorfer, 1990; Korotkov *et al.*, 1991; Elias *et al.*, 1991; Steiner, 1992; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994: unit 3.4.4.1 *i.a.).*
53.212. Slender tufted sedge beds and related communities

Palaearctic formations of the terrestrialisation zone of marshes, ponds and lakes on mostly mineral, neutral, basic or weakly acid substrates, dominated by large bed-forming, rhizomatous, sedges, in particular, *Carex acuta*, *Carex acutiformis* or their relatives.
(Ellenberg, 1963, 1988; van der Ploeg and Rudolphy, 1970, 1971; Horvat *et al.*, 1974; Bournérias, 1979, 1984: 229-230; Dethioux, 1982; Botch and Masing, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984: 79; Nordiska ministerradet, 1984; Golub and Mirkin, 1986; Balatova-Tulackova and Venanzoni, 1989; Oberdorfer, 1990; Korotkov *et al.*, 1991; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994; Mossberg *et al.*, 1995).

53.2128. *Carex hispida* beds
Leucojo-Caricetum p.
Formations of the terrestrialisation zone of Mediterranean marshes, ponds, lakes, ditches dominated by *Carex hispida.*
(Molinier and Martin, 1980: 55; Pignatti, 1982: III, 675; Lanfranco, 1989: 46; Gamisans, 1991: 322-326).

53.22. Tall galingale beds
Palaearctic formations dominated by large perennial Cyperaceae of genus *Cyperus,* other than *Cyperus papyrus.*
(Maire, 1957; Quézel and Santa, 1962; Zohary, 1973; Horvat *et al.*, 1974; Brullo *et al.*, 1977; Pignatti, 1982; Wildpret de la Torre and del Arco Aguilar, 1987; Zahran and Willis, 1992).

53.221. Common galingale beds
Cyperetum longi
Cyperus longus formations of Italy, southeastern Europe, North Africa and Asia Minor.
(Quézel and Santa, 1962; Zohary, 1973; Horvat *et al*., 1974: 154-155, 184, 186, 222, 273; Pignatti, 1982).

53.222. Slender galingale beds
Formations dominated by, or rich in, *Cyperus laevigatus,* characteristic, in particular, of saline depressions in the Canary Islands, of thermal waterbodies on Pantelleria, and of damp, often saline, sites, such as lake, marsh and swamp margins, of North Africa. These formations are apparently extinct in the Maltese Islands.
(Maire, 1957; Quézel and Santa, 1962; Zohary, 1973; Brullo *et al.*, 1977; Pignatti, 1982; Wildpret de la Torre and del Arco Aguilar, 1987; Lanfranco, 1989: 46-47; Zahran and Willis, 1992).

53.3. Fen-sedge beds

Rhragmitetea (*Phragmiti-Magnocaricetea)*: *Phragmitetalia: Magnocaricion elatae: Cladietum marisci* (*Mariscetum serrati)*; *Tofieldietalia* (*Caricetalia davallianae)*: *Caricion davallianae; i.a.*
Cladium mariscus-dominated formations of Europe north to 62° N and the Mediterranean basin, mostly limited in the northern part of their range, where they have a distincty relict distribution, to alkaline and sometimes acid fens and to the land-building zone of calcareous lakes, somewhat more widespread in the Mediterranean region as a waterside vegetation.
(Maire, 1957; Quézel and Santa, 1962; Ellenberg, 1963, 1988; De Sloover, 1970; Zohary, 1973; Schumacher, 1977; Rivas-Martinez *et al.*, 1980; Soo, 1980; Wheeler, 1980a; Pignatti, 1982; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Nordiska ministerradet, 1984: unit 3.6.4.1a; Bournérias, 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Oberdorfer, 1990; Korotkov *et al.*, 1991; Zahran and Willis, 1992; Balatova-Tulackova *et al.*, 1993: 95-96; Påhlsson, 1994: unit 3.4.4.1a; Mossberg *et al.*, 1995: 608).

53.33. Riparian *Cladium* beds
Rhragmitetalia: Magnocaricion elatae: Cladietum marisci (*Mariscetum serrati)*
Species-poor *Cladium mariscus* formations of Palaearctic riversides or lakesides, with a *Phragmition* cortège, mostly characteristic of Mediterranean regions, including North Africa, where they are, however, uncommon.
(Maire, 1957; Micevski, 1957; Quézel and Santa, 1962; Zohary, 1973; Horvat *et al.*, 1974: 154, 222, 273, 494; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Diaz Gonzalez and Fernandez Prieto, 1987: 97; Asensi Marfil and Diez Garretas, 1987; Korotkov *et al.*, 1991; Zahran and Willis, 1992; Balatova-Tulackova *et al.*, 1993: 95-96; Hoda *et al.*, 1998: 7; Micevski, 1999).

53.4. Small reed beds of fast-flowing waters
Rhragmitetea (*Phragmiti-Magnocaricetea)*: *Phragmitetalia: Glycerio-Sparganion* (*Nasturtio-Glycerietalia, Nasturtietea officinalis)*: *Glycerietum fluitantis, Glycerietum plicatae, Nasturtietum officinalis i.a.*
Formations of small helophytes, *Glyceria fluitans, Glyceria plicata, Glyceria nemoralis, Glyceria declinata, Leersia oryzoides, Catabrosa aquatica, Sparganium neglectum, Sparganium microcarpum, Nasturtium officinale, Nasturtium microphyllum, Veronica beccabunga, Veronica anagallis-aquatica, Apium nodiflorum, Sium erectum* occupying, from the Euro-Siberian region, through the Mediterranean basin, to desert oases, the banks of Palaearctic small rivers, brooks, brooklets or springs on alluvial or peaty soils.

(Lebrun *et al.*, 1949: unit 72; Ellenberg, 1963, 1988; Kopecky, 1972; Zohary, 1973; Horvat *et al.*, 1974: 183-184, 273, 404, 494; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Soo, 1980; Rivas-Martinez *et al.*, 1980; De Sloover *et al.*, 1980: 67-68; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Rivas-Martinez *et al.*, 1984b; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Martinez Parras *et al.*, 1987; Wolff, 1987; Lanfranco, 1989: 44; Oberdorfer, 1990; Balatova-Tulackova *et al.*, 1993; Påhlsson, 1994: unit 6.6.1.1 *p.;* Mossberg *et al.*, 1995: 561, 591, 556, 596, 160, 404; Popescu *et al.*, 1997: 144; Hoda *et al.*, 1998: 6).

53.6. Riparian cane formations

Mediterranean, desert, sub-desert, sub-tropical and tropical Palaearctic beds of tall canes lining permanent or temporary water courses and water bodies.
(Maire, 1952; Knapp, 1973; Zohary, 1973; Walter, 1974: 256; Horvat *et al.*, 1974; Rivas-Martinez *et al.*, 1980; Izco *et al.*, 1984; Peinado Lorca and Rivas-Martinez, 1987; Denny, 1993a; Lu, 1995).

