

VEGETATION AND PRIORITY HABITATS

[Edoardo Biondi]

Vegetation is land plant cover, the result of plant distribution and combination over different sites, as determined by ecological, biotic and abiotic factors, as well as by anthropogenic action. Vegetation constitutes the most relevant aspect of phytocenoses, in so far as it is defined by the array of plants that populate the biotope, in which single species each find their own 'vital space', their ecological niche. Competition between species therefore is at the basis of vegetation structure, just as the quality and quantity of on-site available resources.

Vegetation science studies plant communities mainly by analyzing them with regard to:

- their floristic composition and structure,
- the ecological conditions allowing for their survival and flourishing,
- the methods with which they participate to the shaping of plant landscape.

Vegetation science has come a long way to its definitive affirmation and not without strong opposition. In the 18th century systematic Botany was under great expansion, owing to the activity of eminent naturalists who developed classification systems – it may suffice to recall the Swedish-born Carl Linnaeus – in which to accommodate the enormous plant varieties that were discovered during the great expeditions around the planet. During the 19th century this prevailingly systematic side to the study of plants was followed by research on the environmental conditions correlating with plant species' distribution, particularly with the climate. HUMBOLDT is credited with his famous *Ideas for a plant geography*, in which was founded the science that considers plants as relating to their associative local capabilities, following strong conditioning by the diverse climates. Thus came to be expressed for the first time the concept of vegetation, even though it was perceived with a rather limited vision as regards the factors at play on the communities, since the climate was considered as a decisive influence in plant distribution.

The study of vegetation would follow next two main lines of thought, one of which physiognomic-structural and the other floristic-ecological. According to the first, of which GRISEBACH (1838) may be considered to be the precursor, the vegetation of a territory is formed by the vegetation formations' series, namely by the communities' series as defined through the 'growth-form' of the dominant species, unrelated to their specific composition.

According to the second view, the floristic-ecological one, also known as phytosociological or plant sociological, the associative aspects of the plants are investigated, leading to the identification of plant communities, the associations, precisely, which are at the basis of a hierarchical classification system. According to the founder of phytosociology, BRAUN-BLANQUET (1915), 'the association is a plant assemblage, more or less stable and in equilibrium with the environment, characterized by definite floristic composition, in which a few (almost) exclusive elements – character species – show by their presence a particular and independent ecology'.

In current plant sociology three main levels of analysis are recognized:

- the one of Classic Phytosociology, floristic and ecological, also named *sigmatist*, or better Braun-Blanquet's, by which the associations are defined, together with the hierarchical levels (*syntaxa*) connected to them and with their ecology (*synecology*);
- the one of Symphytosociology, or Serial Phytosociology, directed to the study of dynamic relations tying associations together, allowing for the definition of dynamic vegetation series or *sigmeta*;
- the one of Geosymphytosociology, or Catenal Phytosociology, which, by interpreting catenal or geographic relations intervening between vegetation series, leads to the identification of landscape phytogeographic units or *geosigmeta*.

Among the associations different relations can be established, of the dynamic or catenal sort. The first case occurs when they represent successive stages of the very same single evolutive or regressive process, as defined by the vegetation series or *sigmetum*. For example, an association of pasturable vegetation which transforms into a shrub one through neglect, which in turn will evolve to a forest one. The vegetation series is composed by the set of all the associations (communities) linked together by dynamic relations, as can be found over a territory with the same vegetational potentials. This portion of the territory, labelled a *tile*, thus represents the basic environmental-biogeographic unit of the mosaic which forms the vegetation landscape. According to this notion the landscape, grasped as a system of ecosystems, is formed by the integration of the vegetation series defining the vegetation landscape units, called *geosigmeta* or *geoseries*, as they recur over portions of the territory exhibiting the same edaphic and climatic characteristics, such as a valley or a mountain or a stretch of coast (BIONDI, 1994). Hence, vegetation series and *geoseries* are environmental models into which different

aspects can be integrated, the physiographic ones being the first in line (geomorphological characteristics, exposure, inclination, altitude, nature of the rocks), as well as climate conditions and soil characteristics (Figure 4.59). Dynamic and integrated vegetation study is particularly suited for analyzing the current condition of our territories, as over the last few decades their reduced usage as farm land and pasture land has triggered natural recovery processes, through which different aspects have been attained, as marked by unique plant cover.

Using these concepts a high number of phytosociologists is currently involved in the implementation of a groundwork vegetation cartography of Italy at the scale 1:250,000, in which the domains of the different vegetation series are going to be traced, in addition to the present situation (BLASI *et al.*, 2000).

From this brief and oversimplified presentation the development of Phytosociology stands out as having been particularly ample, in that it went all the way from the identification of the communities to their characterization under the ecological, dynamic and landscape viewpoint (BIONDI and ZUCCARELLO, 2000).

The association comes with more than one soul to it; the floristic, ecological and syndynamic have already been introduced, the phytogeographic still awaits presentation,

since it contributes with the others in producing a vast and articulate vision of the plant cover. One of the traditionally utilized criteria for the typification of biogeographic units is *taxa* identification and cartography (family, genus, species, subspecies) restricted to those having their territorial distribution limited to a geographical area. For the delimitation of the major biogeographic units (Kingdom and Region) historic and genetic facts are taken into account such as have led to the composition of the diverse floras and to the presence of the so said macro-scaled endemism, that is endemic families and genera. For the delimitation of the other phytogeographic units instead, endemic *taxa* at the level of the species and the subspecies are mainly taken into account, as well as the relations between them, and hence the geographic vicariations. Recently, by virtue of the remarkable acquisitions accomplished in the field of plant sociology, it has been possible to integrate, in the identification of the phytogeographic territories, the traditional considerations of chorological type with synchorological ones, about the distribution of syntaxa and especially of vegetation series (sigmeta) and geoseries (geosigmeta). On the basis of these notions the biogeographic Map of Europe has recently been carried out, at the scale 1:16,000,000 (RIVAS-MARTINEZ *et al.*, 2001).

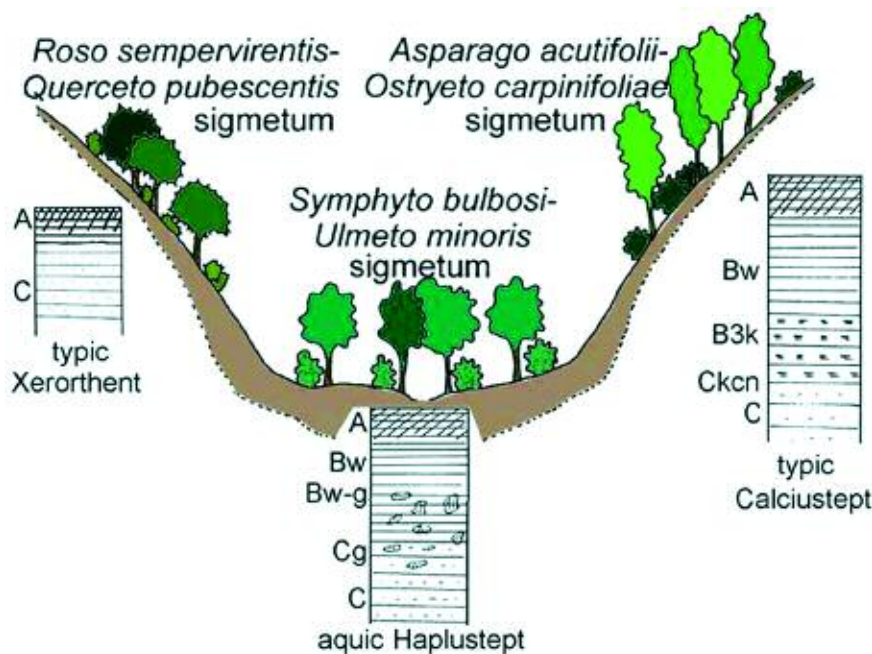


Fig. 4.59 - The plant landscape of a small valley in the marly-arenaceous coasts near the Mount Conero is represented by the geo-sigmetum made up by the distribution of the series of vegetation (sigmeta) occurring along the sides and the bottom of the valley. Note how each series of vegetation matches a precise soil type (BIONDI *et al.*, 2002).

VEGETATION IN THE DIRECTIVE 92/43/EEC

The concept of habitat conservation, clearly expressed in the directive, takes up prominent significance in that for the first time the value of the level of phytocenotic organization of biodiversity has been acknowledged, as can be sensed by phytosociological analyses and hence indicated with specific terminology (attachment I of the Directive). Thus the safeguard of plant and animal species has actually been made to operate, both through direct means and through the protection of the ecosystems in which they live and which come to be singled out and proposed for conservation. Vegetation, in addition to indicating the directly and readily discernible portion of these ecosystems, also provides their ecological characteristics, on the basis of the mentioned scientific postulate of vegetation science, for which to each association corresponds a particular ecological condition. The use of phytosocio-

logical terminology in a EU directive assumes a relevant meaning, as it is the first time that the role of plant sociology as a basic science for the management of biodiversity comes to be acknowledged in an internationally relevant document. It is a case of true 'plant synecology', capable of integrating different aspects of plant associative life, from the community to the landscape level, in close connection to the environmental characteristics.

The habitats indicated in the attachment I of the Directive have been assigned to a biogeographical region following an interpretation of EU territories' biogeography which, though oversimplified to a large extent, ends up being functional to the directive itself, in that it allows for differentiating habitats' typologies in relation to the pertinent biogeographical territories. On the basis of this interpretation the Italian territory was assigned to the Alpine, Continental and Mediterranean regions (Figure 4.60).

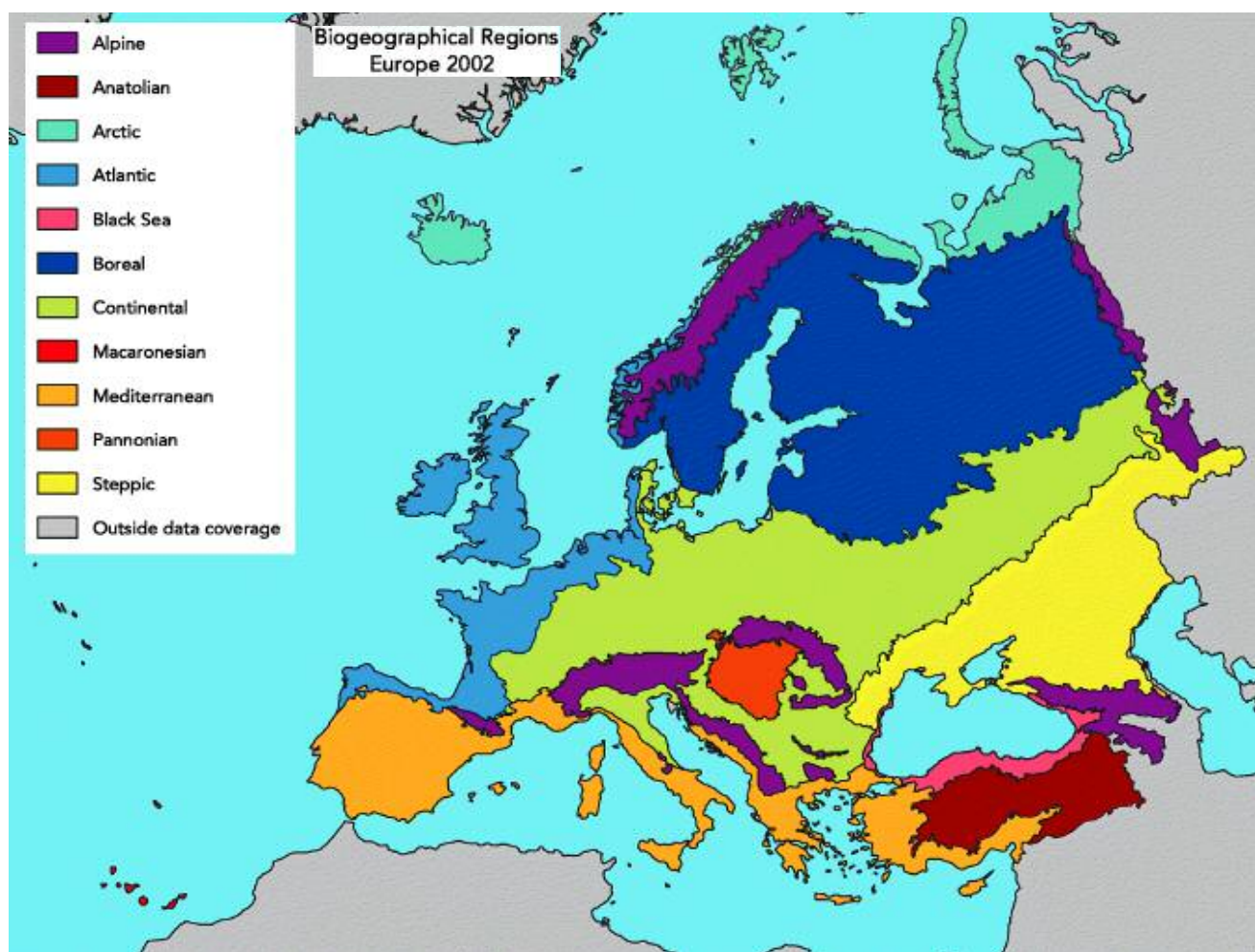


Fig. 4.60 - Map of the biogeographic regions of Europe, updated 2002 (<<http://dataservice.eea.eu.int/atlas>>, modified).

Throughout the application of the Directive, knowledge of the ecosystems and of the social and economic conditions that have shaped them constitutes the inalienable base of the information needed to define the more fitting choices to be taken. Plant sociology thus not only bears the task, already undertaken, of being a reference for biodiversity denomination and identification, but also serves, not in the least less importantly, as a concurrent element in the definition of the most accurate management models, in the sense of their being compatible with identified sites' conservation and being allowed to be monitored over time, keeping in mind that man-induced biodiversity through the ages, as a farmer and livestock breeder, is not in the least less important than the natural one. Economic and social conditions have in fact determined traditional agricultural, silvicultural and breeding managements that have brought forth extraordinary environmental varieties modelled by human actions, with ensuing relevant expansion of quite a few communities' and species' ecological niches. The habitat directive takes this 'humanization' process into account, it having stretched out almost completely over the territory of the EU and in particular over Italian territory, owing to the extraordinary history and to the high population density it has experienced, by indicating many secondary or semi-natural habitats, such as heaths, grasslands and forests that are the outcome of this many-centuried exploitation.

The Habitat Directive being supportive of this issue, its article 10 provides for the Natura 2000 Network incrementing its ecological coherence throughout the nations via the identification of ecological corridors. It's the currently much debated theme of ecological corridors having to be conducive of plant and animal species' displacement, by overcoming the barriers interposed by urbanization of the territory.

The dynamics of the principal vegetational aspects in Italy with regard to the Directive's habitats

In the present chapter, overcoming the necessary schematism of the interpretation handbook of the directive's habitats (European Commission DG Environment, Nature and Biodiversity, 2003 - Interpretation Manual of European Union Habitats - EUR25), the different vegetational aspects relative to the 'coastal and marine environments', to the 'forests, woods and scrubs', and to the 'natural and semi-natural meadows' are described in a unitary and systematic way – with many detailed references at the scale of plant associations.

Coastal and marine vegetation

Marine and coastal environments take on great importance in a nation with prevalent peninsular and insular elements such as Italy, with over 7,500 km of coasts. Approximately 60% of these are low coasts, of sedimentary type, whereas the remaining part is formed by high, rocky coasts. The macrobioclimatic analysis conducted on the basis of the indexes proposed by Rivas-Martinez (1995) and of the recent 'Phytoclimate Map of Italy', implemented within the extent of the programme 'Completion of Basic Naturalistic Knowledge' (BLASI *et al.*, 2004), permits to verify that coasts along the peninsula are mainly interested by Mediterranean bioclimate in the Ionic and Tyrrhenian sectors, aside from a part of the Ligurian arc, while the Adriatic is mostly subjected to temperate climate of continental type, except for the Northern part of the basin, where temperate bioclimate of Atlantic influence is predominant (BIONDI and BALDONI, 1995).

The high biodiversity of the Italian coasts is mainly determined by the geographic position of the peninsula, situated in the middle of the Mediterranean sea, marking off the Western and the Eastern basins, and, at the same time, connecting the North and South ends of the basin, as a bridge between Africa and Europe, incomplete as it may be. To this peculiar geographic condition are connected all indicated bioclimate conditions and not a lesser geological, geomorphological and sedimentological variability. Exceptional environment diversity is brought about over the whole, frequently confined to exceedingly limited sites, where micro-habitats materialize with an extraordinarily relevant presence of plants and animals. Unfortunately the coastal belt also represents the most altered portion of the national territory and, owing to its natural fragility, comes out to be the most heavily menaced by social and economic development, out of high urbanistic-infrastructural, industrial and seaside tourism pressure.

In order to apprehend the ecological characteristics of coastal systems it is necessary to interpret biological phenomena and ecological gradients over the entire coast, avoiding the artificial separation between underwater and dry land environments. Most of the factors regarding geomorphological stability or community distribution over emerged beach areas depend on sea-originated phenomena. The Mediterranean sandbanks which are slightly covered by sea water all the time are characterized by prairies of marine phanerogams, unfortunately undergoing heavy rarefaction, playing a primary role in seabed stabilization. Such communities, in fact, carry out the task of reducing



Fig. 4.61 - *Posidonia* (*Posidonia oceanica*) meadow: a particularly complex habitat, producing plenty of organic matter and oxygen, has also the power to save the sea floor from erosion (Photo by C. Orestano).

the intensity of wave-motion effects through their thick foliage, thus relieving erosion and promoting sand build-up through their expanded root system. *Posidonia oceanica*, for example, which in spite of its name is endemic to the Mediterranean, by elongating its rhizome both in the horizontal and in the vertical direction, counters progressive silting up and gives rise to a terrace formation, *matte* in French, which opposes seabed erosion processes. The *posidonia* beds (Figure 4.61) furthermore constitute a particularly complex ecosystem, producing large quantities of organic substances and oxygen, an ideal habitat for the life of many marine animals, from the simplest zoological groups up to the fish. *Posidonia*'s leaves when run ashore by the waves form spherical bodies called 'sea balls' or *aegagropila*, easily fetched on the beach. Other phanerogams forming submarine prairies are *Cymodocea nodosa*, found up to 20 m deep, *Zostera noltii*, from both the Atlantic and the Mediterranean, where it colonizes the first 5 m deep part, and *Zostera marina*, the most common and most important species along North Atlantic and North Pacific coasts, which in the Mediterranean is found at the mouth of the large rivers, as in the North Adriatic, for example. The phytosociological typification of the submarine prairies leads to the identification of various associations that come to be framed within the *Zosteretea marinae* class.

The beds of *Posidonia oceanica*, in particular, are extremely vulnerable to the variation and alterations of environmental parameters, in that their formation, structure and dynamics are strictly connected to edaphic and climate fac-

tors such as: nature of the substrate, strength and direction of the currents, water temperature and other qualities, penetration of the light, sedimentary flows, etc. By considering the biological characteristics of the plant (slow growing rate) and the dynamics of the meadows themselves (extremely slow recovery after external disturbances), many causes – mainly of anthropogenic origin – have provoked the regression of *Posidonia oceanica* beds over ample stretches of the Mediterranean, despite the importance that this ecosystem assumes in the equilibrium of the coasts.

Emerged beach areas with their dunes represent a group of particularly inhospitable micro-environments for plant life. The wind keeps the sand in motion, causes erosion, vaporizes marine water and moreover affects water economy by interfering with its availability for plants. The species that colonize these coastal stretches are therefore considerably specialized, adapted to the occupation of precise ecological niches, frequently extremely confined, in that the gradients of the most relevant ecological factors undergo significant variations over few metres wide reaches.

The substrate of the area of emerged sandy littoral zones that is regularly washed by the waves, both in the case of calm and heavy sea, ends up being constantly disarranged and is characterized by too coarse a weave to allow for cohesion between its particles and the material that is brought to the coast by the sea. Under these environmental conditions the development of any form of higher plant life is impossible (aphyotic section). Organic material brought by the waves is deposited on the beach in the area not reached



Fig. 4.62 - Moving sand dune subject to strong and constant winds. The European Marram grass (*Ammophila arenaria* subsp. *arundinacea*) and few other psammophilous plants can oppose to the movement of the sand, helping the formation of high sand dunes (Photo by E. Biondi).

by the sea for a few months every year, and here it decomposes, thereby releasing the substances enriching the sandy substrate. This is the development ground for annual halonitrophilous scrubs, which all over the Mediterranean is occupied by the association *Salsola kali-Cakiletum maritimae*, with: the Sea Rocket (*Cakile maritima*), the Prickly Saltwort (*Salsola kali*), the Purple Spurge (*Euphorbia peplis*) and the Sea Knotgrass (*Polygonum maritimum*).

More internally the first heaps of sand appear, the so said embryonic shifting dunes, still subjected to some rearrangement through the action of the wind and occasionally reached by marine water sprays. Embryonic shifting dunes form through the presence of a plant, the Sand Couch (*Agropyron junceum* subsp. *mediterraneum* = *Elytrigia juncea* subsp. *juncea*), endowed with particular adaptations that allow it to endure, or rather, to stand against the accumulation of sand carried by the wind. The aerial part of this plant is less bulky than the hypogeous part, whose rhizomes are conspicuously branched out, so as to give rise to a very dense tangle, from which many roots spread out that are capable of strongly holding on to the sand. The plant association present on embryonic dunes of most Italian beaches is the association *Echinophoro spinosae-Elymetum farcti*, formed by the Spiny Echinophora (*Echinophora spinosa*) and by the two Sand Couches: *Sporobolus pungens* and *Agropyron junceum* subsp. *mediterraneum*, in addition to the Cottonweed (*Otanthus maritimum*), the Sea medick (*Medicago marina*), the Sea bindweed (*Calystegia soldanella*) and the Sea holly (*Eryngium maritimum*).

On the quite taller mobile dunes towering over the close-by embryonic ones, vegetation is formed by the European beachgrass (*Ammophila arenaria* subsp. *arundinacea*), a tall grass with a plumed inflorescence, particularly well-adapted to resist effectively to the action of the wind and to the sanding up, thanks to its very resistant rhizomes, which follow the same development as the ones of the Sand couch (Figure 4.62). As the dune keeps steady-ing up, the association emerging is the *Echinophoro spinosae-Ammophiletum arundinaceae* (belonging to the class *Ammophiletea*), to the constitution of which the following partake: the Sea holly (*Eryngium maritimum*), the Sea spurge (*Euphorbia paralias*) and the Sea daffodil (*Pancratium maritimum*).

On the continental side of the dune the living conditions change quite considerably, in fact micro-environments establish themselves that are protected from the salty winds and are therefore more favourable for the plants, though their substrate may still be low on water and humus. This is the area of the so called 'Grey dune', where the dunes begin to become stabler by the means of small shrubs (chamaephytes), which in the Mediterranean bioclimate zones give rise to low and uneven garigues, dominated by the Maritime crosswort (*Crucianella maritima*), referred back to the alliance *Crucianellion maritimae*; to the latter belong also the Curry plant (*Helichrysum italicum*) or the Perfumed strawflower (*H. stoechas*), the Southern bird's-foot-trefoil (*Lotus cytisoides*) or the Shrubby thyme (*Coridothymus capitatus*). Throughout



Fig. 4.63 - The vegetation made up by the endemic sea pink (*Armeria pungens*) and the dwarf curry (*Helichrysum italicum* subsp. *microphyllum*) colonize the inner side of the dunes in northern Sardinia (Photo by E. Biondi).

Sardinia this vegetation is also characterized by the Sea Scrophularia (*Scrophularia ramosissima*) and the Spiny thrift (*Armeria pungens*), whereas the Curry plant is present with its Sardinian-Corsican subspecies (*Helichrysum italicum* subsp. *microphyllum*) (Figure 4.63).

Quite varied aspects of therophyte vegetation find their way among the typically perennial psammophilous ones, giving rise to an exceptional mosaic. Such transient vegetation made up of minute plants falls into the class *Tuberiaretia*, together with that which colonizes the clearings of the shrublands and of the garigues; within this class ephemeral dunal vegetation is referred back to the order *Malcolmietalia*. The area of the 'grey dune' over Italy and almost the whole of the Mediterranean has been heavily jeopardized by anthropogenic activities, mainly through the mechanical reshaping of the dune, and frequently through the absolutely improper and to a great degree regrettable planting of shrubby and arboreal exotic species.

The further consolidation of the sand leads to the establishment of coastal dunes with *Juniperus* spp., among which the most widespread is the Prickly juniper (*Juniperus oxycedrus* subsp. *macrocarpa*), with its spherical orange-reddish seed cones that are berry-like in shape, colonizing the sea side of dunes. This vegetation is related to the association *Asparago acutifolii-Juniperetum macrocarpae*, present, though in severely fragmented and degraded form, in Sardinia and Sicily, in addition to other sites over the Italian peninsula. In the northern section of the Tyrrhenian coast, to the

North of the river Arno, and at the transition between the Mediterranean bioclimate and the temperate one, this vegetation is substituted by the vicariant association *Spartio juncei-Juniperetum macrocarpae*, which is surely more mesophile than the former (VAGGE and BIONDI, 1999). Instead, in Sicily the association *Ephedro fragilis-Juniperetum macrocarpae* can be found, along the South East littoral zone of the island, closer to the North African formations. On the lee side of the Mediterranean dunes the Prickly juniper is more or less completely substituted by a subspecies of the Phoenician juniper (*Juniperus phoenicia* subsp. *turbinata*), with larger and more ovoidal shaped seed cones than the prototype species. Over in Sardinia this macchia is related back to the association *Oleo-Juniperetum turbinatae*, which is substituted across the inner stations that are placed farther away from the sea, as in the dune camp of Buggerru-Portixeddu, by another type of more evolved and more rare macchia characterized by the Palestine oak (*Quercus calliprinos*) from the association *Rusco aculeati-Quercetum calliprini*; the latter is again substituted across the South East part of Sicily by the vicariant association *Junipero-Quercetum calliprini*. Other Mediterranean plants are characteristic of all of these formations, such as the Mastic (*Pistacia lentiscus*), the Narrow leaf jasmine box (*Phillyrea angustifolia*), the Rough bindweed (*Smilax aspera*), the Fragrant virgin's bower (*Clematis flammula*), the Wild madder (*Rubia peregrina* var. *longifolia*) and the Butcher's broom (*Ruscus aculeatus*). Along the North

Adriatic coasts that are subjected to temperate bioclimate, the vegetation under consideration is represented by the Common juniper (*Juniperus communis*) and the Sea-buckthorn (*Hippophaë rhamnoides* subsp. *fluviatilis*) scrub, which gives rise to the rare *Junipero communis-Hippophaetum fluviatilis* association, establishing itself on the land side of the littoral belts or in the interdunal depressions farther away from the sea, along the coastline between Grado and Ravenna. From the syntaxonomic point of view the Mediterranean associations are related to the class *Quercetea ilicis*, order *Pistacio-Rhamnetalia alaterni* and alliance *Juniperion turbinatae*, whereas the North Adriatic association is ascribed to the class *Rhamno-Prunetea*, order *Prunetalia spinosae* and alliance *Pruno-Rubion ulmifolii*. Owing to the rarity of these vegetation types and to the danger they are subjected to, over all Mediterranean coasts, the habitat directive has correctly deemed them priority.

On many Italian sandy coasts artificial pine forests are also quite commonly found nowadays, the ones that can be considered native being a very rare sight indeed. Over limited areas of Sardinia one can come across natural formations of Aleppo pine (*Pinus halepensis*), for instance on the island of S. Pietro and in the gulf of Porto Pino, on the South West portion of the island, where the pine forest is ascribed to the association *Pistacio-Pinetum halepensis*, subassociation *juniperetosum*. On the other hand the maritime dunes of Portixeddu-Buggerru are home to a spontaneous Stone pine (*Pinus pinea*) pinewood, with century-old specimens. Such pine forests settle into a relationship with the *Quercus calliprinos* forest from the association *Rusco aculeati-Quercetum calliprini*, which gets established as the deterioration of the latter sets in and continues, to involve such phenomena as eolic deflation or erosion of the dunal slopes. The habitat directive considers conservation of both autochthonous Mediterranean pine vegetation on coastal dunes and of the anthropogenic originated one within the Holm-oak forest (habitat 2270¹) to be of great importance. In fact Aleppo pine or Stone pine reforestation practices are quite common along low and sandy Italian coasts.

In the littoral zones lagoon areas of variable expanse are also frequently met with, which form absolutely extraordinary environments that are home to distinguished varieties of plant and animal life. The biocenoses' characteristics of the habitats present in these ecosystems are heavily conditioned by the ecological gradients' variations in salinity, temperature and water depth, in addition to

the characteristics of the substrate. The Directive interprets the necessity of preserving the biodiversity of the lagoons by conceding a specific habitat (1150), which takes into account the 'expanses of coastal salty waters, shallow, with variable salinity and water volume, separated from the sea by a belt of sand and gravel or more rarely by a rocky barrier. Salinity can vary, going from brackish water to hypersaline according to rain water, evaporation, and fresh marine water intakes as a result of storms or of temporary floodings by the sea in winter time. They can be host to vegetation related to the following classes: *Ruppiaetea maritima*, *Potametea*, *Zosteretea* and *Charetea* or to none whatsoever'. The plant associations that are present in Italian lagoon environments are conducive to a couple of main biogeographical domains: the temperate bioclimate area, partly with an oceanic touch to it, in the North Adriatic section between the beaches of Ravenna and the gulf of Trieste, and the other one comprising the remaining Italian lagoons found in Mediterranean bioclimate areas. Among the associations founding the habitat over Italy the *Zosteretum marinae* is found chiefly in the temperate region, whereas in the Mediterranean one *Zostetum noltii* prevails. The association *Ruppiaetum spiralis* is widely spread over the whole Mediterranean region, while the association *Ruppiaetum drepanensis* is much more thermophilic and is mainly distributed over the pools of South Sardinia and West Sicily.

A priority habitat that comes into contact with the lagoon is that of 'Mediterranean salt steppes', made of Mediterranean coastal associations pertaining to depressions being characterized by high salinity, rich in perennial plants thriving on soils temporarily covered by salt water and exposed to extreme summer drought, which leads to the formation of salt surfacings. In these environments the growing vegetation types can be ascribed to the following syntaxa: *Limonietalia*, *Arthrocnometalia* (= *Sarcocornietalia fruticosae*), *Thero-Salicornietalia* and *Saginetalia maritima*. In the North Adriatic, within the temperate bioclimate region, this habitat's vegetation presents a few associations that underline the macroclimate it is connected with, whereas others, on the contrary, represent the extreme northern expansion of typically Mediterranean and even thermomediterranean types, such as the association *Arthrocnemo macrostachyi-Halocnemetum strobilacei*. Among the associations with typically temperate distribution and especially with Atlantic distribution the presence of the association *Limonio serotini-Spartinetum maritima* deserves special mention, as in this part of the North Adriatic *Spartina maritima* comes by the only stations of dis-

¹ Cf. table 4.28 for habitat numbering and official designation.

tribution over the Mediterranean. From the biogeographic point of view *Salicornia veneta* vegetation is particularly significant, as it is held to be endemic to this limited sector, even though recent reports locate it around the S'E-na Arrubia district, in West central Sardegna (Filigheddu *et al.*, 2000). In the Mediterranean bioclimate regions the successions and community types that are present in the lagoon environments turn out to be rather uniform. For the coastal areas with thermomediterranean macroclimate the vegetation of Cagliari's pools and more generally all coastal areas of the southern part of Sardegna can be accounted for. Here, though the most widespread association is *Puccinellio festuciformis-Sarcocornietum fruticosae*, also the association *Arthrocnemum macrostachyi-Halocnemum strobilacei* tends to be particularly abundant. From another standpoint, on higher substrate areas *Halimione portulacoides* vegetation is found, here ascribed to the association *Cynomorio coccinei-Halimionetum portulacoidis*. Among retrodunal salt meadows, formations can be traced that are dominated by plants of the *Limonium* genus, ascribed to the class *Salicornietea fruticosae*, order *Limonietalia*. It is the case of extremely rare communities, occupying as a rule very reduced habitats.