53.61. Mediterraneo-Pontic Ravenna cane communities
Imperato-Erianthion
Mediterranean and, locally, southern and southwestern Pontic, tall cane beds formed by *Imperata cylindrica*, *Saccharum ravennae* (*Erianthus ravennae)*, *Saccharum strictum*, *Saccharum spontaneum* (*Saccharum aegyptiacum)*, *Arundo plinii*, *Hemarthria altissima*, mostly lining temporary water courses, but also developing in damp depressions, in particular dune slacks.
(Maire, 1952; Zohary, 1973; Rivas-Martinez *et al.*, 1980; Pignatti, 1982; Izco *et al.*, 1984; Meshinev and Apostolova, 1994).

53.62. Provence cane beds
Arundetum donacis i.a.
Very tall thickets of *Arundo donax* lining water courses of the Middle East and Central Asia; similar formations of the Mediterranean basin, where the species is an old introduction, are included.
(Zohary, 1973: 602, 604, 605; Walter, 1974: 256; Lanfranco, 1999a).

6. INLAND ROCKS, SCREES AND SANDS

Terrestrial habitats and landscapes, free of direct marine influence, in which the mineral substrate, algae, lichens, bryophytes or colonies of animals dominate the physiognomy, and the herb, shrub or woodland communities that occupy enclaves or restricted surfaces within their expanse, in particular rock faces and rock pavements, and the lichen, bryophyte or rock-crack communities that colonize them, unstable screes and lichen, moss, herb, or shrub scree communities, permanent snow and ice, nondesert inland sand systems and all the communities they may support, caves, volcanic features and the specialized bacteria, animal, algae, lichen, moss or herb communities that they support.

61. SCREES, GRAVEL AND BOULDER FIELDS

Thlaspietea rotundifolii p., Drypetea spinosae i.a.
Accumulations of boulders, stones, rock fragments, pebbles, gravels or finer material, of non-aeolian depositional origin or of erosional origin, unvegetated, occupied by lichens or mosses, or colonized by sparse herb- or shrub-dominated communities. Depositional formations are produced in particular by slope processes, by glacial, fluvio-glacial or periglacial depositional processes or by former coastal constructional processes; erosional formations may result from frost weathering, heaving, thrusting or cracking, from aeolian denudation, erosion or abrasion processes, or from glacial erosion. Included are screes and scree slopes, moraines, drumlins, sandar, eskers, kames, block slopes, block streams, block fields, ancient beach deposits, felsenmeer, patterned ground. Deposits originating from aeolian processes (dunes) or from eruptive volcanic activity are not included, nor are those developed under desert climates; they are included in sections 64, 66 and 7, respectively. High mountain, boreal and mediterranean unstable screes are colonized by highly specialized plant communities. They or their constituting species may also inhabit moraines and other debris accumulations in the same areas. A very few communities form in lowland areas elsewhere.
(Lebrun *et al.*, 1949; Rechinger, 1951; Braun-Blanquet, 1954, 1975c, 1977; Ellenberg, 1963, 1988: 436-445; Archiloque *et al.*, 1969; Schaer *et al.*, 1972; Guinochet and Vilmorin, 1973; Zohary, 1973; Horvat *et al.*, 1974; Fernandez Casas, 1975; Ratcliffe, 1977a; Gruber, 1978; Bournérias, 1979, 1984; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Fernandez Casas and Ceballos Jimenez, 1982; Pignatti, 1982; Duvigneaud, 1982b; Fernandez Prieto, 1983; Lippert, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Géhu, 1984a; Rivas-Martinez *et al.*, 1984b; Nordiska ministerradet, 1984; Whittow, 1984; Dupias, 1985; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Salomez, 1990; Jonglet, 1990; Oberdorfer, 1990; Summerfield, 1991: 146, 163-189, 239-240, 274, 275-280, 284-287, 297, 307-308, 327-330; Mayhew and Penny, 1992; Englisch *et al.*, 1993; Påhlsson, 1994; Einarsson, 1994: 125-132, 155-170, 185-186, 191-194; Gudmundsson and Kjartansson, 1996: 57-60).

61.3. Western Mediterranean and thermophilous screens

Thlaspietea rotundifolii: Androsacetalia alpinae p., Thlaspietalia rotundifolii p., Galio-Parietarietalia officinalis (*Stipetalia calamagrostis, Polystichetalia lonchitis) p.*
Screes of warm exposures in the Alps and the Pyrenees, of calcareous substrates in the Pyrenees, of Mediterranean mountains, hills and lowlands and, locally, of warm, sunny middle European upland or lowland sites.
(Lebrun *et al.*, 1949; Braun-Blanquet, 1954, 1977; Ellenberg, 1963, 1988; Archiloque *et al.*, 1969; Schaer *et al.*, 1972; Guinochet and Vilmorin, 1973; Fernandez Casas, 1975; Ratcliffe, 1977a; Gruber, 1978; Bournérias, 1979, 1984; Molinier and Martin, 1980; Ozenda, 1981, 1985; Fernandez Casas and Ceballos Jimenez, 1982; Pignatti, 1982; Duvigneaud, 1982b; Fernandez Prieto, 1983; Lippert, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Géhu, 1984a; Rivas-Martinez *et al.*, 1984b; Dupias, 1985; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Salomez, 1990; Jonglet, 1990; Oberdorfer, 1990, 1992a; Englisch *et al.*, 1993; Julve, 1993: 33-36).

61.3B. Central Mediterranean screes
Thlaspietea rotundifolii: Androsasetalia alpinae: Androsasion alpinae p.; Thlaspietalia rotundifolii: Linario-Festucion dimorphae, Thlaspion stylosi; Polystichetalia lonchitidis: Dryopteridion oreadis p.; Scrophulario-Helechrysetalia: Linarion purpureae; Carlinetea macrocephalae: Carlinetalia macrocephalae: Arrhenatherion sardoi
Screes of the Italian peninsula, of Corsica, Sardinia, Sicily and their associated islands.
(Gamisans, 1991; Oberdorfer, 1992a; Englisch *et al.*, 1993; Julve, 1993).

61.3B1. Central Mediterranean calcareous screes
Thlaspietalia rotundifolii: Linario-Festucion dimorphae, Thlaspion stylosi; Scrophulario-Helechrysetalia: Linarion purpureae
Calcareous screes of the Italian peninsula, of Corsica, Sardinia, Sicily and their associated islands.