Therophytic annual vegetation is mainly provided by *Salicornietum emerici*, in the flat basins often resulting from production abandonment of salt pans, or by the association *Suaedo maritimae-Salicornietum patulae*, particularly distributed over the *Puccinellio festuciformis-Sarcocornietum fruticosae* meadows.

In order to conclude the present review of coastal vegetation it is necessary to point, however briefly, at the one that colonizes the sea cliffs of the coasts, very demanding environments, indeed. They are groups of microhabitats subjugated diversely to the ecological factors letting different plant communities become implanted, as conditioned by the lithologic and geomorphological nature of the substrate, by the micromorphology that determines chances of accumulation of soil and debris in favour of aerohaline and diversely halo-tolerant communities, by therophytic formations close to garigue and shrubland ones. The most typical sea cliff vegetation, however, is the one that is directly reached by marine aerosol, thriving on rocks' fissures and thus taking on the true characteristic of halophilic cliff vegetation, framed by the class *Crithmo-Staticetea*. Such vegetation is essentially dominated by the Rock samphire (*Crithmum maritimum*) and by numerous species of *Limonium* - Statice – that take to countless endemic associations distributed along the littoral zones of the Italian peninsula and of the islands.

Forest, woody and shrubland vegetation

At our latitude the internal plant landscape, with regard to the coastline, is potentially represented by the forest, which without any break would occupy the entire territory situated below the altitudinal high limit of the forest. In reality the Italian territory is covered by forests over approximately 10 million ha, and that's about 30% of the entire national area. Over the centuries the forests have in fact been destroyed or radically modified, so that nowadays there is no Italian forest system that could be ascribed to this scientific term in its strict sense, taken as a primitive formation. It is better therefore to speak about woods, and, even more so, of less evolved structures such as the pre-forest or the shrubland.

The woods in our country have however progressively been on the increase since 1940, owing to the loss of economic interest that has invested them as well as the prairies, leading to their abandonment, with the ensuing spontaneous recovery of the vegetation, which through its affirmation has pushed along the associations included in the vegetation series.

The different forest formations distinguish themselves on the floristic side chiefly on the basis of the distribution in the altitudinal direction, that stays connected to the climate variations, given the same phytogeographic zone and the same nature of the substrate.

In Italy the woody and Mediterranean shrubland vegetation is represented by the formations that are ascribed to the class *Quercetea ilicis* and that are concerned both with the hot and dry areas of the Mediterranean bioclimate (sub- and thermo-Mediterranean) and with the more fresh and humid ones (meso-Mediterranean). In the former ones the shrubland formations prevail, consisting in the thermophile species of the order *Pistacio-Rhamnetalia alterni*, where the European Fan palm (*Chamaerops humilis*) can be found, the Woody spurge (*Euphorbia dendroides*), the Mastic (*Pistacia lentiscus*), the Sicilian tea (*Prasium majus*), the White asparagus (*Asparagus albus*). On the dunes are found the formations with Prickly or Phoenician turbinate juniper, already mentioned, belonging to the alliance *Juniperion turbinatae*, while it is only on the Pelagic islands and in the southern sector of the Island of Pantelleria and in the channel of Sicilia that shrubs are found ascribable to the alliance *Periplocion angustifoliae*, which has a prevalent North African distribution; these shrublands are home to rare species, such as *Periploca* (*Periploca laevigata* subsp. *angustifolia*) (Figure 4.64) and the *Lycium* (*Lycium intricatum*) with the associations *Periploco angustifoliae-Juniperetum turbinatae* and *Periploco-Eu-*



Fig. 4.64 - The wolfbane (*Periploca laevis* subsp. *angustifolia*) participates in making up the extremely rare maquis fragments which occur in Italy only in the islands of the Canale di Sicilia (Photo by E. Biondi).

phorbietum dendroidis. This vegetation is linked to the infra-Mediterranean zone and therefore only experiences a very limited distribution in our country, while the shrublands of the thermo-Mediterranean bioclimatic zone are more widely distributed; they are connected to the alliance *Oleo-Ceratonion*, whose name comes from the Wild olive (*Olea europaea* var. *sylvestris*) and from the Carob tree (*Ceratonia siliqua*). The habitat directive does not indicate any sort of priority habitat for the thermophilic and aridophilic shrublands, thus marking a severe gap especially involving the formations of the *Periplocion angustifoliae* alliance, very rare and localized in our country. The forests of the meso-Mediterranean bioclimate zone are chiefly constituted by holm-oak woods and cork woods. The former can be found also on calcareous substrates, whereas the latter are exclusive to crystalline rocks. Woods ascribed to this alliance contain a consistent variety of evergreen shrubs, such as the Phillyreas (*Phillyrea media*, *P. latifolia*,

P. angustifolia), the Laurestinus (*Viburnum tinus*), the Terebinth (*Pistacia terebinthus*), the Common myrtle (*Myrtus communis*), etc. The lianas are also widespread, such as the Rough bindweed (*Smilax aspera*), the Madder (*Rubia perigrina* var. *longifolia*), the Clematis (*Clematis flammula* and *C. cirrhosa*), etc. Among the main associations of holm-oak forests in Italy, the *Viburno tini-Quercetum ilicis* is present, with Provençal distribution and a barest presence in the western riviera ligure, the *Cyclamino repandi-Quercetum ilicis* over the Tyrrhenian zone of the peninsula, and the *Erico-Quercetum ilicis* on crystalline substrates of southern Italy. The following mixed associations of sclerophyllous evergreen and deciduous plants are also present over the Italian territory, mainly distributed in the Adriatic area: *Fraxino orni-Quercetum ilicis*, *Ostryo-Quercetum ilicis* and *Cephalanthero longifoliae-Quercetum ilicis*.

Throughout the submediterranean and temperate areas that cover vast surfaces of the Italian peninsula, forest vegetation is mixed deciduous and is ascribed to the class *Querco-Fagetea*, order *Quercetalia pubescentis* and alliance *Carpinion orientalis*, with prevailing Balkanic distribution. In the Apennine this vegetation comprises woods dominated by the Hop hornbeam (*Ostrya carpinifolia*) and by the Downy oak, often accompanied by the Oriental hornbeam (*Carpinus orientalis*) and the Hungarian maple (*Acer obtusatum*).

Over the acid soils of central and southern Italy can be traced the forest associations of the alliance *Teucrio siculi-Quercion cerridis*, comprising woods with the Turkey oak (*Quercus cerris*) and the Hungarian oak (*Q. frainetto*).

The mountain vegetation zone is dominated by the potentiality for beech forests (*Fagus sylvatica*), which over the central and northern Apennine are normally related to the Balkanic alliance *Aremonio-Fagion* within which the sub-alliance *Cardamino kitaibelii-Fagenion sylvaticae* is indicated, whereas in the central and southern Apennine the endemic alliance *Geranio versicoloris-Fagion sylvaticae* is present.

The woods of the sub-alliance *Cardamino kitaibelii-Fagenion* to the South of the Emilian Apennine lose a relevant amount of their differential floristic component and settle as relict forms on the summit of the Apennine ranges of Umbria, Marche and Abruzzo. It is over these stretches of the Apennine that the area of strained relations between the southern beech forests of the alliance *Geranio versicoloris-Fagion* and those of *Aremonio-Fagion* is outlined. The contact with the former is made out through the presence of the characteristic species: *Lathyrus venetus*, *Cyclamen hederifolium*, *Helleborus bocconeii*, *Daphne*



Fig. 4.65 - The beech and silver Fir woods of the Monti della Laga are a rare example of the priority habitat 9220 in the central Apennine (Photo by E. Orsomando).

laureola, *Acer obtusatum*, *Pulmonaria apennina*, *Ranunculus lanuginosus*. The associations pertaining to this alliance are found at the lowest altitude of the mountain zone of the central Apennine: *Lathyro veneti-Fagetum sylvaticae*, of calcareous ranges, and *Staphyleo pinnatae-Fagetum sylvaticae*, of flysch substrates (BIONDI *et al.*, 2002).

For the southern Apennine and Sicilia the alliance *Geranio versicoloris-Fagion* presents numerous associations, such as: *Geranium versicolor* (= *G. striatum*), *Anemone apenninae-Fagetum*, *Acer lobelii-Fagetum*, *Campanulo trichocalycinae-Fagetum* and *Doronico columnae-Fagetum*. In the domain of Apennine woods to which these types belong the directive has pointed out two priority habitats: 'Apennine beech forests with *Taxus* and *Ilex*' and 'Apennine beech forests with *Abies alba* and beech forests with *Abies nebrodensis*', both phytogeographically and ecologically relevant. The beech formations with Yew and Holly are almost pure microtherm beech forests, of straight mountainous habitat, or else mixed thermophile beech forests, with various sub-Mediterranean broadleaved plants. As for the other habitat 'Apennine beech forests with *Abies*

alba and beech forests with *Abies nebrodensis*' it has to be pointed out that the endemic Fir of the Nebrodi is currently cut down to a single population, of just 29 individuals, located in the Vallone degli Angeli on the Madonie range, and that the Apenninic Silver fir presents quite a few differential morphological characters with respect to the species, so that it has recently been assigned to *Abies alba* subsp. *apennina* Brullo, Scelsi and Spampinato. The most important localizations are in Abruzzo (Gran Sasso and Monti della Laga – Figure 4.65), in the Apennine of Molise and of central-northern Basilicata, on the Gargano and Pollino, Sila, Serre Calabresi and Aspromonte.

On the Alps the deciduous forests usually occupy the less elevated stations, on the Prealps with a bioclimate of oceanic type, whereas the conifers tend to thrive at a higher altitude, starting from the mountain zone where the fir woods with Silver fir are found. The beech forests of the North East Alps (POLDINI and VIDALI, 1995) and partly those of the Central Alps, exhibit, even more so than the ones of the central northern Apennine, the alliance bond *Aremonio-Fagion* with the analogous oriental formations,

with respect to which they are placed in the sub-alliance *Lamio orvalae-Fagenion*, assembling the mesophile beech associations of the central mountains of the Illyrian region. Along the rest of the Alps the beech forests are framed by the alliance *Galio odorate-Fagion*, including both alpine and central European woods. Within the framework of this alliance the following sub-alliances are present: *Galio odorati-Fagenion sylvaticae* and *Cephalanthero-Fagenion sylvaticae*, with respective bearing upon micro-thermal and xero-thermal formations. The greater specificity of alpine forest vegetation is however furnished by conifer woods of the class *Vaccinio-Picetea*, among which spruce forests range, compact formations of Spruce (*Picea abies*) representing the most widespread forest vegetation in Trentino-Alto Adige. Scots pine (*Pinus sylvestris*) formations are relevant too; in the territory of Trentino they get assembled into associations referring to continental type climate conditions (*Ononido-Pinion*) and to suboceanic type (*Erico-Pinion*). At a higher altitude along the subalpine zone a few spruce forests (known as subalpine *Picea* forests) are found that gradually open up to leave room for shrubby formations with a few arboreal species such as the European larch (*Larix decidua*) and the Swiss pine (*Pinus cembra*) with the *Rhododendro-Laricetum* and *Rhododendro-Pinetum cembrae* associations, both being characterized by a dense cover of Alpenrose (*Rhododendron ferrugineum*) with the Bilberry (*Vaccinium myrtillus*) and the Mountain cranberry (*V. vitis-idaea*). Still higher up, in the so said horizon of twisted bushes, this vegetation gives way to the association *Rhododendretum ferruginei*, completely deprived of the presence of arboreal species; within the same area the vegetation with the Mountain juniper (*Juniperus alpina*) and the Bearberry (*Arctostaphylos uva-ursi*) is found, of the *Junipero-Arctostaphyletum* association. And finally, in the area of the primary shrubs, the prostrate bushes with *Pinus mugo* and *Rhododendron hirsutum* (with the association *Mugo-Rhododendretum hirsuti*) have to be mentioned, because of their distribution over the Alps, for their presence in a few Apennine stations, too, and for their consideration as a priority habitat (4070).

In the gorges and the ravines of the areas with a temperate bioclimate on the Alps, and partly on the Apennines, too, woods of the alliance *Tilio-Acerion* keep growing, mixed formations of noble broadleaved plants with Maples, Limes and Ashes. The priority habitat 'Tilio-Acerion forests of slopes, screes and ravines' (9180) in Italy exhibits the largest growth over the Alpine Arc territories, whereas on the Apennine belt it is only come across as a relict (TAFETANI, 2000).

Outstanding importance is bestowed upon the group of habitats defined by the directive as 'Mediterranean and Macaronesian mountainous coniferous forests', within which a few priority habitats are located: 'Southern Apennine *Abies alba* forests' (9510), '(Sub-) Mediterranean pine forests with endemic black pines' (9530), 'Endemic forests with *Juniperus* spp.' (9560) and 'Mediterranean *Taxus baccata* woods' (9580).

For the Southern Apennine *Abies alba* forests, the new definition leaves the habitat itself being a little less significant than the previous version, which brought together the 'Apennine *Abies alba* and *Picea excelsa* forests'. It makes the habitat all the more coherent with the Mediterranean biogeographic region it belongs to, but it bars the *Picea excelsa* Apennine forests, which lose importance at being reduced to a non-priority habitat; rather, it would have been advisable just to leave them there, given the exceptional nature of these woods, which are present in an extremely limited area of the Tuscan-Emilian section of the North Apennine: the valley of the torrent Sestaione, close to the Alpe delle Tre Potenze, where they amount to an extremely interesting example of relict vegetation from the phytogeographic point of view.

With the habitat 'Endemic forests with *Juniperus* spp.' (9560) the Thuriferous juniper (*Juniperus thurifera*) relict formations are taken into consideration for Italy; they have a West Mediterranean range (North-African-Ibero-Provençal) and find their eastern distribution boundary in Italy, on the Piedmontese Alps. It's the case of two stations located at Valdieri, Val Gesso, and at Moiola, Valle Stura. The settling in of the populations of *Juniperus thurifera* (Figure 4.66) looks like having been an ancient event, at least pre-wurmian, as is also witnessed by the presence of numerous endemic rupestral species, both found in the vegetation and in other communities that are part of the vegetation series of this important phytocenosis. In both the Italian stations Thuriferous juniper is confined to shelter areas, where it chooses rupestral zones and edaphic xerophilic conditions. It consists of clear cut Mediterranean communities, as can also be derived by the presence at Valdieri of Phoenician juniper (*Juniperus phoenicea*) and at both stations of *J. hemisphaerica*; the communities are connected dynamically to chamaephytic Mediterranean garigues by the means of species such as *Lavandula vera*, *Satureja montana*, *Artemisia alba* and *Fumana procumbens*.

The habitat 'Mediterranean *Taxus baccata* woods' (9580) accounts for some important relict forest formations of Sardegna, as can be traced in gorges and gullies bordered by



Fig. 4.66 - Rare specimens of thuriferous juniper clinging with individuals of phoenician juniper in the Val di Gesso (Photo by E. Biondi).

lithologically acid ranges at an altitude comprised between 500 and 900 m. Such formations give rise to a mesophilic series that is being introduced into Holm-oak forests-based climatic vegetation domains. An alternative vegetation thrives on basic to neutral-basophile substrates, at an altitude comprised between 900 and 1,500 m, where it comes into contact with climatic formations of the order *Quercetalia pubescentis* or of the alliance *Quercion ilicis*.