62. INLAND CLIFFS AND EXPOSED ROCKS

Asplenietea trichomanis, Aeonio-Greenovietea, Adiantetea capilli-veneris i.a.
Unvegetated, sparsely vegetated, and bryophyte- or lichen-vegetated cliffs, rock faces and rock pavements formed by weathering, by fluvial or glacial processes, by aeolian processes or by past marine action, not presently adjacent to the sea, and not resulting from recent volcanic activity. Plant communities developing in parts of seacliffs free from the influence of wave or wind transported marine salt are included and may be noted by combined use of a code from unit 18.1 with a code from unit 62.
(Rechinger, 1951; Braun-Blanquet, 1954; Lausi and Poldini, 1962; Niklfeld, 1962; Archiloque *et al.*, 1969; Sutter, 1973; Horvat *et al.*, 1974; Ratcliffe, 1977a; Gruber, 1978; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Fernandez Prieto, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Géhu, 1984a; Bournérias, 1984; Rivas-Martinez *et al.*, 1984b; Dupias, 1985; Nordiska ministerradet, 1984; Aparicio Martinez and Silvestre Domingo, 1987; Sfikas, 1987; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Ellenberg, 1988; Latridis, 1988; Salomez, 1990; Jonglet, 1990; Oberdorfer, 1990; Summerfield, 1991: 129-158, 198-199, 219-220, 239-242, 272-275; Julve, 1993; Mucina, 1993f; Påhlsson, 1994; Dimopoulos *et al.*, 1997).

62.1. Calcicolous chasmophyte communities

Asplenietea trichomanis: Potentilletalia caulescentis, Asplenietalia petrarchae, Cirsietalia chamaepeucis, Onosmetalia frutescentis, Potentilletalia speciosae, Silenetalia odontopetalae
Rock-crack communities of dry, calcareous inland cliffs. Specific plant associations colonize montane and Mediterranean cliffs. Most of the subdivisions below refer to them. Northern lowland cliffs usually support fragments of communities listed in other units.
(Rechinger, 1951; Braun-Blanquet, 1954; Lausi and Poldini, 1962; Niklfeld, 1962; Archiloque *et al.*, 1969; Sutter, 1973; Horvat *et al.*, 1974; Ratcliffe, 1977a; Gruber, 1978; Bellot Rodriguez, 1979; Molinier and Martin, 1980; Strid, 1980; Ozenda, 1981, 1985; Pignatti, 1982; Fernandez Prieto, 1983; Moravec *et al.*, 1983; Matuszkiewicz, 1984; Géhu, 1984a; Bournérias, 1984; Rivas-Martinez *et al.*, 1984b; Dupias, 1985; Nordiska ministerradet, 1984; Aparicio Martinez and Silvestre Domingo, 1987; Sfikas, 1987; Peinado Lorca and Rivas-Martinez, 1987; Martinez Parras *et al.*, 1987; Ellenberg, 1988; Latridis, 1988; Salomez, 1990; Jonglet, 1990; Oberdorfer, 1990; Julve, 1993; Mucina, 1993f; Påhlsson, 1994).

62.11. Western eumediterranean calcicolous chasmophyte communities
Asplenietalia petrarchae (*Asplenietalia glandulosi)*: *Asplenion petrarchae, Poterion ancistroidis p., Brassico balearicae-Helichrysion rupestris, Cosentinio bivalentis-Lafuenteion rotundifoliae, Saxifragion boissiero-reuteranae, Teucrion buxifolii, Asperulion garganicae, Centaureo-Campanulion, Centaureo-Portenschlagiellion, Dianthion rupicolae, Brassicion insularis*
Calcareous cliff and rock communities of the mediterranean level of mainland Spain, of the Balaearics, of the thermo- and meso-mediterranean levels of mainland France, of Corsica and Sardinia, of peninsular Italy, of Sicily and associated islands, of the Adriatic coastal regions of the Balkan peninsula.
(Lausi and Poldini, 1962; Niklfeld, 1962; Archiloque *et al.*, 1969; Sutter, 1973; Horvat *et al.*, 1974; Bellot Rodriguez, 1979; Brullo and Marceno, 1979; Molinier and Martin, 1980; Ozenda, 1981; Pignatti, 1982; Géhu, 1984a; Peinado Lorca and Rivas-Martinez, 1987; Gamisans, 1991; Julve, 1993).

62.115. Sicilo-Italic *Dianthus* cliffs
Asplenietalia petrarchae (*Asplenietalia glandulosi*): *Dianthion rupicolae*
Calcareous cliff and rock communities of the thermo- and mesomediterranean levels of Sicily, the Egadi Islands, the Maltese Islands, southern Calabria, southern Tyrrhenian Italy, rich in large subshrubby plants, with *Dianthus rupicola, Iberis semperflorens, Lithodora rosmarinifolia, Antirrhinum siculum, Brassica rupestris, Brassica incana, Scabiosa limonifolia, Pimpinella anisoides, Seseli bocconi* ssp. *bocconi, Silene fruticosa, Asperula rupestris, Cymbalaria pubescens, Odontites bocconei*, all of them endemic to these communities or having in them their area of greatest diffusion.
(Brullo and Marceno, 1979: 133; Géhu, 1984a; Lanfranco, 1989: 13).

62.1154. Hyblaean putoria-micromeria cliffs
Dianthion rupicolae: Putorio-Micromerietum microphyllae
Cliff communities of Miocene limestones of the Iblei Mountains in southeastern Sicily, with *Putoria calabrica, Micromeria microphylla, Asperula aristata* ssp. *scabra* and the Iblei endemics *Trachelium lanceolatum* and *Urtica rupestris.* The *Dianthion rupicolae* cortège is reduced to *Dianthus rupicola, Antirrhinum siculum, Silene fruticosa, Brassica incana, Odontites bocconei, Cymbalaria pubescens, Pimpinella anisoides.* An isolated representative of the community exists on the Maltese Islands, located in a wadi of the central part of the main island, at Misram Gnonoq, dominated by *Putoria calabrica*, but with an otherwise reduced cortège that includes *Micromeria microphylla* and *Antirrhinum siculum* but not *Dianthus rupicola. Chiliadenus bocconei*, characteristic of the next unit, is present.
(Brullo and Marceno, 1979: 132, 135-136, 142; Lanfranco, 1989: 27).

62.1155. Maltese rdum communities
Dianthion rupicolae: Triadenio-Chiliadenetum bocconei
Calcareous cliff and rock communities of the Maltese Islands, characteristic of the western coasts of Malta, of Gozo, and of the vertical walls of wadis, harbouring many vulnerable, rare or endemic species. Endemic, often palaeoendemic, species include *Chiliadenus bocconei, Palaeocyanus crassifolius, Cremnophyton lanfrancoi, Darniella melitensis, Limonium melitensis.* Subendemic species comprise *Crucianella rupestris, Senecio pygmaeus, Daucus rupestris.* Among characteristic or physionomically important species are *Hypericum aegyptiacum* (*Triadenia aegyptiaca*), *Salsola vermiculata, Capparis orientalis* (*Capparis spinosa* var. *inermis*), *Arthrocnemum glaucum, Inula crithmoides, Crithmum maritimum, Asphodelus microcarpus.* Communities in Gozo are perhaps even more diverse and include endemic *Helichrysum melitense, Hyoseris frutescens, Matthiola incana* subsp. *melitensis* and subendemic *Senecio leucanthemifolius*, with *Daucus gingidium* and *Allium arvense.* More impoverished communities of Comino are mainly characterized by *Darniella melitensis* with *Daucus rupestris, Senecio leucanthemifolius* and *Inula crithmoides.*
(Brullo and Marceno, 1979: 132, 136-137; Lanfranco, 1989: 12, 15, 16, 25, 26, 27, 35; Stevens, 1999a, 1999b; Schembri, 1999b; Lanfranco, 1999a).

62.3. Pavements, rock slabs, moss and lichen carpets

More or less level surfaces of rock of lowlands, hills and mountains of nondesert regions of the Palaearctic exposed by glacial erosion, by weathering processes, or by nondesert aeolian scouring, bare or colonized by mosses, algae or lichens. The hard rock surface may be apparent or partially or completely covered by indigenous erosional rock debris, in particular, those produced by frost weathering, heaving, thrusting or cracking. Included are, in particular, lapiés, karren, limestone pavements of karst landscapes, rock dome tops, whaleback, roche moutonnée, flyggberg and rock basin formations of periglacial areas, frost-shattered mountain-top detritus and felsenmeer formations, level surfaces of dykes and old lava flows. Vascular plant communities may colonize cracks and superficially decomposed areas, in particular, *Sedo-Scleranthion, Alysso-Sedion albi* or *Sedo albi-Veronicion dillenii* communities of units 34.11 and 36.2, occasionally scree communities of unit 61 or chasmophyte communities of units 62.1 or 62.2. More developed communities belonging to other units may also be present.
(Pearsall, 1971: 80-85; Whitten and Brooks, 1972: 255, 261; Whittow, 1984: 158-159, 302, 389-390, 458-459, 551; Summerfield, 1991: 146, 148-150, 239-240, 273-275, 297; Einarsson, 1994; Gudmundsson and Kjartansson, 1996).

62.31. Pavements, rock slabs, rock domes
Bare or sparsely vegetated more or less level surfaces of rock of lowlands, hills and mountains of nondesert regions of the Palaearctic exposed by erosion or weathering processes, physiognomically dominated by hard rock surfaces or indigenous erosional rock debris.
(Pearsall, 1971: 80-85; Whitten and Brooks, 1972: 255, 261; Whittow, 1984: 158-159, 302, 389-390, 458-459, 551; Summerfield, 1991: 146, 148-150, 239-240, 273-275, 297; Einarsson, 1994; Gudmundsson and Kjartansson, 1996).

62.311. Limestone pavements
More or less level surfaces of calcareous rock of lowlands, hills and mountains of nondesert regions of the Palaearctic, including karstic pavements, lapiés, with their clints and grikes.
(Whitten and Brooks, 1972: 255, 261; Whittow, 1984: 302, 389-390, 458-459, 551; Summerfield, 1991: 148-150).

62.3115. Mediterranean limestone pavements
More or less level surfaces of calcareous rock of lowlands, hills and low mountains of the Mediterranean region.

62.34. Rock pavement and slab pools
Pools, usually temporary, forming in basins, hollows or depressions on more or less level surfaces of rock of lowlands, hills and mountains of nondesert regions of the Palaearctic. They may be colonized by highly specialized communities of units 22.2 and 22.3.
(Bournérias, 1984; Arnal, 1996; Lanfranco, 1999b).

62.341. Limestone pavement pools
Pools, usually temporary, forming in karst pans, runnels, basins, pits of limestone pavements of lowlands, hills and mountains of nondesert regions of the Palaearctic. They may be colonized by highly specialized communities of units 22.25, 22.27 and 22.3. Remarkable, endemic-rich faunas occur, in particular, in temporary pools of Malta, of the Causses and of the Slovenian karst.
(Schembri, 1989; Lanfranco and Schembri, 1989: 130; Summerfield, 1991: 148-151; Lanfranco, 1999a, 1999b; Schembri, 1999b, 1999c).

62.4. Dry inland cliffs

Noncoastal cliffs and exposed rocks of nondesert regions of the Palaearctic. At high altitudes and high latitudes, they may be devoid of vascular vegetation; they are then usually colonized by lichen crusts and "ink stains". At lower altitudes in the mountains, as well as in Mediterranean and boreal regions, they comprise, besides lichen communities and bare surfaces, fissure communities of units 62.1 and 62.2. In nemoral and steppe lowland and hills, these specialized fissure communities are very impoverished, reduced to the extremely paucispecific communities of units 62.1B and 62.29; they share the cliffs with debris sward communities of unit 34.11, more evolved grassland communities of unit 34.35, sometimes 34.31, 34.33 or 34.341, and lacunar shrub formations of unit 31.8.
(Ellenberg, 1988: 446-455, 484-485).

62.41. Limestone dry inland cliffs
Rrotoblastenietea immersae, i.a.
Limestone rocks and cliffs of lowlands, hills and mountains of nondesert regions of the Palaearctic. Their lichen communities are composed of internal crustose lichens (*Protoblastenia, Verrucaria, Petractis, Polyblastia),* external crustose lichens (*Caloplaca, Xanthoria)* or gelatinous (*Collema)* and foliose (*Dermatocarpon)* lichens.
(Ellenberg, 1988: 453).

62.415. Mediterranean limestone cliffs
Limestone rocks and cliffs of lowlands, hills and low mountains of the Mediterranean region, harbouring specialized Mediterranean chasmophyte communities.

65. CAVES

Natural caves, cave systems, underground waters and subterranean interstitial spaces. Caves and their associated waters (units 65.1-65.7) harbour varied, but paucispecific, communities of animals, fungi and algae that are restricted to them (troglobiont organisms), or are physiologically and ecologically capable of conducting their entire life cycle within them (troglophile organisms), or are dependent on them for part of the life cycle (subtroglophile organisms). Underground waters not associated with caves (stygon, unit 65.8) and interstitial spaces (units 65.9, 65.A) harbour distinctive faunas.
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Vornatscher, 1979; Neuherz, 1979; Passauer, 1979; Culver, 1986; Leser, 1994; Einarsson, 1994; Gudmundsson and Kjartansson, 1996; Celhar, 1997).

65.3. Insular subtroglophile vertebrate caves

Caves of the islands of Eurasia and North Africa essential to parts of the life-cycle of vertebrate subtroglophiles (elective periodic trogloxenes).
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Culver, 1986; Stebbings, 1988; Erminio, 1988; Corbett, 1989; Ransome, 1990; Schober and Grimmberger, 1991; Nöllert and Nöllert, 1992; Macdonald and Barrett, 1993; Leser, 1994).

65.32. Insular bat caves
Caves of the islands of Eurasia and North Africa with permanent or temporary colonies of bats.
(Stebbings, 1988; Lanfranco and Schembri, 1989: 134-135; Ransome, 1990; Schober and Grimmberger, 1991; Macdonald and Barrett, 1993).