The habitat 'Mediterranean pine forests with endemic black pines (including *P. heldreichii*)' comprises the 'forests of the Mediterranean mountain zone, on a dolomitic substrate, dominated by pine trees of the group *Pinus nigra*, often with a dense structure'. The following are endemic Mediterranean pine trees present on the Italian mountains: the Black pine (*Pinus nigra* subsp. *nigra*), the Calabrian pine (*P. nigra* subsp. *laricio*) and the Bosnian pine (*Pinus heldreichii*). In the Italian peninsula the Black pine is present with populations that are deemed to be native in Friuli Venezia Giulia, Veneto, Abruzzo, Molise, Campania, Basilicata and Calabria. In Abruzzo *Pinus nigra* subsp. *nigra* is known to have assumed an intermediate form between subsp. *nigra* and *laricio*, the Pine of Villetta Barrea in the Abruzzo National Park. The Black pine gives rise for the most part to rupestral forests that in Friuli Venezia Giulia are referred to the association *Fraxino orni-Pinetum nigrae*, of the alliance *Fraxino orni-Ostryon carpinifoliae* (POLDINI, 1969), whereas in central-southern Apennine they get introduced to different vegetation typologies: in Basilicata the association *Genisto sericeae-Pinetum nigrae*, dynamically linked

to the Orno-ostryetum, in Calabria the beech forests' stands, in addition to the deciduous oaks' ones. The Calabrian pine is found in Corsica and in Italy, where it is chiefly located in Calabria (Sila and Aspromonte) and in Sicilia (Mt. Etna). In Calabria the populations have been credited as being different from the Corse ones, thus giving rise to a variety, *Pinus nigra* subsp. *calabrica*. Both in Calabria and in Sicilia this Pine tree forms very large pine forests, expanding from the 1,000 to 1,800-1,900 m belt – on Mt. Etna – up to the upper limit of arboreal vegetation, where it behaves as a pioneer and frugal species, colonizing the lava rocks and settling over poor soils and sun-scorched slopes, where other arboreal plants would grow with difficulty. The Calabrian pine forests are related to the association *Hypochaerido-Pinetum laricionis*. The Bosnian pine is a species distributed over the mountain ranges of the North East Mediterranean sector, which is found only in Basilicata and Calabria as far as Italy is concerned: in the former region *Pinus heldreichii* is found mainly on the Pollino Massif, whereas in Calabria it stands on the mountains of Orsomarso and Montea. The Bosnian pine expands from the 800-2,000 m altitude mark up to the upper limit of arboreal vegetation, where the woods it gives rise to are ascribed to the class *Pino-Juniperetea* and to the association *Pino leucodermis-Juniperetum alpinae*, the latter belongs to the more mature phytocenoses of Mount Pollino and turns out to be dynamically connected to the meadows of the association *Carici-Seslerietum nitidae* and to pioneer stages with *Juniperus alpina* (STANISCI, 1997).

Natural and semi-natural grassland formations

The grasslands are composed of perennial herbaceous plants, whose biological form ties in with the hemicryptophyte habitus, that is with plants that survive through the adverse season, the winter, with their buds on level with the ground, protected by dry leaves from the previous year. The grasslands are marked as primary, when found at altitudes higher than the potential forest's higher limit, and secondary, when they are the end result of the forest's demise. The grasslands, either primary or secondary, on account of their being the most important structural aspect of plant cover together with the forests, have been the object of phytosociological investigations since the dawning of this science and keep feeding renewed interest to researchers even in present times.

The secondary meadows are maintained through the agricultural and pastoral management of the sod, which stops the woods from gaining ground back on the land that has been previously taken away from them, just as through stubble-burning, which is carried out to turn the land obtained from forest fires into cultivable land. Many secondary prairies are often stable and capable of preserving the soil from water erosion, frequently even more so than forest vegetation, and have particularly rich floristic compositions, so much so that they are regarded as a relevant dominion for biodiversity conservation.

The different grassland physiognomic formations, connected to agronomical and zootechnic use as meadow, meadow pasture and pasture, have been framed into different phytosociological classes. Among which the most interesting ones, also for applicative purposes, are the *Carici rupestris-Kobresietea bellardii*, the *Elyno myosuroidis-Seslerietea coeruleae* and the *Nardetea strictae* for largely primary grasslands, and the *Molinio caeruleae-Arrhenatheretea elatioris* and the *Festuco-Brometea* for secondary formations, respectively related to the mesophilic and mesohygrophilous aspects of mowable meadows and to the semiarid to mesophilic aspects of hill and mountain pastures. For the Mediterranean areas of the EU the directive indicates the priority habitat 'Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*' (6220), with regard to the class *Thero-Brachypodietea*, though it would also rather comprise the perennial prairies with therophyte abundance as well as single annual plants formations. Through this class in fact communities have been brought together having different floristic, structural and dynamic compositions, so that it has recently been replaced with specific classes, framing more homogeneous formations, such as the *Lygeo-Stipetea*, of open prairies

with large perennial grasses and a pseudo-steppe physiognomy, and the *Tuberarietea guttatae*, of small ephemeral therophytic meadows, xeric and pioneering, and developing within the former, to which they are joined by successional processes. Particular importance, for the areas of the West Mediterranean, is also taken on by the class *Poetea bulbosae*, to be found in Italy chiefly throughout the silicicolous zones of Sardegna (LADERO *et al.*, 1992), where cultivation and livestock breeding assume characteristics similar to those leading to the establishment of the *dehesa* landscape, typical of the Iberian peninsula.

The grasslands of the class *Lygeo-Stipetea* are mainly shaped by formations with predominating *Ampelodesmos mauritanicus*, *Hyparrhenia hirta* or *Lygeum spartum*. The stately caespitose grass *Ampelodesmos mauritanicus*, called 'tagliamani' in Italian (for the sharp edge of its blades), forms savannah-like phytocenoses, playing a primarily relevant role in the stabilization of mobile substrates.

Hyparrhenia hirta is a species with ample distribution, widespread over the Mediterranean and over African, West Asian and Macaronesian territories. In Italy thatching grass vegetation is expressed at its best over a few areas of Calabria and Sicilia, where the following associations have been described: *Heteropogono contorti-Hyparrhenietum hirtae*, to which the species *Heteropogon contortus* and *Aristida caerulescens* also belong, and *Aristido caerulescens-Hyparrhenietum hirtae*, characterized by the grasses *Stipa parviflora* and *Stipagrostis sahelica*.

Vegetation with *Lygeum spartum* is found on clay soils of southern Italy, which are often interested by phenomena of rapid erosion bordering on the carving of badlands (Figure 4.67). Under these conditions the Matweed prevails upon the other species, owing to its root system being over developed; such system protects the substrate from the erosive action of superficial water flow.

As far as Mediterranean therophytic vegetation is concerned, it touches its highest level of biological diversity in the warmest areas of the Italian peninsula and of the islands, through an outstanding series of associations that are grouped by the orders *Malcolmietalia*, present on the sandy formations, and *Trachynetalia distachyae*, on the calcareous substrates. On the Italian dunes of the Adriatic the associations *Sileno coloratae-Vulpietum membranaceae* and *Maresio nanae-Ononidetum variegatae* are found, whereas the associations *Sileno coloratae-Ononidetum variegatae*, *Sileno nicaensis-Ononidetum variegatae*, *Sileno nicaensis-Cutandietum maritimae* and *Senecioni leucanthemifolii-Matthioletum tricuspidatae* can be traced along the coasts of the Tyrrhenian and of the Ionian seas. The



Fig. 4.67 - *Lygeum spartum* meadow on argillaceous salty terrains near the town of Taranto (Photo by E. Biondi).

main associations of the order *Trachynetalia distachyae* described as existing outside of the dunal systems for the central Adriatic sector of the peninsula are the *Saxifraga tridactylites-Hypochoeridetm achyrophori* and the *Trifoglio scabri-Hypochoeridetm achyrophori*, with late-winter and spring time phenology respectively, while for the Tyrrhenian and South Adriatic sectors the association *Crucianello latifoliae-Hypochoeridetm achyrophori* has been identified, surely more thermophilic than the previous one. Other associations are reported on the major islands, among which the following may be mentioned: *Thero-Sedetum cerulei*, *Vulpio-Trisetarietum aureae*, *Lophochloa cristatae-Plantaginetum lagopi* and *Valantio muralis-Sedetum cerulei*.

The class *Festuco-Brometea* in Italy presents three orders: *Festucetalia vallesiaca*, which is mainly found in the inland continental valleys of the Alps, *Scorzoneretalia villosae*, under eastern influence, present in Friuli-Venezia Giulia (POLDINI, 1995) and throughout the South Apennine, and *Brometalia erecti*, distributed on the Apennine and occasionally present in Sicilia, too (BIONDI *et al.*, 1995). Throughout the Apennine the order *Brometalia erecti* is present with the two suborders *Artemisio albae-Bromenalia erecti* and *Leucanthemo vulgaris-Bromenalia erecti*. The former brings together the xerophilic and semi-mesophilic alliances, for the most part calcicoles: *Phleo ambigu-Bromion erecti* and *Xerobromion*, and it is set apart from the suborder *Leucanthemo vulgaris-Bromenalia erec-*

ti for the presence of Mediterranean species distinguishing the classes *Rosmarinetea officinalis* and *Cisto-Micromerietea*. The suborder *Leucanthemo vulgaris-Bromenalia erecti*, with its single alliance *Bromion erecti*, is related instead to the mesophilic non calcicoles grasslands and is set apart for its quota of boreal species, which are for the most part characteristic of the classes *Molinio-Arrhenatheretea* and *Artemisietea vulgaris*, order *Agropyretalia repentis*. The endemic alliance of the Apennine *Phleo ambigu-Bromion erecti* brings together the xerophilic and semi-mesophilic pastures present on high mountain, mountain and hill ranges of the calcareous Apennine and in a limited sector of Sicilia, hitting the optimum on the bioclimatic hill range. Within the dominion of the Apennine alliance two suballiances are identified: *Brachypodenion genuensis* for the high mountain range of calcareous Central and North Apennine, *Sideridenion italicae* (= *Sideridenion syriacae* corrected) for the mountain and high mountain bioclimatic ranges of Central and South Apennine with a clearly defined Mediterranean character. Finally there is the alliance *Xerobromion*, comprising essentially chamaephytic pioneering pastures developing on calcareous-marly and marly-arenaceous substrates (BIONDI *et al.*, 1995). The reduced use of secondary prairies over vast zones of the Alps and of the Apennines has allowed for the rise of spontaneous vegetation recovery processes, which will bring about the return of the forest, through the establishment of shrubland and pre-forest formations. By this



Fig. 4.68 - An example of secondary multispecies grasslands with plenty of orchids. Note the huge bloom of *Gymnadenia conopsea* and asphodel (*Asphodelus albus*) (Photo by M. Baldoni).

means man-induced biodiversity resources are going to be depleted and the habitat directive intends to preserve them by identifying one priority habitat among others, namely 'Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (*important orchid sites)' (6210). The natural evolution of such grasslands, upon cessation of all agricultural and pastoral activities, leads to the development of thermophilic and heliophilic shrubs pertaining to the class *Rhamno-Prunetea*, with the foregoing distribution of herbaceous formations, again thermophilic, of the class *Trifolio-Geranietea*. The terminology 'important orchid sites' refers to grassland stations that are host to a dense suite of *Orchidaceae* or simply to a single numerically relevant population of the same, considered to be uncommon over the national territory. In Italy this habitat is met with over large expanses especially on the Apennine, in the temperate bioclimate, along the sub-Mediterranean and hilly ranges, where the orchids' populations tend to concentrate (Figure 4.68). The main orchids to be identified in these environments are: *Aceras anthropophorum*, *Anacamptis pyramidalis*, *Coeloglossum viride*, *Dactylorhiza latifolia*, *Epipactis atrorubens*, *Gymnadenia conopsea*, *G. widderi*, *Neotinea maculata*, *Ophrys apifera*, *O. bertolonii*, *O. fuciflora*, *O. fusca*, *O. holoserica*, *O. sphegodes*, *O. tenthredinifera*, *Orchis coriophora*, *O. italica*, *O. mascula*, *O. morio*, *O. papilionacea*, *O. pauciflora*, *O. provincialis*, *O. purpurea*, *O. sambucina*, *O. tridentata*, *O. ustulata*, *O. x colemanii*, *Pseudorchis al-*

bida, *Serapias lingua*, *S. parviflora*, *Spiranthes spiralis* and *Traunsteinera globosa*. These plants are apt to living in very diverse environments, as they manage to colonize even the poorest and meanest lands, thanks to their high degree of specialization based on their symbiosis with fungal mycorrhizas and on their intense collaboration with the pollinating insects. The conservation of the grasslands in hand and thereby of their orchid settlements demands an accurate management of the territory, in particular through interventions aimed at opposing natural vegetation recovery over the grasslands once they be no longer employed. This is feasible through the maintenance of the traditional agricultural and pastoral practices, involving grazing and haymaking, in a well balanced relation with the geomorphological and biological characteristics of the sites (Figure 4.69). Such management actions are thus tied to agricultural economy, and there is no question that the loss of economic revenue from livestock breeding in the wild has determined in fact the ultimate abandonment of the ample sections of the territory that were once devoted to such endeavours.

The grasslands dominated by *Nardus* (*Nardus stricta*), a caespitose grass with very characteristic deep purplish-blue-coloured unilateral spikes, also thrive on siliceous substrates of mountainous and sub-mountainous areas and more rarely on calcareous ones, and have been considered as a priority habitat by the directive. It is the case of formations which under the best conditions are



Fig. 4.69 - The conservation of grasslands (and therefore of orchids populations) requires the careful management of the territory, including the traditional agropastoral activities, like pasture and haymaking (Photo by E. Biondi).

closed sod and species rich: *Arnica montana*, *Avenula versicolor*, *Campanula barbata*, *Gentiana kochiana*, *G. punctata*, *Geum montanum*, *Leontodon helveticus*, *Nigritella nigra*, *Polygonum bistorta*, *Potentilla aurea*, *Pseudorchis albida*, *Trollius europaeus*, etc. In Italy *Nardus* pasture lands are mainly located on the Alps, where they occupy conspicuous - at times - expanses in the sub-alpine and mountain bioclimate ranges, even extending to the alpine range. Along the Apennine belt the mat-grass grasslands are relatively common in the high Tuscan-Emilian range, whereas in the Central to South Apennine they are frequently met with and sometimes even widespread over recurring favourable geolithological and geomorphological conditions (especially on the Monti della Laga range). On the calcareous ridges of Gran Sasso d'Italia and of Velino their distribution is linked to particular geomorphological conditions such as the bottom of sinkholes or other flat surfaces on a deep soil (BIONDI et al, 1999). The other mountainous systems of Central Apennine, and even more so those of the South Apennine, are rather devoid of herbaceous *Nardus* formations. Over the Alps and in the North Apennine the high mountain and sub-alpine mat-grass grasslands are clearly related to the alliance *Nardion strictae*, while in Central and southern Apennine the diverse associations that have been described are framed within the alliance *Ranunculo-Nardion*. The directive indicates the priority habitat as 'Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas in Continental Eu-

rope)' (6230); for its conservation the same indications hold for the most part as have been furnished for the grasslands of the order *Brometalia erecti*, hence the need for traditional management, though without exceeding with heavy load livestock grazing.

The grasslands of the order *Festucetalia vallesiacae* have also been accounted for by the directive, though only more recently through the entry of Austria in the EU, it having asked for the introduction of the priority habitat 'Sub-Pannonic steppic grasslands' (6240). This habitat is present in Italy as well, in the inland valleys of Trentino Alto Adige (PEDROTTI, 1965-68).