65.4. Troglobiont invertebrate caves

Caves harbouring communities that include no troglobiont amphibians or fish, but include troglobiont invertebrates, limited worldwide to a relatively small number of species belonging to a limited number of groups, and including remarkable relict species. In the Palaearctic region, the majority are situated in the northern Mediterranean basin and the peri-Pontic region. Gastropoda, Opiliones, Chilopoda (Lithobiidae), Collembol, Coleoptera (Bathysciinae and Trechinae subfamilies) among the terrestrial faunas, Turbellaria, Gastropoda and Urodela, among the aquatic faunas, are characteristic of their communities, and essentially restricted to caves of temperate regions.
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Vornatscher, 1979; Neuherz, 1979; Culver, 1986; Aljancic, 1993; Leser, 1994; Celhar, 1997; Mrsic, 1997).

65.41. Troglobiont invertebrate temperate caves
Caves under normally oxygenated, buffered microclimates, dry, humidified by seeps or crossed by permanent or temporary watercourses, but not retaining glaciers, and harbouring communities of troglobiont invertebrates, often including remarkable relict species.
(Schembri, 1989: 72, 74, 75; Mrsic, 1997).

65.5. Troglophile invertebrate caves

Caves harbouring communities that include no troglobiont organisms, but include troglophile invertebrates. Generally, they are caves crossed by watercourses or with rich trophic substratum, excavated in limestone afforested zones.
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Vornatscher, 1979; Neuherz, 1979; Culver, 1986; Aljancic, 1993; Leser, 1994; Celhar, 1997).

65.6. Subtroglophile invertebrate caves

Caves essential to parts of the life-cycle (quiescence period) of invertebrate subtroglophiles (elective periodic trogloxenes), such as Lepidoptera, Diptera, Hymenoptera, Coleoptera; in general they are stably cool (or warm) and humid caves.
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Vornatscher, 1979; Neuherz, 1979; Culver, 1986; Aljancic, 1993; Leser, 1994; Celhar, 1997).

65.7. Atroglozoocoenotic caves

Caves, often small and dry, devoid of significant troglobiont or troglophile zoocoenoses, and not harbouring significant subtroglophiles.
(Thinès and Tercafs, 1972; Ginet and Decou, 1977; Neuherz, 1979; Leser, 1994; Einarsson, 1994; Gudmundsson and Kjartansson, 1996).

65.8. Stygal biocenoses

Communities harboured by ground waters (stygon), not including those of cave waters. They are constituted by mostly small, elongated forms, in Europe principally bacteria, protozoans, turbellarians, rotifers, nematodes, copepods and amphipods.
(Motas, 1962; Holthuis, 1973; Botosaneanu, 1986; Iliffe, 1992).

65.82. Interstitial phreatic biocenoses
Communities of stygobiont invertebrates and vertebrates, highly distinctive, occupying eustygal habitats, interstitial water saturating porous sediments below the water table.
(Motas, 1962; Botosaneanu, 1986).

65.9. Hyporheic interstitial biocenoses

Rhythrostygal (potamostygal) communities of stygobiont organisms, mostly fresh-water mites and small crustaceans, occupying interstitial water in sand and gravel sediments accompanying running water courses.
(Orghidan, 1955, 1959; Botosaneanu, 1986; Schembri, 1989: 75).

65.A. Subterranean interstitial biocenoses

Communities occupying the compartment of the subterranean ecosystem in direct contact with the lower horizon of the soil, at a depth ranging from a few centimeters to a few meters, in the interconnected microspaces of the colluvions or the fissures of the superficial zones of the bedrock. Distinctive interstitial assemblies of troglobiont invertebrates, comprising coleoptera, myriapods, isopods, spiders, pseudoscorpions, have been described from the Pyrenees, the Alps, the Carpathians, the Canary Islands, the Azores.
(Juberthie *et al.*, 1980; Juberthie *et al.*, 1981).

8 . AGRICULTURAL LAND AND ARTIFICIAL LANDSCAPES

Cultivated or built-up areas under the overwhelming influence of human activity; the natural vegetation cover has been totally replaced as a result of agricultural practices, urbanization or industrialization. A natural flora and fauna subsists mainly in areas of extensive and traditional cultivation and dwelling. Wild plants may grow among crops, in hedges, along roads, on walls and in fallow fields. Many animals have, during the course of the past few thousand years, adapted to these man-created habitats.
(Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; de Planhol, 1976; Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Fuller, 1982; Ehrenreich *et al.*, 1982; Chiappini, 1985b; Phillips, 1986; Way and Greig-Smith, 1987; Noirfalise, 1988; Barneschi, 1988; de Rougemont, 1989; Morrison, 1989; Oberdorfer, 1993b; Belder and Misonne, 1994, 1997; Scott and Jones, 1995).

81. IMPROVED GRASSLANDS

Heavily fertilized or reseeded permanent grasslands, sometimes even treated by selective herbicides, with very impoverished flora and fauna.
(Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; Chiappini, 1985b; Noirfalise, 1988; de Rougemont, 1989; Morrison, 1989; Dziewulska, 1990; Green, 1990; Montserrat and Fillat, 1990; Loiseau *et al.*, 1990; Ito, 1990; Shildrick, 1990; Breymeyer, 1990; Oberdorfer, 1993b; Pott, 1996; Grabherr, 1997).

81.1. Dry improved grasslands

Dry or mesophile intensive pastures.
(Rodwell, 1992: unit MG7).

82. CROPS

Fields of cereals, beets, sunflowers, leguminous fodder, potatoes and other annually harvested plants. Faunal and floral quality and diversity depend on the intensity of agricultural use and on the presence of borders of natural vegetation between fields. If a tree layer is present, it can be indicated by simultaneous use of a code of 83 or 84 with the present one.
(de Candolle, 1883; Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; de Planhol, 1976; Vanden Berghen, 1980; Chiappini, 1985b; Phillips, 1986; Way and Greig-Smith, 1987; Noirfalise, 1988; de Rougemont, 1989; Morrison, 1989; Shah and Friend, 1992; Lopez-Bellido, 1992; Spiertz *et al.*, 1992; Nalborczyk and Czembor, 1992; Gataulina, 1992; Oberdorfer, 1993b; Ozenda, 1994; Pott, 1996; Grabherr, 1997).

82.1. Unbroken intensive cropland

Intensive cultivation, involving moderate to high chemical or organic fertilization and/or systematic use of pesticides, with complete ground occupation on dry land.

82.11. Field crops
Cereal and other crops grown on large, unbroken surfaces in open field landscapes.

82.12. Market gardens and horticulture
ntensive cultivation of vegetables, flowers, small fruits, usually in alternating strips of different crops.

82.2. Field margin cropland

Intensively treated crops interspersed with strips of spontaneous vegetation.

82.3. Extensive cultivation

Traditionally and extensively cultivated crops, in particular, of cereals, harbouring a rich and threatened flora of field weeds including *Agrostemma githago, Centaurea cyanus, Legousia speculum-veneris, Chrysanthemum segetum, Calendula arvensis, Adonis spp., Consolida spp., Delphinium spp., Nigella spp., Papaver spp.;* their varied range of associations can be indicated by subdivisions.
(Thill, 1964: 50; Oberdorfer, 1993b; Mucina, 1993c).