The primary grasslands can be distinguished in floristic terms with regard to the substrate and to the biogeographic region. On the Alps the siliceous soils higher up than the potential forest limit are interested by the presence of grasslands dominated by the Alpine sedge (*Carex curvula*) or by the *Nardus* (*Nardus stricta*), whereas on basic soils thrive formations dominated by the Blue moor grass (*Sesleria varia*), a mid-European orophyte not reaching as far as the Apennines, or by Bellard's Kobresia (*Elyna myosuroides*), an arctic-alpine cyperacean present as a relict over only few mountain tops of the Central Apennine (Figure 4.70). The continuity of primary grasslands is often interrupted by the so said 'nival valleys', more or less deep depressions that, owing to their shape, retain fallen snow for a longer lapse, frequently up to the summer, and are interested by the presence of particularly mesophilic vegetation types, such as the ones dominated



Fig. 4.70 - Landscape of the alpine bioclimatic level on the Gran Sasso d'Italia (Photo by E. Biondi).

by Dwarf willows (*Salix herbacea* and *S. retusa*). These turn out to be well represented on the Alps, while rather rare along the Apennines. In particular, the Apennine vegetation dominated by the Dwarf willow (Figure 4.71) is only sighted at few stations having the southern distribution limit at the Gran Sasso d'Italia, where the willow is present with the extremely rare endemic association *Armerio majellensis-Salicetum herbaceae*, which is thus worthy of the utmost attention (BIONDI *et al.*, 2000). The conservation of this vegetation's relict stations should be warranted in fact by their being located within the integral reserve area of the National Park 'Gran Sasso e Monti della Laga'. By this example, however, the problem of the safeguard of particular issues of phytocenotic diversity often not adequately considered by the Directive is raised; they are connected to local associations asserting themselves at stations lingering at the distribution limit of particularly significant species – from a phytogeographic point of view. In such cases, distinguishing the degree of conservation policy seems to be the answer, further extending it with respect to associations with strong local significance, as has already been elaborated for the species. In fact the very same Dwarf willow species is mentioned in the "Liste Rosse Regionali delle Piante d'Italia" (CONTI *et al.*, 1997) as being under great danger (CR) in Emilia-Romagna, experiencing a lower risk (LR) in the Marche, Lazio and Abruzzo, and being totally out of danger in the Alpine regions, where the species exhibits the widest known distribution in our country.



Fig. 4.71 - Dwarf willow (*Salix herbacea*) vegetation of the endemic association *Armerio majellensis-Salicetum herbaceae* in the nival small valleys of the Gran Sasso d'Italia (Photo by E. Biondi).

THE HABITATS OF THE EUROPEAN DIRECTIVE IN ITALY

[Emanuela Giovi]

In order to highlight the outstanding ecological value of the Italian territory both in terms of its flora, vegetation and fauna, and of its ecological network, it has been deemed appropriate to revert to the structure of the habitats' macro categories as is presented in the interpretation manual, with particular regard to our country¹ as far as the distribution of priority habitats goes (they are marked with an asterisk).

The special commissions at work within the 'Natura 2000' network have identified 218 habitat typologies representative as a whole of the environmental variability of Europe throughout. 68 of these habitats, close to around 31% of the total, have been given the priority status. Italy alone is endowed with 124 habitats (Table 4.28) adding up to around 57% of all European ones; out of these 124 habitats 27 are priority, that is approximately 40% of the Italian total. Thus, inside a territory covering less than 10% of Europe's expanse, more than half of all community habitats are represented.

As is often the case when dealing with taxonomic biodiversity, the concentration of so many and so diverse habitats over such limited territory is to be ascribed beyond doubt to the present uneven configuration of the Italian territory, resulting from the complex series of paleoclimatic events that have been affecting the peninsula over time. Nowadays such diverse entities can coexist within a very rich mosaic thanks to the physiographic and climatic variability of Italy. A country without big uninhabited stretches of land, unlike a few North European nations, and for this very reason all the more precious: the populations that have dwelt in Italy, though exerting an age long cultural influence over the environment, have managed to establish a balanced relationship with the same, leading to the conservation of so many different environmental occurrences, some of which are the very outcome of the interaction itself.

The hereby following report is a first hand synthesis of the community habitat typologies present in Italy, as they have been grouped by the EU itself in an ordered hierarchy, to be accounted as valid by all member states. In Italy all the devised macro categories are represented, as well as most of the intermediate groupings. The adherence of such a classification system to the Italian landscape types is not always unquestionable, and differing influences of few or other member states can frequently be perceived in the texture of the definitions themselves.

Italy, though such a large section of these habitats be represented on its own territory, has sometimes been penalized from the decision-making point of view, and it may be said that not all of the habitats' mosaic unravelling throughout our country is described in detail; at the same time, though sporadically, a few definitions find it hard to get adapted to what is present in Italy. For future meetings a more distinct effort on the side of the Italian delegation is to be sought for; this is likely to be accomplished in view of the recently achieved big programmes of naturalistic data collection, which are going to make Italy more self-assured even when confronted with nations that have been always boasting a thorough knowledge of their own territories.

In the following descriptions and comments what should come as a surprise is not only Italy's representativeness with respect to the whole of the habitats described for Europe, but especially the fact that for the most part these habitats are present at a high number of sites and that more than a single habitat is almost always represented at each site.

1 Coastal and halophytic habitats²

Italy, with its particular peninsular configuration, assumes remarkable importance in the representation and in the conservation of the habitats connected to marine and brackish environments. With respect to the rest of Europe it has a central position in the Mediterranean basin; it could be said that it is placed at the crossroads of biodiversity. The more continental or Atlantic aspects however are not totally absent, vital testimonies of ancient influences or active exchange centres between the diverse areas of the continent. All of these environmental typologies, though present in Italy by and large, have not been receiving sufficient attention up to now in terms of specialized botanic research. Much remains in fact to be investigated, especially about a few extreme environments, such as the brackish ones, that are host to particular habitats and to highly specialized organisms.

¹ The data on the presence of the habitats inside the SCI are from the data bank Natura 2000, based at the Ministry of the Environment and of the Protection of the Territory.

² The names and the codes of the habitats' classes as in the Annex I of the Directive 92/43/EEC 'Habitat Directive':

<http://europa.eu.int/comm/environment/nature/nature_conservation/eu_nature_legislation/habitats_directive/index_en.htm>.

		A	C	M
1	COASTAL AND HALOPHYTIC HABITATS			
11	Open sea and tidal areas			
1110	Sandbanks which are slightly covered by sea water all the time		x	x
1120 *	<i>Posidonia</i> beds (<i>Posidonium oceanicae</i>)			x
1130	Estuaries		x	x
1140	Mudflats and sandflats not covered by seawater at low tide		x	
1150 *	Coastal lagoons		x	x
1160	Large shallow inlets and bays		x	x
1170	Reefs		x	x
12	Sea cliffs and shingle or stony beaches			
1210	Annual vegetation of drift lines		x	x
1240	Vegetated sea cliffs of the Mediterranean coasts with endemic <i>Limonium</i> spp.		x	x
13	Atlantic and continental salt marshes and salt meadows			
1310	<i>Salicornia</i> and other annuals colonizing mud and sand		x	x
1320	<i>Spartina</i> swards (<i>Spartinion maritimae</i>)		x	
14	Mediterranean and thermo-Atlantic salt marshes and salt meadows			
1410	Mediterranean salt meadows (<i>Juncetalia maritimi</i>)		x	x
1420	Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>)		x	x
1430	Halo-nitrophilous scrubs (<i>Pegano-Salsoletea</i>)			x
15	Salt and gypsum inland steppes			
1510 *	Mediterranean salt steppes (<i>Limonietalia</i>)		x	x
2	COASTAL SAND DUNES AND INLAND DUNES			
21	Sea dunes of the Atlantic, North Sea and Baltic coasts			
2110	Embryonic shifting dunes		x	x
2120	Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes")		x	x
2130 *	Fixed coastal dunes with herbaceous vegetation ("grey dunes")		x	
2160	Dunes with <i>Hippophaë rhamnoides</i>		x	
2190	Humid dune slacks		x	x
22	Sea dunes of the Mediterranean coast			
2210	<i>Crucianellion maritimae</i> fixed beach dunes			x
2230	<i>Malcolmietalia</i> dune grasslands		x	x
2240	<i>Brachypodietalia</i> dune grasslands with annuals		x	x
2250 *	Coastal dunes with <i>Juniperus</i> spp.		x	x
2260	<i>Cisto-Lavenduletalia</i> dune sclerophyllous scrubs			x
2270 *	Wooded dunes with <i>Pinus pinea</i> and/or <i>Pinus pinaster</i>		x	x
23	Inland dunes, old and decalcified			
2330	Inland dunes with open <i>Corynephorus</i> and <i>Agrostis</i> grasslands		x	
3	FRESHWATER HABITATS			
31	Standing water			
3110	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)		x	
3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with <i>Isoetes</i> spp.			x
3130	Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i>	x	x	x
3140	Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	x	x	x
3150	Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> -type vegetation	x	x	x
3160	Natural dystrophic lakes and ponds	x		x
3170 *	Mediterranean temporary ponds	x	x	x
32	Running water			
3220	Alpine rivers and the herbaceous vegetation along their banks	x	x	
3230	Alpine rivers and their ligneous vegetation with <i>Myricaria germanica</i>	x	x	
3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	x	x	x
3250	Constantly flowing Mediterranean rivers with <i>Glaucium flavum</i>			x
3260	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	x	x	x

3270	Rivers with muddy banks with <i>Chenopodium rubri</i> p.p. and <i>Bidention</i> p.p. vegetation	x	x	x
3280	Constantly flowing Mediterranean rivers with <i>Paspalo-Agrostidion</i> species and hanging curtains of <i>Salix</i> and <i>Populus alba</i>	x	x	x
3290	Intermittently flowing Mediterranean rivers of the <i>Paspalo-Agrostidion</i>			x
4	TEMPERATE HEATH AND SCRUB			
4030	European dry heaths	x	x	x
4060	Alpine and Boreal heaths	x	x	x
4070 *	Bushes with <i>Pinus mugo</i> and <i>Rhododendron hirsutum</i> (<i>Mugo-Rhododendretum hirsuti</i>)	x	x	
4090	Endemic oro-Mediterranean heaths with gorse	x	x	x
5	SCLEROPHYLLOUS SCRUB (MATORRAL)			
51	Sub-Mediterranean and temperate scrub			
5110	Stable xerothermophilous formations with <i>Buxus sempervirens</i> on rock slopes (<i>Berberidion</i> p.p.)	x	x	x
5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands	x	x	x
52	Mediterranean arborescent matorral			
5210	Arborescent matorral with <i>Juniperus</i> spp.	x	x	x
5220 *	Arborescent matorral with <i>Zyziphus</i>			x
5230 *	Arborescent matorral with <i>Laurus nobilis</i>		x	x
53	Thermo-Mediterranean and pre-steppe brush			
5310	<i>Laurus nobilis</i> thickets		x	x
5320	Low formations of <i>Euphorbia</i> close to cliffs			x
5330	Thermo-Mediterranean and pre-desert scrub		x	x
54	Phrygana			
5410	West Mediterranean clifftop phryganas (<i>Astragalo-Plantaginetum subulatae</i>)			x
5420	<i>Sarcopoterium spinosum</i> phryganas			x
5430	Endemic phryganas of the <i>Euphorbio-Verbascion</i>			x
6	NATURAL AND SEMI-NATURAL GRASSLAND FORMATIONS			
61	Natural grasslands			
6110 *	Rupicolous calcareous or basophilic grasslands of the <i>Alysso-Sedion albi</i>	x	x	x
6130	Calaminarian grasslands of the <i>Violetalia calaminariae</i>		x	x
6150	Siliceous alpine and boreal grasslands	x		
6170	Alpine and subalpine calcareous grasslands	x	x	x
62	Semi-natural dry grasslands and scrubland facies			
6210 *	Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites)	x	x	x
6220 *	Pseudo-steppe with grasses and annuals of the <i>Thero-Brachypodietea</i>		x	x
6230 *	Species-rich <i>Nardus</i> grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	x	x	x
63	Sclerophyllous grazed forests (dehesas)			
6310	Dehesas with evergreen <i>Quercus</i> spp.			x
64	Semi-natural tall-herb humid meadows			
6410	<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)	x	x	x
6420	Mediterranean tall humid grasslands of the <i>Molinio-Holoschoenion</i>	x	x	x
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	x	x	x
65	Mesophile grasslands			
6510	Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)	x	x	x
6520	Mountain hay meadows	x	x	
7	RAISED BOGS AND MIRES AND FENS			
71	Sphagnum acid bogs			
7110 *	Active raised bogs	x	x	
7120	Degraded raised bogs still capable of natural regeneration	x		
7140	Transition mires and quaking bogs	x	x	x
7150	Depressions on peat substrates of the <i>Rhynchosporion</i>	x	x	x
72	Calcareous fens			
7210 *	Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	x	x	x
7220 *	Petrifying springs with tufa formation (<i>Cratoneurion</i>)	x	x	x
7230	Alkaline fens	x	x	x
7240 *	Alpine pioneer formations of the <i>Caricion bicoloris-atrofuscae</i>	x		

8	ROCKY HABITATS AND CAVES			
81	Scree			
8110	Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>)	x	x	x
8120	Calcareous and calcschist screes of the montane to alpine levels (<i>Thlaspietalia rotundifoliae</i>)	x	x	x
8130	Western Mediterranean and thermophilous scree	x	x	x
8160 *	Medio-European calcareous scree of hill and montane levels	x	x	x
82	Rocky slopes with chasmophytic vegetation			
8210	Calcareous rocky slopes with chasmophytic vegetation	x	x	x
8220	Siliceous rocky slopes with chasmophytic vegetation	x	x	x
8230	Siliceous rock with pioneer vegetation of the <i>Sedo-Scleranthion</i> or of the <i>Sedo albi-Veronicion dillenii</i>	x	x	x
8240 *	Limestone pavements	x	x	x
83	Other rocky habitats			
8310	Caves not open to the public	x	x	x
8320	Fields of lava and natural excavations			x
8330	Submerged or partially submerged sea caves			x
8340	Permanent glaciers	x		
9	FORESTS			
91	Forests of Temperate Europe			
9110	<i>Luzulo-Fagetum</i> beech forests	x	x	x
9130	<i>Asperulo-Fagetum</i> beech forests	x	x	x
9140	Medio-European subalpine beech woods with <i>Acer</i> and <i>Rumex arifolius</i>	x		
9150	Medio-European limestone beech forests of the <i>Cephalanthero-Fagion</i>	x	x	x
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	x	x	x
9170	<i>Galio-Carpinetum</i> oak-hornbeam forests	x	x	
9180 *	<i>Tilio-Acerion</i> forests of slopes, screes and ravines	x	x	x
9190	Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains		x	x
91B0	Thermophilous <i>Fraxinus angustifolia</i> woods	x	x	x
91D0 *	Bog woodland	x		
91E0 *	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)	x	x	x
91F0	Riparian mixed forests of <i>Quercus robur</i> , <i>Ulmus laevis</i> and <i>Ulmus minor</i> , <i>Fraxinus excelsior</i> or <i>Fraxinus angustifolia</i> , along the great rivers (<i>Ulmenion minoris</i>)	x	x	x
91H0 *	Pannonian woods with <i>Quercus pubescens</i>	x	x	x
92	Mediterranean deciduous forests			
9210 *	Apennine beech forests with <i>Taxus</i> and <i>Ilex</i>	x	x	x
9220 *	Apennine beech forests with <i>Abies alba</i> and beech forests with <i>Abies nebrodensis</i>	x	x	x
9250	<i>Quercus trojana</i> woods			x
9260	<i>Castanea sativa</i> woods	x	x	x
9280	<i>Quercus frainetto</i> woods			x
92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	x	x	x
92C0	<i>Platanus orientalis</i> and <i>Liquidambar orientalis</i> woods (<i>Platanion orientalis</i>)			x
92D0	Southern riparian galleries and thickets (<i>Nerio-Tamaricetea</i> e <i>Securinegion tinctoriae</i>)			x
93	Mediterranean sclerophyllous forests			
9320	<i>Olea</i> and <i>Ceratonia</i> forests			x
9330	<i>Quercus suber</i> forests			x
9340	<i>Quercus ilex</i> and <i>Quercus rotundifolia</i> forests	x	x	x
9350	<i>Quercus macrolepis</i> forests			x
9380	Forests of <i>Ilex aquifolium</i>			x
94	Temperate mountainous coniferous forests			
9410	Acidophilous <i>Picea</i> forests of the montane to alpine levels (<i>Vaccinio-Piceetea</i>)	x	x	
9420	Alpine <i>Larix decidua</i> and/or <i>Pinus cembra</i> forests	x		
9430 *	Subalpine and montane <i>Pinus uncinata</i> forests (* if on gypsum or limestone)	x	x	
95	Mediterranean and Macaronesian mountainous coniferous forests			
9510 *	Southern Apennine <i>Abies alba</i> forests			x
9530 *	(Sub-) Mediterranean pine forests with endemic black pines	x	x	x
9540	Mediterranean pine forests with endemic Mesogean pines	x		x
9560 *	Endemic forests with <i>Juniperus</i> spp.			x
9580 *	Mediterranean <i>Taxus baccata</i> woods	x		x

Table 4.28 - Distribution of the habitats quoted for Italy in the three biogeographic regions: alpine (A), continental (C), Mediterranean (M).