83. ORCHARDS, GROVES AND TREE PLANTATIONS

Ligneous crops. Extensive orchards and old plantations may support a rich flora and fauna; it is in particular the case of ancient olive groves and old poplar plantations with tall herb undergrowth.
(de Candolle, 1883; Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; de Planhol, 1976; Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Ehrenreich *et al.*, 1982; Chiappini, 1985b; Barneschi, 1988; de Rougemont, 1989; Morrison, 1989; Belder and Misonne, 1994, 1997; Pott, 1996).

83.1. High-stem orchards

Stands of trees cultivated for fruit or flower production, with an avocation of permanent tree cover once mature.

83.11. Olive groves
Mediterranean formations of *Olea europaea* var. *europaea.*
(le Houerou, 1959; Lanfranco, 1989: 26).

83.111. Traditional olive groves
Ancient olive groves, often made of very old trees shading herbaceous layer, extensively treated. Greek olive groves are an important habitat of the very restricted sylviid *Hippolais olivetorum,* as well as of many orchids.

83.112. Intensive olive groves
Intensively treated or young olive groves.

83.14. Almond groves
Land planted in broad-leaved winter-deciduous almond trees.

83.15. Fruit orchards
High-stem orchards of apple, pear, plum, apricot, peach and other Rosaceae.

83.152. Southern fruit orchards
Thermophilous Mediterranean and sub-Mediterranean fleshy-fruit Rosaceae orchards, usually intensively treated.

83.16. Citrus orchards
Land planted in broad-leaved evergreen citrus trees.

83.18. Other orchards
Land planted in deciduous or evergeen trees, other than those of units 83.11 to 83.16, cultivated for fruit, leaves or flowers.

83.181. Other deciduous orchards
Land planted in deciduous trees, other than those of units 83.12, 83.13, 83.14, 83.15, cultivated for fruit, leaves or flowers.

83.182. Other evergreen orchards
Land planted in evergeen trees, other than those of units 83.11, 83.16, 83.17, cultivated for fruit, leaves or flowers.

83.2. Shrub orchards and plantations

Plantations of dwarf trees, shrubs, espaliers or perennial ligneous climbers, mostly cultivated for fruit or flower production, with an avocation of permanent shrubby cover, or else for wood or small tree production, with a regular whole-plant harvesting regime.

83.21. Vineyards
Plantations of vine.

83.211. Traditional vineyards
Vineyards that have preserved their characteristic accompanying flora, generally lightly treated.

83.212. Intensive vineyards
Vineyards usually cleared of their herb layer, intensively treated.

83.22. Fruit, flower and wood shrub crops
Plantations of dwarf trees, shrubs, espaliers or perennial ligneous climbers other than vineyards and tea plantations, as well as young stages of units 83.23 and 83.21.

83.221. Shrub and low-stem tree orchards
Plantations of dwarf trees, shrubs, espaliers or perennial ligneous climbers, other than vineyards and tea plantations, cultivated for fruit or flower production, with an avocation of permanent shrubby cover. They include, among others, espaliers of various Rosaceae plantations and berry shrub patches.

83.222. Shrub and dwarf tree plantations
Plantations of dwarf trees or shrubs cultivated for wood or small tree production, with a regular whole-plant harvesting regime, including, among others, osier beds, Christmas tree crops, horticultural nurseries. Young stages of units 83.23 and 83.21.

83.3. Tall tree plantations

Cultivated tree formations planted most often for the production of wood, composed of exotic species or of native species out of their natural range and habitat. Early stages of such plantations are listed in unit 83.2.

83.31. Conifer plantations
Cultivated ligneous formations of exotic conifers or of native conifers out of their natural range and habitat.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979; Påhlsson, 1994).

83.311. Native conifer plantations
Plantations of Palaearctic conifers within their broad biogeographical area of occurrence, but outside of the conditions described under "reforestation" in the relevant subdivisions of unit 42.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979; Påhlsson, 1994: unit 2.1.3.1).

83.3111. Native fir, spruce, larch, cedar plantations
Plantations of Palaearctic conifers of genera *Abies, Picea, Larix* or *Cedrus* within their broad biogeographical area of occurrence, but outside of the conditions described under "reforestation" in the relevant subdivisions of unit 42.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979; Påhlsson, 1994: unit 2.1.3.1).

83.3112. Native pine plantations
Plantations of Palaearctic conifers of genus *Pinus* within their broad biogeographical area of occurrence, but outside of the conditions described under "reforestation" in the relevant subdivisions of unit 42.
(Zohary, 1973: 633; Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979; Påhlsson, 1994: unit 2.1.3.1).

83.3113. Native cypress, juniper, yew plantations
Plantations of Palaearctic conifers of genera *Cupressus, Juniperus, Taxus* within their broad biogeographical area of occurrence, but outside of the conditions described under "reforestation" in the relevant subdivisions of unit 42.
(Bary-Lenger *et al.*, 1979).

83.312. Exotic conifer plantations
Plantations of non-Palaearctic species of conifers or of Palaearctic species outside of their broad biogeographical region of occurrence.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979).

83.3121. Exotic spruce, fir, larch, douglas fir, deodar plantations
Plantations of conifers of genera *Abies, Picea, Larix, Pseudotsuga* or *Cedrus* formed of non-Palaearctic species or of Palaearctic species outside of their broad biogeographical region of occurrence.
(Bary-Lenger *et al.*, 1979; Bournérias, 1979: 404-407; Eysteinsson, 2000).

83.3122. Exotic pine plantations
Plantations of conifers of genus *Pinus* formed of non-Palaearctic species, or of Palaearctic species outside of their broad biogeographical region of occurrence.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979: 404-407; Eysteinsson, 2000).

83.3123. Other exotic conifer plantations
Plantations of conifers of genera other than *Pinus, Abies, Picea, Larix, Pseudotsuga* or *Cedrus*, formed of non-Palaearctic species or of Palaearctic species outside of their broad biogeographical region of occurrence.
(Bary-Lenger *et al.*, 1979).

83.32. Plantations of broad-leaved trees
Cultivated evergreen or deciduous broad-leaved tree formations planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in artificial conditions with a considerably modified accompanying cortège.
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979).

83.321. Poplar plantations
Plantations of species, hybrids or cultivars of the deciduous genus *Populus*, in particular, *Populus nigra, Populus nigra* cv. *italica, Populus deltoides, Populus xcanadensis, Populus balsamifera, Populus trichocarpa, Populus candicans.*
(Ortuno and Ceballos, 1977; Bary-Lenger *et al.*, 1979; Bournérias, 1979; Eysteinsson, 2000).

83.3211. Poplar plantations with megaphorb herb layer
Old poplar plantations with a tall herb-rich undergrowth, substitution habitat for some riparian forest species of plants and animals.

83.3212. Other poplar plantations
Poplar plantations devoid of tall herb-rich undergrowth.

83.322. Eucalyptus plantations
Plantations of trees of the Australian genus *Eucalyptus*, in particular, *Eucalyptus globulus, Eucalyptus camaldulensis, Eucalyptus cladocalyx, Eucalyptus delegatensis, Eucalyptus nitens, Eucalyptus radiata, Eucalyptus astringens, Eucalyptus bicostata, Eucalyptus brockwayi, Eucalyptus regnans, Eucalyptus gomphocephala, Eucalyptus grandis, Eucalyptus maidenii, Eucalyptus cornuta, Eucalyptus fastigata, Eucalyptus pauciflora, Eucalyptus viminalis.* These plantations offer little support for indigenous biological diversity and constitute biological deserts as far as the fauna is concerned.
(Ortuno and Ceballos, 1977).

83.323. Exotic oak plantations
Cultivated formations of deciduous trees of genus *Quercus* planted most often for the production of wood, composed of exotic species or of Palaeartic species out of their natural range.
(Bary-Lenger *et al.*, 1979).

83.324. Locust tree plantations
Plantations and spontaneous formations of *Robinia pseudacacia.*
(Bary-Lenger *et al.*, 1979).

83.325. Other broad-leaved tree plantations
Cultivated evergreen or deciduous broad-leaved formations of trees of genera other than *Populus, Eucalyptus, Quercus* and *Robinia*, planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in artificial conditions with a considerably modified accompanying cortège.
(Bary-Lenger *et al.*, 1979).

83.3251. Broad-leaved deciduous tree plantations
Cultivated deciduous broad-leaved formations of trees of genera other than *Populus, Quercus* and *Robinia*, planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in artificial conditions with a considerably modified accompanying cortège.
(Bary-Lenger *et al.*, 1979).

83.3252. Broad-leaved evergreen tree plantations
Cultivated evergreen broad-leaved formations of trees of genera other than *Eucalyptus* planted for the production of wood, composed of exotic species, of native species out of their natural range, or of native species planted in artificial conditions with a considerably modified accompanying cortège.
(Bary-Lenger *et al.*, 1979).

84. TREE LINES, HEDGES, RURAL MOSAICS

Ligneous formations of small size, arranged in a linear, reticulated or insular manner, closely interwoven with grassy or cultivated habitats. Also, combinations of such elements and mixed agricultural formations, containing both ligneous and herbaceous layers. Very artificial, disturbed or heterogeneous systems, containing many planted or exogenous elements can be listed here while more natural ensembles utilising many natural elements and covering substantial surfaces are better classified under section 9 (units 91 and 92). Landscapes in which pastures, crops and plantation elements are intimately mixed (equivalent to unit 92) can be described by use of

the first three codes below (if useful, specified by codes from units 31.8, 41, 42 and 83) in conjunction with other codes from section 8 and other open habitat sections. Surfaces characterized by mixed agricultural formations, and in particular, those that combine ligneous and herbaceous elements on the same surfaces (equivalent to unit 91) can be designated by one of the codes 84.4 or 84.5 and their elements specified by use of other codes from section 8 or any other.
(Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; de Planhol, 1976; Way and Greig-Smith, 1987; Noirfalise, 1988; Morrison, 1989; Pott, 1996).

84.1. Tree lines

Tall ligneous formations arranged in a linear manner, planted mostly for shelter or shading.

84.2. Hedgerows

Ligneous formations arranged in a linear or reticulated manner, closely interwoven with grassy or cultivated habitats, usually serving functions of partition and shelter, characteristically formed of trees and shrubs in temperate oceanic regions of the western seaboard of continents, notably in the western Palaearctic, of cacti in arid and semiarid regions.
(de Planhol, 1976: 81; De Sloover *et al.*, 1980: 81-84).

84.3. Small woodlots

Ligneous formations of small size, arranged in an insular manner within cultivated environments.

84.4. Rural mosaics

Reticulated landscapes of tree-lines, hedgerows, plantations, woodlots, pastures and crops.

84.5. Shaded crops and pastures

Crops or pastures developed under orchards or other cultivated ligneous formations.

85. URBAN PARKS AND LARGE GARDENS

Usually varied formations, created for recreational use. The vegetation, usually composed mainly of introduced species or cultivars, can nevertheless include many native plants and supports a varied fauna when not intensively managed. The heterogeneity of the habitat engenders a high faunal diversity with, however, a preponderance of common species. The frequent presence of old trees favors the installation of rarer specialists.
(Morrison, 1989; Belder and Misonne, 1994, 1997).

85.1. Large parks

Large, varied green spaces. Their constituting elements can be specified by use of the codes below.

85.11. Park woodlots
Copses, groves or woods of native or introduced trees, with or without accompanying shrubbery and herbaceous undergrowth, constituting elements of urban parks.

85.12. Park lawns
Grasslands, usually mowed, composed of native or sometimes exotic grasses, constituting elements of urban parks.

85.13. Park basins
Bodies of water, including basins or more natural ponds or lakes, constituting elements of urban parks. Seminatural communities that might colonize them can be indicated by use of codes from sections 11, 15, 22, 23, 24 or 53.

85.14. Park flower beds, arbors and shrubbery
Plantations of ornamental forbs or shrubs constituting elements of urban parks.

85.15. Park sub-natural communities
Elements of sub-natural communities enclaved in parks or colonizing their elements; codes from sections other than 8 are to be used to specify their nature.

85.2. Small parks and city squares

Small public urban green spaces usually with a simplified structure and suitable for only a very impoverished representation of rural faunas.

85.3. Gardens

Areas of land planted with ornamental or food-crop vegetation, and adjoining a dwelling.

85.31. Ornamental gardens
Areas of land adjoining a house, planted with ornamental grass, shrubs, trees, flower beds.

85.32. Subsistance gardens
Areas of land used for the cultivation of fruit, vegetables, fruit trees or other domestic crops in the immediate vicinity of a dwelling.

85.4. City block inner spaces

Complexes of gardens or other green spaces, often partitioned by walls, located inside city blocks and completely or almost completely surrounded by continuous architectural structures.

86. TOWNS, VILLAGES, INDUSTRIAL SITES

Areas used for human occupation and industrial activities. A considerable fauna has adapted to buildings. Birds such as *Apus apus, Tyto alba* and *Hirundo rustica* nest nearly exclusively in them, using mostly structures with traditional architecture. Other species, of montane rocky habitats, such as *Phoenicurus ochruros*, have colonized lowlands in villages and towns. Bats roost in buildings. Rock plants colonize old walls and roofs.
(Ghio, 1978; Morrison, 1989; Waugh, 1995; Grabherr, 1997).

86.1. Towns

Densely populated settlements integrated within a built-up ensemble of medium to large size, with limited access to surrounding rural areas.
(Waugh, 1995: 384-419).

86.11. Urban centers
Areas situated around the center or the subcenters of a town, characterized by continuous or nearly continuous spatial occupation by buildings destined for habitation or circadian occupation periods.

86.12. Suburban areas
Areas situated at the periphery of a town, characterized by relatively low density and strongly discontinuous spatial occupation by buildings.

86.13. Town features
Relatively large, outstanding structures incorporated within a town ensemble, characterized by a relatively low intensity of spatial or temporal human presence, such as religious edifices and monuments.