11 Open sea and tidal areas

The open sea and the areas subjected to the tides are among the environments in which Italy plays a crucial part in the economy of the continent. The ample stretches of *Posidonia oceanica* and the coastal lagoons of many sections of the peninsula are a vivid example of this. As in only few other environments, it is a matter of sites whereby the survival of a great number of organisms is at stake, regarding widely varied taxonomic groups. The presence of water spermatophytes is thus connected to the reproduction of many salt water micro- and macro-invertebrates, just as much as it depends on the establishment and endurance of complex algal communities of huge taxonomic interest.

In Italy among the habitats grouped in this category there are the sandbanks slightly covered by sea water all the time (1110), relevant for their water angiosperm communities and as marine birds nidification sites; the estuaries (1130), a rarer sight over Italy, where border areas between fresh water and salt water come about, as essential prerequisites to the survival of aquatic spermatophyte communities as well as of benthic micro-environments, both algal and dominated by invertebrates; the areas not covered by seawater at low tide (1140), rich in micro algae and especially diatoms; the large shallow inlets and bays (1160), rich in benthic invertebrate communities and very rich in sediments useful to water plants communities; the marine reefs of biogenetic origin, very rich in algae (1170).

Two priority habitats belonging to this category are found in Italy: the *Posidonia* beds (*Posidonion oceanicae*), exclusive to the Mediterranean, where *Posidonia*, an angiosperm of priority status, is host in turn to different priority *taxa* among invertebrates and marine fish (1120* - 159 SCI); the coastal lagoons, complex systems with variable saline balance, that are home to very rich communities of micro- and macrophytes and provide for the life and the reproduction of animals belonging to different taxonomical groups (1150* - 78 SCI).

12 Sea cliffs and shingle or stony beaches

There are not many habitat typologies represented in Italy within this meso-category; however, they are abundantly present in quantitative terms, and this is a good sign, as it has to be considered that coastal environments, in general, end up falling prey to invasion and urbanization more easily than others, following both exploitation and tourism measures.

The drift line (1210), together with the belt immediately to the rear, constitutes an environment which is at the same time very rich in organic material's deposits and

undergoing intense mechanical and micro climatic strains. It is an extreme environment, in which only particular plant communities manage to settle in, with remarkable structural fluctuations derived from seasonal dynamics. Italy, in spite of the anthropogenic impact bearing down on most of its coastal areas, still preserves most such habitats, especially along the Tyrrhenian side and the South Adriatic coast, but they are under extreme risk due to the continuous fragmentation caused by touristic and residential pressure.

As regards the rocky cliffs Italy boasts the presence of ample vegetated sea cliffs, rich in frequently endemic species (1240). In these environments, apart from the extreme conditions of life (marine aerosol, gales, intense sunlight), the vegetation also has to adapt itself to naturally imposed spatial limitations. In fact, plants exhibiting unique ecology manage to survive only in minute land pockets, by implementing a fragmentation and a biological diversity that may fit together just over a few metres-wide expanse. In these environments the genus that has further put to the test its own evolutive potential both in taxonomical and in geographical terms is *Limonium*. Such evolution is still fully under way: along our coasts continual speciation events have occurred and keep on occurring, leading as a result to the production of a high number of Italian endemisms following the entire geographic and ecological micro variability of the cliffs.

13 Atlantic and continental salt marshes and salt meadows

These environments have been insufficiently studied up to now. This often descends from taxonomic difficulties in the recognition of the species present. Instead they are worthy of better attention and are part of quite peculiar worlds yet to be appreciated. In the past flooded brackish environments have been subjected to heavy drainage interventions. Nowadays this tendency has been reversed for the most part and the value of these environments as a living source of biological diversity is starting to gain wide recognition.

Salt marshes areas can host species sporting specialized adaptations to the high saline content of the substrate and of the physical surroundings (1310). The *Chenopodiaceae* family, in particular, with the genus *Salicornia* and a few akin genera, has developed very sophisticated systems of not only functional but also morphological specialization. Extremely compact structures are thereby implemented, characterized by high water accumulation, and by reproductive systems in turn getting specialized. It's the peculiarity of these structures that turns these genera into tru-

ly critical groups from the systematic point of view; hence, the study of such *taxa* has been known to be discontinuous and fragmented in the past.

A few grasses manage to reach similar specialization levels, too, so as to tolerate hyperaline environments. The genus *Spartina* in fact forms expanded belts linked to shoal environments, and more generally this habitat corresponds to more stable situations – it acts like a consolidating agent, thanks to the contribution produced by the long submerged root systems (1320).

14 Mediterranean and thermo-Atlantic salt marshes and salt meadows

Where the climate conditions and the geographical position determine a more tempered situation, instead of the formations that are described in the previous paragraph, communities are met with that are functionally similar to the preceding ones, but structurally more complex. The restrictions imposed by hyperalinity still apply, but it is possible to find, in addition to the annual species, also plant communities of a persistent nature.

Thus beds of rushes exist of varied composition, at any rate characterized by the presence of numerous priority stenocious species and therefore exhibiting high conservationist interest (1410).

In addition to these environments, however, which are displaying physiognomic features of small to medium size herbaceous plant stretches, halophilous scrub communities of variable size are present (1420). Under conditions of higher edaphic aridity provided by sodium chloride concentration, perennial *Chenopodiaceae* halophilous communities settle in, exhibiting elements of Mediterranean and Atlantic origin. All sorts of taxonomical problems already encountered with *Salicornia*-dominated communities are again in effect, but the evolutive relations inside the genera and the ecological dynamics connecting the species to the environment and to other species are all being accounted for.

When the nitrate content grows higher, in place of the more strictly halophilous plants there are communities with a higher degree of structural organization (1430). In Italy these environments are found both over flat lands and in typical badlands formations. The aridity determined by salt content stays at top level, however the substrate does not enter into direct contact with salt water, so that in addition to a few *Chenopodiaceae* of the genera *Salsola*, *Atriplex* and *Suaeda*, also other families' exponents find their way, not endowed with halophilous, but simply with halo-tolerant and nitrophilous features.

15 Salt and gypsum inland steppes

An important priority habitat belonging to this group (1510* - 63 SCI) is present in Italy with a significant number of sites. Mediterranean salt steppes in fact represent a habitat type bearing resemblances in numerous details to other European Mediterranean ranges, especially Spanish ones. Representativeness at the ecological and geographic level is quite remarkable, too; the expanses of numerous *Limonium* species, a genus which has already been recorded as being well adapted to extremely arid conditions, hereby endure conditions ranging from rising tides, with substrate saline content increases, to extreme drought periods during the summer. These characteristics are present in quite a few locations over our peninsula: from the area of the Po's base level to the coastal lakes of Gargano, from the Sardinian 'ponds' to the Sicilian salt-pans' basins.

2 Coastal sand dunes and inland dunes

Where the coast is devoid of rocky stretches, the littoral sands may constitute complex dune systems, more or less continuous and fully developed. The structure of such sandy aggregations is determined by diverse factors: among the natural ones a primary role is played by the wave swell, the winds and the granulometry of the sands. But it's the human factors that can bring about the most significant structural alterations, bordering on complete disgregation.

In a country with a rich coastline such as Italy, the dunes, with their fragile structural dynamics, have often been subjected to intense alterations, especially corresponding to tourism expansion cycles that hit our shores in the last century. In spite of which Italy still possesses well conserved coast stretches, where the dunes keep on performing their duty as buffer areas with respect to the sea, through their plant communities rich in biological diversity.

21 Sea dunes of the Atlantic, North Sea and Baltic coasts

More structured European dunes are placed in this category. They are typical of oceanic or of open and very large seas' coasts, however particular geographic and conservation conditions over Italy have them recurring. All temporal phases of dune formation and all the more or less structured belts are deemed important for the persistency and the solidity of the dune itself. Each belt enters into close contact with the adjacent ones and becomes a prelude to their stability: the plants that compose them, through their root systems, exercise a physical – not chem-

ical – processing action upon the substrate, resulting in an otherwise impossible consolidation of the sands. The following description is concerned with the typical structure of little disturbed dunes; it should be kept in mind that such a spatial arrangement is often subjected to penetrations and inversions, depending on various types of interference patterns.

The species that first afford the opportunity for the evolution of the dune (2110) thrive and are active in the belt looking onto the water-mark. This area is still subjected to the direct influence of the sea, both in terms of an occasional contact with the salt water and, more so, with marine aerosol; only plants that are annual and have special adaptations can settle down here. Most are grasses, provided with sturdy root runners, with external tissues hardenings, and often densely covered with matted hairs.

Behind this belt, where the sea water normally does not reach, shifting dunes establish themselves, mainly constituted by a large grass with a robust underground system, *Ammophila arenaria* (2120). Shifting dunes are subjected to a continual rearrangement, due to the action of the wind; but it is this plasticity that allows them to play an important buffer role with respect to fixed dunes.

Fixed coastal dunes that are related to this grouping, the so said ‘grey dunes’, are colonized by communities which, though lacking in pronounced pioneer characteristics, are nevertheless well adapted to high sodium chloride concentration, that teams up with a little evolved substrate with an extremely low capability of meteoric water retention. This belt is characterized by perennial herbaceous vegetation with good capacity for dilute soil retention. Unfortunately in Italy the mature phase of such dunal systems has become increasingly rare (2130* - 21 SCI): typical of many areas of the Adriatic, it has cut back in time, especially as a consequence of ongoing urbanization and industrialization processes in the North Adriatic.

Fixed dunes are not the end of the dunal system: in a wider sense, it also comprises the totality of the hollows interspersed between each dune and the next. These depressions may be very arid or else allow for the accumulation of a certain amount of water. In a few, extremely rare, interdunal depressions a *Hippophaë rhamnoides* dominated community can establish itself – a shrub sometimes taking on a prostrate form. This habitat (2160) is represented in Italy by a single SCI located in the area of the Po’s delta, even though the species happens to be more widely distributed over the Italian territory. Humid dune slacks with more complex vegetation (2190) are more frequently met with, though in keeping with the conserva-

tion state and with the continental character of our country. With respect to water abundance conditions, complex fresh water or low salt water algal communities, as well as tall grassland and willows-dominated communities may also be present.

22 Sea dunes of the Mediterranean coast

Along the Mediterranean coasts the dunes exhibit more varied characters over the less expanded spatial ranges. Together with the beach and the proper dune communities, by means of particular climate and morphological conditions, evergreen woody vegetation forms settle in with particular adaptations to both seasonal aridity and salt concentration dependent aridity. In this case, too, the survival of such a range of environments has often been threatened by touristic and urbanistic expansion rates.

Here, too, the different belts correspond to diverse substrate consolidation potentials and to diverse pioneer stages, in full respect of a structural hierarchy that is analogous to that of the previous category. Due to anthropogenically induced interferences, in many cases it is possible to witness the loss of all such structuring and a chaotic intermingling of the various sections.

Characteristic of the dunes proper are the communities dominated by *Crucianella maritima* rich in species with high biogeographic and conservationist value, such as *Pancratium maritimum* for example, and in perennial species adapted to coastal environments (2210). These environments are rather frequent in Italy, especially along the Tyrrhenian, Ionian and partly along the Adriatic coasts, and they are very well represented, for example, along the littorals of low Lazio. Sometimes even small fruticose plants may get established, such as is the case with the genera *Euphorbia* ed *Ephedra* (2220). Between one dune and the next ephemeral therophyte dominated communities thrive, exploiting the short periods during which meteoric waters are more abundant to complete their life cycle, often accompanied by many-coloured flowerings. More stably arid settings are usually colonized by expanded herbaceous formations of perennial plants with a pronounced thermophilic and xerophilic character and abundant ingressions of annual elements. Such communities, which are found on level ground and in the typical ‘mound-shaped scrubs’ still to be found in Italy, are dominated by *taxa* belonging to the genus *Brachypodium*, over pseudo-steppes ranges, on oligotrophic, often basic soils (2240).

The more evolved and sheltered contexts dominated by woody species constitute, for example, articulate habitats with prevailing junipers (2250*). They are represent-

ed in Italy by 95 SCI many of which are scattered on the islands, where they give rise to peculiar landscapes both functionally and aesthetically relevant. The raging winds naturally mould the junipers into twisted shapes that stand out strikingly with respect to the remaining vegetation. In the more sheltered areas cistus and lavender shrubs may grow (2260), whereas man-managed areas are home to arboreal formations dominated by *Pinus pinea* and *P. pinaster* (2270*). These areas, though resulting from a landscape form for the most part historically introduced by man, fall into the standpoint of semi-natural contexts' protection, as maintained by the spirit of the 'Natura 2000' network. This is in fact the case of a priority habitat, represented all over Italy by 68 SCI, also playing a significant part in the conservation of a few birds and as a wind barrier.

23 Inland dunes, old and decalcified

These formations, more typical of the Baltic areas and pertaining to the North Sea, are represented in Italy by a single SCI (2330) preserving the lower part of the river Ticino. They are characterized by dunes of glacial origin with siliceous arid soils, very rich in lichen communities. Among the vascular plants the acid-loving herbaceous ones prevail instead, giving rise to expanded meadows strongly dominated by the annuals.

3 Freshwater habitats

Inland waters furnish one of the most important contributions to both plant and animal taxonomic biological diversity. Wetlands in general have received since a few years the attention they are worthy of, through the establishment of commissions at the international level and the promulgation of conventions and agreements. As for the salt marshes, in this case, too, the dedicated studies have not come in overwhelming numbers up to now: the conservation emergency experienced by all the wetlands still demands particular attention, however, as they are the ones more readily subjected to draining procedures for economic and agricultural purposes. Inland waters may be conventionally divided into lentic waters and lotic waters; both typologies present peculiar vegetation forms, both in their floristic compositions and in the ecological roles and in the adaptations of the plants comprised.

31 Standing waters

Depending on the trophic state of the waters and on the nature of the substrates, still waters can be character-

ized by different forms of vegetation. On sandy substrates, often derived from fossil dunes, rare surviving forms of plant physiognomies can be traced. They are temporarily flooded areas mainly following winter dynamics, with oligotrophic waters characterized by plants that become visible only during brief periods of the year (3110). In particular, in the Mediterranean domain, a few examples of such landscapes can be accounted for in some Tyrrhenian sectors, throughout areas untouched by drainings: plants characteristic of these environments are a few relict pteridophytes with an amphibian life cycle belonging to the genus *Isoetes* (3120). They are linked to the presence of water especially during the reproductive phase, in which the micro spores are released.

With a certain increase in the organic substance of the substrate, often quite close to water basins proper, or even within the range of their overflow area, the period of time water stays close to the surface is extended so that plant communities composed of minute plants (3130) can establish themselves. It is mostly the case of small *Juncaceae* and *Cyperaceae* with a distinct pioneer character and a very short life cycle, closely connected to the seasonal rainfall variations. In addition to these temporary collections of water with a largely acid pH, a few occurrences take place - similar insofar as seasonal dynamics - with a high content of bases in solution. In these waters with a low trophic content, mostly located in northern Italy but also not infrequent farther South along the peninsula, live benthic algal communities forming large submerged matted surfaces (3140).

As regards lake basins proper, rich in complex and articulate vegetation typologies, in Italy two main forms of natural lakes are present, the difference between them once more being based on the water trophic content. The largest part of Italian lakes or ponds is related to a basin typology of eutrophic waters with pH greater than 7. At these sites it is possible to admire the enticing helophyte and pleustophyte communities made up of spermatophytes as well as of water ferns and liverworts (3150). In northern Italy instead, existing lakes have a high acidity, and the rich sphagnum communities there are linked to the dynamics of the peat bogs (3160).

Mediterranean temporary ponds constitute a totally different case, in the past heavily altered by draining activities (3170* - 75 SCI). It is a priority habitat made of rather shallow water pools that tend to dry up completely during summer. They are occupied by small size vegetation and work as reproductive sites for many invertebrate water animals.

32 Running water – stretches of flowing water on natural or semi-natural dynamics (with minor, medium size and major water beds) with no significant alterations of water quality

Flowing waters present a few physical conditioning factors so as to determine particular forms of vegetation. The chief ones influencing vegetation are water depth, the nature of the bed itself and the water regimen. The flow of water represents a mechanical obstacle to the establishment of the vegetation; the plants, in relation to the water regimen and to the speed of the flowing water, present particular adaptations and flowering compositions. Where the flow is particularly rapid and turbulent the water macrophytes cannot survive; with a high rate of flow life forms become established nonetheless, with particular hydrodynamic adaptations. Plants often exhibit dimorphism phenomena, so that the submerged portion presents thinned out and elongated stems and fringed and threadlike leaves, whereas the floating part exploits the solar radiation through expanded leaf blades, and attracts the pollinators with flowers carried at the surface of the water.

The Alpine rivers (3220), also including various Apenninic basins, gather major water contributions from the melting of glaciers so that their maximum water capacity coincides with the summer season. The banks of these rivers are colonized by tall grasses and subshrubs with prevailing boreal or arctic chorotypes, and with frequent ingressions of exotic elements where the sediments are deposited. Such physiognomies are interspersed by woody formations characterized by shrubs such as *Myricaria germanica* and *Salix* sp. pl. (3230) and, in further evolved forms and along more slowly flowing courses, by shrubs and trees belonging to the genera *Salix*, *Alnus*, *Betula* (3240).

The Mediterranean rivers have water regimes that are primarily influenced by season-ruled meteoric and aquifer water flows; minimum water capacity corresponds to the summer season, with frequent total or partial drainage phenomena. Watercourses with gravel layered water beds transport and deposit pebbles over the banks, too, where herbaceous and fruticose communities establish themselves, especially *Glaucium flavum* and *Myricaria germanica* (3250). Strictly aquatic vegetation instead is characterized by the adapted forms mentioned above. The genus *Ranunculus*, in particular, has given rise to exceptional dimorphic adaptations, especially with *R. fluitans*, *R. aquatilis*, *R. trichophyllus*. Other genera too, such as *Myriophyllum*, *Callitriche*, *Potamogeton*, represent perfect forms of organism adaptation to the environment. In the cases of low

pollution levels, it is possible to come across *Fontinalis antipyretica*, an indicator of average water health state (3260). Along the muddy banks, all the more rare owing to the watercourse management progressively under way, extremely season-sensitive communities settle in, characterized by *Chenopodium rubrum* and *Bidens frondosa* (3270). These habitats are very well represented especially in Central Italy, but present irregular dynamics, making their survival more and more a matter of chance. Along the more consolidated banks, landscapes are displayed characterized by arboreal prospects, often favoured by man for his own purposes. Again as a consequence of embankment building, annual and perennial habitats are protected, consisting in nitrophilous meadows growing on flood plains' sediments, and which are frequently associated to the woody riparian formations dominated by *Salix* sp. pl. and *Populus alba* (3280). A few watercourses present very discontinuous regimens, with sometimes extended periods during which the water flow becomes very spare, if not totally absent. In such cases, inside the river bed a few flooded areas may persist, which however no longer possess the characteristics of flowing water, drawing rather significantly closer to still waters. These ranges then are colonized by taxa such as *Polygonum amphibium* and *Potamogeton* sp. pl., more typical of stagnant ponds (3290).

4 Temperate heath and scrub

In temperate areas and on acid soils vegetation formations develop similar to a few typical landscapes of Center and North Europe. In Italy they are rather widespread, more so than normally acknowledged, and are represented by numerous SCIs (171 in all). Such landscape forms, with a more or less arid character according to the different contexts and latitudes, are found over a sizeable portion of the Italian territory, with some variances.

The more arid forms pertaining to peninsular contexts, or however influenced by the Mediterranean climate, present mesophilous and xerophilous vegetation (4030), recur in 91 SCIs and are characterized by the presence of numerous instances of the families *Ericaceae* and *Vacciniaceae*, with frequent elements of the *Fabaceae* and *Cistaceae*. *Vaccinium*, *Erica*, *Calluna*, are distinctly acid loving genera, moulding a typical landscape with low scrubs, especially in northern Italy, and intermingling with other types of vegetation as they head South along the peninsula.

In the environments of northern Italy the most typical form of center-European low heath (4060) is found,

with 183 SCIs. The dominant families are again *Vacciniaceae* and *Ericaceae*, but the more represented genera are the ones exhibiting small size species, plants that are well adapted both morphologically and ecologically to cold-arid environments and corresponding climate factors. *Loiseleuria procumbens*, *Vaccinium* sp. pl., *Arctostaphylos uva-ursi*, the precious relict *Dryas octopetala*, but also Gymnosperms such as *Juniperus nana* and, last but not least, very rich lichen communities. All these spermatophytes share very prostrate bearing and a series of adaptations having to do with the leaf surface, such as abundant matted hairs, sheltered stomata, thick layers of wax, as a shield against intense solar radiation and the drying up caused by strong winds.

High altitude zones of the Alps and, to a lesser scale, of the Apennines, are occupied by shrubs, sometimes consisting in pioneer bushes of *Pinus mugo* and *Rhododendron* sp. pl. (4070*). It is a priority habitat, at risk as a consequence of the progressive rise of the limit of the forest, still quite necessary as the unique means of consolidation of the more elevated mountain slopes. In Italy it is represented by 91 SCIs for the most part located in the Alpine sector.

Finally there is one last formation in Italy with bushes and low shrubs dominated by *Fabaceae* for the most part thorny, present in numerous different textures in the European Mediterranean countries (4090). This habitat is represented by 57 SCIs in Italy, most of which are located in Sicilia and Sardegna. These formations are strictly related, in floristic composition, to the mountain morphology and to the soil on which they grow. This has given rise to numerous endemic groups of Sardegna and Corsica, of Mt. Etna, and of the peninsular mountain ranges of southern Italy.

As is the case with all these formations characterized by woody species and a more or less prostrate bearing, such bushes make for a sort of protection with regard to other species which, under the same climatic conditions, could not manage to survive. Hence these habitats, in addition to protecting the species directly taking part in vegetation architecture, indirectly manage to increase the level of biological diversity in otherwise prohibitive environments.

5 Sclerophyllous scrub (matorral)

In the Mediterranean and sub-Mediterranean world scrub formations are found that sometimes may be interpreted as degradation phases of forest successions, but

more often represent a mature and persistent phase, in balanced equilibrium with particularly stressful climate and edaphic conditions. As regards the latitudes and the climate, it is possible to identify different scrub typologies, many of which assume in Italy a relict character and therefore are in demand of particular attention in terms of conservation actions, having often been subjected in the past to transformations on man's side.

51 Sub-Mediterranean and temperate scrub

In the hill and low mountain range, along rocky slopes, it is possible to come across a few characteristic scrub formations, dominated by *Buxus sempervirens* (5110). These communities are expressed on calcareous soils and represent a transitional phase between calcareous meadows and thermophile mixed deciduous forests. For the latter sometimes such scrubs constitute a mantle vegetation and show frequent ingressions from the forest environments. In Italy the habitat is especially represented at the level of Central peninsula, with 33 SCIs. More frequently, from the base to the mountain level, it becomes introduced into environments similar to the open communities dominated by *Juniperus communis*, dynamically connected to mesophilous or xerophilous grasslands on limestone (5130). Very well represented throughout Italy with 174 SCIs, this habitat comprises diverse bushes and shrubs, in particular among the *Rosaceae* (*Rosa* sp. pl., *Prunus spinosa*, *Crataegus* sp. pl.).

52 Mediterranean arborescent matorral

In many cases *Juniperus communis*, just as other junipers, assumes an arboreal-type habitus and is accompanied by scrub formations of evergreen sclerophyllous plants (5210). Naturally this habitat finds its optimum at the basal and at the hill ranges; however, cases are reported in which this particular type of scrub settles in at higher altitudes, too; in Abruzzo, at more than one SCI, it is present up to 1,500 m AMSL. If this habitat is represented throughout Italy by 142 SCIs, the priority habitat dominated by arborescent *Zyziphus lotus* (5220*) is much more rare. Typical of, and almost exclusive to, the extremely arid South West sector of the Iberian peninsula, in Italy it is represented only by the SCI of Mount Pellegrino in Sicily (PA). Under more humid conditions, over plains and through gorges, a plant formation of great value and above all of great paleoclimatic significance is found, albeit rarely. In 28 SCIs in fact the presence is reported of the priority habitat formed by arborescent matorral with *Laurus nobilis*

(5230*), a sclerophyllous that as a spontaneous occurrence represents not only a rarity but a veritable relict. It bears testimony of the time when Italy, during the Cenozoic, and occasionally later on, was characterized by a warm and humid climate allowing for the development of lush forests. Nowadays the remnants of such forests can be admired, for example, at different sites over Lazio, Campania, Sicilia, and, more rarely, in other regions too.

53 *Thermo-Mediterranean and pre-steppe brush*

When the edaphic and climatic conditions are not conducive to their full development under the form of open and polyspecific scrubs, the Laurel-dominated formations can occupy fresh and humid areas inside more distinctly arid situations. The Laurel then forms very dense almost monospecific scrubs (5310), very rare and represented by only 8 SCIs in the central part of Italy. To these distinctly thermo-Mediterranean surroundings belong those environments that are comprised between the cliffs proper and the garigues that are spatially and dynamically connected to them. These formations are openly exposed to marine winds, and are composed of small size plants or plants of reduced size with respect to the normal growth model (5320). In these habitats *Euphorbia* sp. pl., *Pistacia lentiscus*, *Helichrysum* sp. pl., *Thymelaea* sp. pl. are frequently found. The SCIs this habitat is represented by are exclusive to islands and rocky coasts, many of which belong to the Tyrrhenian side.

As a consequence of the particular abundance and of the multiple solutions that they exhibit in Italy, the thermo-Mediterranean bushes and scrubs with pre-desert tendencies (5330) are to be treated separately. In fact they are represented at over 300 SCIs, largely located along the coastal belts and on the islands, and not rare at inland sites either, where they often bear testimony to ancient tertiary vegetation. This category in fact comprises both the formations dominated by *Euphorbia dendroides*, typical of our major islands, and the garigues with *Ampelodesmos mauritanica*, present by and large throughout central and southern Italy and in the islands. But here are also included the superb spontaneous groupings with *Chamaerops humilis* that are present discontinuously along the Tyrrhenian coast and more abundantly in the islands, particularly Sardegna. In many of these sites the Fan Palm betrays its custom small size to soar up high with individuals of remarkable size; more often it forms bush-like dense groupings standing out along the warmer sides of the coasts.

54 *Phrygana*

A few typologies of vegetation are included under this denomination, composed of sclerophyllous plants, often provided with thorns, and assuming a typical cushion-like form, curling up close to the substrate. These are not so common formations in Italy, where they are considered to be at the westward limit of their distribution range, and thereby exclusively colonize very arid, mostly insular environments.

Many of these formations occupy the top areas of sea cliffs, where, in addition to solar radiation and to a very thin and very draining soil, they have to face winds laden with saltiness. It is the case of a rare typology, only present in 7 SCIs, with predominant *Helichrysum italicum*, *Thymelaea hirsuta*, *Plantago subulata* and a few small size *Fabaceae* (5410). The low spiky scrubs dominated by *Sarcopoterium spinosum* instead are absolutely rare; they are typical of South East Mediterranean and are present only in 3 SCIs over Italy (5420). A third habitat typology that can be related to this grouping is *Phrygana*, endemic to the *Euphorbio-Verbascion* (5430), present in various areas of Mediterranean Italy with numerous geographic variants. Common traits to all the variants are the tendency to form low cushion-like groupings, and sclerophyll behaviour often coupled to the presence of thorns. Hereby included are the extremely rare *Helichrysum aegyptiacum* communities from the rocks of Sardegna and Lampedusa, the *Sarcopoterium spinosum* formations from Sardegna and Puglia, and those dominated by *Genista* sp. pl., shared by Sardegna and nearby Corsica.

6 Natural and semi-natural grassland formations

The landscapes with herbaceous formations, be as they may grasslands or pasture lands, constitute one of the most relevant examples of coexistence and equilibrium between human activities and nature. Most of the environments among those with the highest plant biodiversity have in fact come to life following agropastoral activities; should such activities be brought to cessation, these habitats would progressively evolve toward their actual climaxes thus dropping out of existence. Similarly, in view of the possible variation of the climatic conditions in the direction of the Earth's warming, the herbaceous formations, especially those of the high mountain belt, would be the first to come under the menace of immediate decline and disappearance. The raising of the current limit of arboreal vegetation in fact would lead to the confinement of high prairies to ever shrinking areas. Among these

habitats there are some that look more 'fragile' than others for the very reason that their survival depends upon constant maintenance actions put up by man.

61 Natural grasslands

Among primary herbaceous formations particular relevance is bestowed upon those that proceed to the colonization of thin or recently deposited soils (6110*), both on limestone and on other basic substrates. Due to scarce water supply, these substrates may be occupied only by annual plants with a distinct pioneer character, or by a few *Crassulaceae*, such as *Sedum* sp. pl. and *Sempervivum* sp. pl., which can count upon special arrangements devised in view of water usage optimization. It is a priority habitat, represented by 144 SCIs all over the national territory, at an altitude ranging from the sea level up to around 2,000 m AMSL, as in the case of the Pollino massif.

A very particular case in Italy is that of the pioneer formations on soils rich in heavy metals (6130). Life here is only granted to species tolerating a high metal content, such as *Viola calaminaria*, and to local varieties of other more common *taxa*. The habitat is only represented by 6 Ligurian SCIs, at an altitude comprised between 500 and 1,300 m AMSL.

Much more frequent are the Alpine and sub Alpine grasslands, both on acid and calcareous substrates. The acidophilic herbaceous formations (6150) belong to the top sectors of the Alps and are rich in species and ranges of boreal and Alpine type. An important function of this habitat, represented by 43 SCIs, is also to allow for the expression of an exceptional biological diversity in terms of bryophyte and lichen flora. One of the most fascinating habitats by far (6170) is expressed on calcareous substrates, in 209 SCIs located on Alpine and Apennine mountains throughout Italy. At top altitudes, but frequently also on the lower glades, a vegetation is set out which is made, above others, of small hemicryptophytes and geophytes, clad in bright colours. To the harsh life conditions encountered both in wintertime, for the frost and scarce water supply in the liquid form, and in summertime, due to the high incidence of solar radiation and wind, the plants inhabiting these prairies oppose a strenuous resistance, out of precise morphophysiological adaptations and perfectly season-timed life rhythms. Many of these top altitude grasslands are still exploited as pasture land by man; in these cases their floristic composition, with regard to the livestock-induced mechanical strain and to the increase in organic substance, may undergo even marked simplification.

62 Semi-natural dry grasslands and scrubland facies

As already mentioned, a few landscapes have been in need of man's intervention to become established, and are still in need in order to keep on going. This is the case of secondary herbaceous formations, generally found along the sub-mountainous and low-mountain range, but sometimes also at lower altitudes. An all too important habitat in this category is the one referring to grasslands and scrubland facies on calcareous substrates (6210*). Throughout these dense formations, very rich in species, with their more or less mesophilous variants ascribable to the *Festuco-Brometea*, a truly integrated system for the conservation of biodiversity is implemented, with elements coming from both the sub-Mediterranean and from the subcontinental worlds. But the true importance of these 575 SCIs, at their various locations all over the national territory, mostly resides in the fact that they constitute optimal habitats for many orchids. Numerically consistent and well structured populations in fact make sure that a good-quality genetic interchange keeps going on within the species, which is an essential prerequisite for the *taxon* to maintain its high internal variability and hence its strong resistance to perturbing factors. At the same time these grasslands also play a significant role in the conservation of various Lepidoptera (among which the Swallowtail, *Papilio machaon*) and Neuroptera (among which the Mantis).