86.14. Town ruins and construction sites
Structures and spaces incorporated within a town ensemble, characterized by very low intensity of spatial or temporal human presence, such as ruins, abandoned buildings and construction sites.

86.2. Villages

Small groups of houses in rural areas, susceptible to strong interconnection between usages by the fauna of the built-up and countryside habitats.
(Waugh, 1995: 360-383).

86.21. Village cores
Areas situated around the center of a village, characterized by continuous or nearly continuous spatial occupation by buildings.

86.22. Village peripheries
Areas situated at the near periphery of a village, with relatively low density and strongly discontinuous spatial occupation by buildings.

86.23. Village features
Relatively large, outstanding structures incorporated within a village ensemble, including its near periphery, characterized by a relatively low intensity of spatial or temporal human presence, such as religious edifices, monuments.

86.24. Village ruins and construction sites
Structures and spaces incorporated within a village ensemble, including its near periphery, characterized by very low intensity of spatial or temporal human presence, such as ruins, abandoned buildings and construction sites.

86.3. Active industrial sites

Areas built-up for the purpose of large-scale or relatively large-scale industrial activities, including agro-industry and intensive stock raising, and presently in operation.

86.31. Active extraction sites
Areas used for open-sky mining and quarrying activities and presently in operation.

86.32. Active industrial constructions
Areas built-up for the purpose of industrial activities and presently in operation.

86.4. Old industrial sites and open spaces

Abandoned industrial sites, open areas and byproducts of industrial activities susceptible of colonisation by seminatural communities.

86.41. Abandoned quarries
Permanently or temporarily unworked sites or parts of sites of open-sky extractive activities.

86.411. Sand, clay and kaolin quarries
Permanently or temporarily unworked sites or parts of sites of open-sky soft material extraction, often significant as reproduction sites of burrowing species.

86.412. Gravel quarries
Permanently or temporarily unworked sites or parts of sites of open-sky pebble extraction.

86.413. Hard stone quarries
Permanently or temporarily unworked sites or parts of sites of open-sky hard material extraction, sometimes significant as reproduction or forraging sites of rupicolous species.

86.42. Slag heaps and other detritus heaps
Features of relief formed by byproducts of industrial activities, susceptible of colonisation by seminatural communities.

86.43. Marginal and disused industrial sites
Disused sites of industrial activities, including transportation, social recreation, waste dumping, as well as marginal and interstitial spaces developed within or alongside areas still used for such activities, susceptible of colonisation by seminatural communities.
Saintenoy-Simon, 1984).

86.431. Transport network margins and disused sites
Margins and interstitial spaces of transport infrastructures, including highways and their margins, railroad tracksides, switch yards and maintenance areas, airport runways, aprons and adjacent grounds, portside service areas, as well as disused surfaces of such infrastructures, susceptible of colonisation by seminatural communities.
(Saintenoy-Simon, 1984).

86.432. Recreation area margins and disused sites
Margins and interstitial spaces of surfaces used for recreational activities, including sports playing fields, tracks for athletic events, horse and car racing, playgrounds, amusement parks, military exercise grounds, as well as disused areas of such surfaces, susceptible of colonisation by seminatural communities.

86.433. Rubble and detritus tips
Sites where wasteproducts of human activity are dumped, including household, agricultural, nonmineral industrial and construction wastes, susceptible of colonisation by seminatural communities. Large landscape-shaping features holding industrial wastes are excluded and included in unit 86.42.

86.434. Disused industrial constructions
Areas built-up with superstructures for the purpose of industrial activities, presently inactive, susceptible of colonisation by seminatural communities.

86.5. Rural scattered constructions

Structures dispersed within the rural or natural environment established for the purpose of agricultural activities, permanent or temporary residences, small-scale commercial, artisanal or industrial activities, recreation, research, environmental protection. They include isolated greenhouses, animal shelters, harvest-drying structures, sheds and huts, field and pasture enclosures. High concentration batteries of such constructions are excluded and considered industrial structures listed in unit 86.32.

86.6. Archeological sites

Sites of former human activity, containing ruins of greater or lesser spatial coverage and vertical profile.

87. FALLOW LAND, WASTE PLACES

Fields abandoned or left to rest, roadsides and other interstitial spaces on disturbed ground. They are colonised by numerous pioneering, introduced or nitrophilous plants. They sometimes provide habitats that can be used by animals of open spaces.
(Ellenberg, 1963, 1988; Knapp, 1973; Zohary, 1973; Phillips, 1986; Morrison, 1989; Oberdorfer, 1993b; Mucina and Ellmauer, 1993).

87.1. Fallow fields

Stellarietea mediae p.
Communities of segetal plants, pioneering, introduced or nitrophilous plants colonising fallow fields, disused farmland, vinyards, neglected flower beds and abandoned gardens of the Palaearctic region.
(Oberdorfer, 1993b; Mucina and Ellmauer, 1993: 76; Mucina, 1993c).

87.2. Ruderal communities

Polygono-Poetea annuae, Artemisietea vulgaris, Stellarietea mediae p.
Communities of pioneering, introduced or nitrophilous plants colonising waste places, disturbed natural or seminatural areas, roadsides and other interstitial spaces or disturbed ground within arctic, boreal, nemoral, mediterranean, steppic, desert or tropical regions of the Palaearctic.
(Delescaille, 1987: 78; Oberdorfer, 1993b; Mucina, 1993b; Mucina, 1993c; Jarolimek *et al.*, 1997).

88. MINES AND UNDERGROUND PASSAGES

Artificial underground spaces. They may constitute important substitution habitats for cave-dwelling bats and for significant subterranean invertebrates such as crustaceans, planarians etc.
(Kapteyn, 1995; Limpens *et al.*, 1997).

89. INDUSTRIAL LAGOONS AND RESERVOIRS, CANALS

Very artificial aquatic habitats; seminatural communities that might colonize them can be indicated by use of codes from sections 11, 15, 22, 23, 24 or 53.
(Fuller, 1982; Morrison, 1989; Scott and Jones, 1995).

89.1. Saline industrial lagoons and canals

Artificial watercourses and basins carrying saltwater or brackish water.

89.11. Sea harbours
Seaside complexes of artificial basins and inlets constructed for the purposes of navigation.

89.12. Saltworks
Active or recently abandoned salt-extraction evaporation basins. Detailed habitats can be specified by use of the subdivisions of 15 and 23 in conjunction with 89.12.

89.13. Other saline industrial lagoons and canals
Inland artificial saltwater bodies.

89.2. Fresh water industrial lagoons and canals

Artificial watercourses and basins carrying freshwater.

89.21. Navigable canals
Linear artificial freshwater bodies open to navigation.

89.22. Ditches and small canals
Narrow linear artificial freshwater bodies, mostly used for irrigation or partition.

89.23. Industrial lagoons and ornemental ponds
Artificial freshwater basins used for the needs of navigation, industrial activities, recreation or ornamentation outside of city parks.

89.24. Sewage farms and sewage works
Sewage treatment plants and their basins.

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