A rather similar vegetation type, but with more thermophilic tendencies, has a more southern distribution, and constitutes, with its 507 SCIs, the pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea* priority habitat (6220*). On poor, mostly calcareous soils various local variants of herbaceous formations develop, all exhibiting a high therophyte component. These areas, too, have often been used as pasture land, and, as is the case with the ones mentioned above, in the absence of a well-regulated pasture regimen, they may easily head toward impoverishment and simplification.

Still another priority habitat can develop on acid substrates, represented throughout Italy in 173 SCIs (6230*). On mountainous, and, in more continental areas, also sub-mountainous ranges, grasslands dominated by *Nardus stricta* settle in, which under normal conditions are very much diversified. Frequently, however, these expressions of biodiversity become subsided and simplified through excessive grazing. Mat grass then becomes totally dominant, as it is not sought after by the livestock. These habitats, just as any other forms of grassland, are in extreme need of grazing pressure regulation actions; nowadays, as most mountains have become depopulated,

ed, it is all the more necessary to avoid the indiscriminate and chaotic invasion of these environments by the cattle.

63 *Sclerophyllous grazed forests (dehesas)*

These are typical landscapes of the Iberian peninsula; in our country they are represented through 55 SCIs mainly distributed in southern Italy and in the major islands (6310). The habitat is formed by grazed or cultivated land, where the herbaceous vegetation develops under the heads of loose evergreen oaks' standings. Owing to the presence of small mammals and many insects, these environments are considered to be quite important for the life and reproduction of birds of prey.

64 *Semi-natural tall-herb humid meadows*

Throughout less arid contexts when in spatial proximity with still or running waterbodies, the soil manages to retain humidity over a variable period of time so that tall-herb meadows can develop. These landscapes, more frequent in the North, are found from the base to the mountain level, and come in a few different varieties, depending on the substrate, the climate and organic substance availability.

Communities dominated by *Molinia coerulea* (6410) settle on poor substrates, and, particularly on neutral or basic soils, manifest high levels of biodiversity and distinct season dependent dynamics. This habitat is present in 101 SCIs scattered throughout northern Italy. The Mediterranean climatic conditions typical of the central and southern sectors are responsible instead for a warm-humid environment, at the basis of the development of tall-herb communities, among which many *Poaceae* and *Juncaceae*, sometimes venturing as far as interdunal depressions (6420).

Increased water availability, often linked to the presence of lakes or rivers, allows for the settling of hydrophilous tall herb communities on the fringe of waterbodies or forests (6430). 377 SCIs, distributed all over Italy, are home to this habitat formed by tall or trailing herbaceous plants. Under normal conditions the communities are very rich in species and achieve great relevance in humid soil consolidation; in more extreme cases, however, a dystrophic situation may take over, consisting in an excessive accumulation of organic substance and subsequent ingression of nitrophilic species, up to their predominance.

65 *Mesophile grasslands*

As is often the case, the man-generated cultural landscape may offer novel cues for plant and animal biodiver-

sity conservation. The regularly mowed mesophile grasslands, both at low and at high altitudes, always offer unforgettable sights with their showy blossoming. The regular mowing activities to make hay, instead of interfering with the vegetation, promote the cyclic nature of interventions, so that even those species that would never have benefited from direct sunlight, due to the taller herbs towering above them, are allowed to come out in front. All of the mesophile grasslands, moreover, are fundamental environments for the life and reproduction of a great number of arthropods. The lowland hay meadows (6510) are represented by 111 SCIs distributed all over Italy, whereas the montane and subalpine hay meadows (6520) are found in 73 SCIs, many of which are located in northern Italy.

7 Raised bogs and mires and fens

The environments with permanent water supply possess very delicate dynamics, in which even minimal interferences are unfailingly met with irreversible deterioration. Among the most conspicuous cases are the bog, mire and spring environments. On the one side the delicate equilibrium that is supporting these sites, on the other side their progressive elimination for economic purposes, both mark them as among the most highly endangered in Italy.

71 *Sphagnum acid bogs*

The bogs are complex vegetation forms in which a delicate equilibrium allows for the accumulation of lignin by means of an incomplete decomposition of organic substances. The anoxia that is produced in a permanently flooded ground, in fact, enables only anaerobic organisms to perform their normal decomposition activities; but they are only capable of degrading the cellulose component of plant tissues. This results in a build-up of lignin layers that has come to be known as peat. The bogs, with respect to the substrate, to the organisms, and to the water dynamics, are distinguished into acid and alkaline bogs. The acid bogs, also known as raised or transition bogs, receive their supply from meteoric and layer waters, whereas into the basic or low bogs superficial waters flow, together with their debris.

The active raised bogs (7110*), typical of northern Italy, are rare and fascinating environments dominated by sphagnum, where various acidophilic spermatophytes can grow, such as *Ericaceae* and *Vacciniaceae*, together with various carnivore plants (genera *Drosera*, *Utricularia*). What makes a priority habitat out of them, represented in 300 SCIs over Italy, is its fragility and at the same time its importance in the conservation of many arthropods, among the others

arachnids, odonates, lepidoptera and orthopterans. Water canalization and river management have wiped out many bogs in the past, today used as pasture land. Raised bogs can withstand only short periods of inactivity, due to fires or particularly dry seasons, for example. In Italy only one case is known, the SCI Paluaccio di Oga near Bormio in Lombardia, in which a raised bog that was altered in the past is nowadays considered as susceptible of renewed activity (7120).

Again in northern Italy it is possible to come across the transition bogs (7140), with an intermediate dynamics between the raised and the low ones, at more than 100 SCIs. The water supply from a double origin, both meteoric and superficial, increases the organic substance content thus allowing for the colonization by aquatic spermatophytes typical of waterbodies, too. Rich sphagnum and moss communities coexist with the latter, and their organic remains are only partly converted into peat. The small depressions that do not join the permanently flooded areas with a single system are colonized by a pioneer vegetation dominated by *Rhynchospora* sp. pl., *Drosera* sp. pl., *Lycopodiella inundata* (7150). These habitats are only rarely reported in northern Italy (32 SCIs).

72 Calcareous fens

The flooded areas in alkaline environments can constitute particular surroundings for collecting water and sometimes even lakes proper, with the presence of *Cladium mariscus* and aquatic vegetation that can be assigned to *Caricion davallianae* (7210*). In 64 SCIs this priority habitat is represented in northern and central Italy, at various sites and altitudes.

When the calcium content rises even more, the water springs may bring forth phenomena of calcareous depositions from which travertines arise (7220*). These environments are represented in 66 SCIs distributed in the North and over peninsular Italy. They are very important priority habitats for the conservation of bryophytic communities and frequently they come directly in contact with cave and chasmophytic vegetation environments.

Low fens, through their external supply, also receive calcium which is dissolved in the incoming waters. Calcium then is likely to deposit in the form of travertines and a modest activity of peat deposition is likely to occur. As a result of the relations that these flooded areas entertain with the surroundings, the vegetation tends to be of a variable nature, according to the different geographical areas it develops into (7230). Only in 11 SCIs a form of pioneer vegetation of an Alpine sort is eventually represented, with a high component of small *Cyperaceae* and *Juncaceae* (7240*).

8 Rocky habitats and caves

Plants display incredible adaptations to the most prohibitive life conditions in terms of temperature, water availability, light. Among the most peculiar vegetation morphologies there are those that are characteristic of almost non-existent soil conditions, those that engage all plant structures, suspended in the void, into opposing resistance to the force of gravity, and those that are almost never reached by light.

81 Scree

Mountain screes host vegetation forms that are highly specialized to survive with extremely reduced soil amounts at their disposal. In Italy natural screes of siliceous nature found at montane to glacier levels (8110) are practically exclusive to the Alps; that very same typology of vegetation, rich in small spermatophytes, but also in ferns, bryophytes and lichens, is also found at lower levels, on rock debris of anthropogenic origin, such as coming from excavation or cave creation activities. Calcareous screes (8120), similar to the siliceous ones insofar as general vegetation aspect goes, differ from the latter in floristic composition and geographic distribution. In fact they are found in relevant numbers on the Alps, as well as in the topmost ranges of the Apennine mountains.

The warm montane slopes and the screes at the lower levels are home to plant formations however adapted to very thin soils (8130), thanks to vigorous root and rhizome systems, and which can also grow to remarkable sizes, as they are less conditioned by the action of top mountain winds (i.e. *Achnatherum calamagrostis*). One particular case is represented by Medio-European calcareous and calcareous-marly debris of hill and montane levels (8160*), a priority habitat found in 78 SCIs.

82 Rocky slopes with chasmophytic vegetation

Rupestrial environments present vegetation forms exhibiting adaptations similar to the ones of the screes, if possible even more extreme. In addition to the scantiness of the soil and to the scarceness of the water, the plants also have to overcome remarkable mechanical forces generated both by landslides and by the simple force of gravity. The rocks, coastal or inland, can have a calcareous or a siliceous nature. Both typologies are represented by a great number of geographical variants, with sizeable contingents of endemic species; the calcareous rocky slopes (8210) are found rather regularly from the base level to the high-montane, and are represented by 461 SCIs distributed all over

Italy. The siliceous rocky slopes (8220), instead, are found mainly inland throughout Italy, and are chiefly located along the Alpine arc, but they are also present at a few insular sites, with 158 SCIs. The first colonization phases of the siliceous rocks are particularly interesting. These environments, accounting for a habitat that stands on its own (8230), with 154 SCIs of central and northern Italy, are made of few groups of pioneer plants, especially bryophytes, lichens, and, among vascular plants, a few *Crassulaceae* (*Sedum* sp. pl., *Sempervivum* sp. pl.).

A particular formation, representing a priority habitat that has been reported for 84 SCIs, consists of the so said limestone pavements (8240*). These typologies are more characteristic of northern Europe than of our latitudes. They are made up of large calcareous blocks arranged in rather regular sets, and interspersed with likewise regularity by crevices where deep soil may align, so that it may be possible for the vegetation – even arboreal – to implement the settling of micro environments (genera *Fagus*, *Sorbus*, *Acer*, etc.) characteristic of humid climates, in contrast with the thin or absent soil layer that can be found on the blocks themselves.

83 Other rocky habitats

Rocky environments are all quite hard to colonize stably. A few of them are there, however, in which nature is truly put to the test, and in which life seems to be almost impossible, set aside, as it were, for ultra-specialized organisms. An example is furnished by cave environments. A particular community habitat, represented by 131 SCIs distributed all over Italy, is the one of caves not open to the public, which are only explored for study purposes (8310). In these environments only mosses and algae can live, as far as the plant component goes; for the animal, the caves represent habitats of great conservationist value: numerous endemic species are found among the invertebrates (crustaceans, coleopters, orthopterans, molluscs) and the vertebrates, especially the amphibians (genus *Proteus*). Moreover, the caves are hibernation resorts for Chiropterans.

The fields of lava and the natural volcanic excavations, which Italy is particularly endowed with, also offer a few examples of extreme life (8320): with 16 SCIs, this habitat describes very reduced communities of volcanos' summits, rich in lichens, above all.

In this grouping also come to be included both submerged or partially submerged sea caves (8330), only favourable to algal life and assigned to 21 SCIs, and permanent glaciers (8340), with 34 SCIs.

9 Forests

(Sub)natural forests dominated by indigenous species of more or less ancient implant (high forest), including the scrubs in the typical understory, meeting the following criteria: rare or residual, and/or characterized by the presence of community interest species

During the current interglacial period, the forests constitute the mature potential vegetation toward which many Italian zones spontaneously tend. Man, however, in his strutting upon the surface of the Earth, soon realized both how to exploit directly the materials coming out of the forests, and, above all, how to turn to his own advantage the usage of the territories on which the forests thrived. So he began to raise pastures for his own livestock, first at the expense of plain and low level forests, subsequently not sparing mountain forests either. This action has been so profound and prolonged over time, that nowadays it can be said that no primeval forests exist. Man, however, just as he has destroyed, has also been able, involuntarily perhaps, to allow for the recreation of structure and floristic composition of specific areas, which to a great extent may be said to be close reminders of the originals. Therefore, in spite of everything, Italy today still possesses magnificent forests, not only functioning as biodiversity reservoirs at all levels, but also fulfilling an unavoidable protective duty with respect to mountain slopes.

91 Forests of Temperate Europe

Forests of temperate Europe, described as part of the community habitats, are for the most part well represented over the Italian territory. Beech forests, oak forests, forests rich in maple and lime trees, all with high floristic diversity, are all distributed, with few exceptions, all over the Italian territory, with a great number of SCIs.

The Beech is without doubt in a privileged position. *Fagus sylvatica* in fact is a distinctly mesophile tree, with precise requirements in terms of humidity and temperature, but at the same time quite indifferent to the substrate, as long as the latter manages to provide it with a good water supply. If the soil is fertile and rich with humus, the Beech becomes so competitive that it tends to form pure standings, only conceding advantage to the other species in case of an unfavourable area. As a consequence of the Beech's versatility, Italy presents a wide range of beech forests, with different floristic compositions. Beech forests with conifers (*Abies alba*, *Picea abies*), typical of central Europe (9110), develop in northern Italy, on acid soils, with an acidophilic understory. Beech forests

on neutral soils, very rich in species, in particular rhizomatose geophytes such as *Cardamine* subg. *dentaria*, *Lamium galeobdolon*, *Anemone nemorosa* etc (9130), are widespread in the North, but also have some SCIs in the Center of Italy and others in the South. A few subalpine beech woods are exclusive to northern Italy instead (9140), where they are represented in 9 SCIs. They are rich in *Acer pseudoplatanus* and in herb species of nearby high level meadows. Instead, limestone beech forests with an understory rich in *Poaceae*, *Cyperaceae* and *Orchidaceae* (9150) and a more thermophilic character are rather well represented in Central and South Italy.

At modest altitudes pedunculate oak formations (*Quercus robur*), at times intermingled with other species such as *Carpinus betulus*, *Acer campestre*, *Tilia cordata*, which have a sub-atlantic character (9160 – 51 SCIs), or such as the Sessile oak (*Quercus petraea*), which has a sub-continental character (9170 – 8 SCIs), are found on highly impermeable soils.

Along escarpments, screes or deep valleys, where the build up of humus is partially hampered, the trees with high water demands cannot grow. In these environments a magnificent priority habitat is found, which is dominated by *Acer pseudoplatanus* in more fresh and humid surroundings, or by *Tilia platyphyllos* or *T. cordata* on more rugged morphologies and more arid contexts (9180*). In 119 SCIs distributed all the way from the North to the South these mixed and bright woods successfully colonize steep slopes with an extremely rich and valuable floristic parade, in which many arboreal species take part (including *Taxus baccata*, in specific contexts) and a lush understory.

On the sandy plains both of northern Italy and of a few zones of central Italy it is still possible to be present with fragments of the ancient plain forests that had to be dominant at one time in the swampy subcoastal environments connected to the rivers (9190). Represented only by 10 SCIs, these old acidophilous oak woods with *Quercus robur* can be admired, for example, inside the state owned forest of the Circeo National Park, where they also constitute a fundamental habitat for the life and reproduction of insects, freshwater macroinvertebrates and amphibians.

The thermophilous *Fraxinus angustifolia* formations, with the participation of thermophilous woods (91B0), present in 26 SCIs overall, are characteristic of Sicily, but are also scattered throughout the peninsula.

Forest formations strictly connected to bogs (91D0*) are represented in 28 SCIs, and are found throughout north-

ern Italy in very humid or flooded environments. They are dominated by conifers and are rich in acidophilous species and sphagnum. The functional tie they have with peat bogs makes these formations extremely important, so much so that they have been configured as priority habitats.

The riparian woodland has undergone heavy alterations over time, following the leveeing of many watercourses and the artificial embankments built along the banks. Natural forest vegetation instead assumes a very important role both in the consolidation of the banks and in the water balance of the river valleys. The most beautiful forests dominated by *Alnus glutinosa* and *Fraxinus excelsior* (91E0*) are represented in 280 SCIs located in northern Italy. Dense galleries with *Salix* sp.pl. are found inside them, together with tall-herb communities with *Carex* sp.pl. and many *Umbelliferae*, and just as many geophytes common to beech forests, too. Another typology, more open to other arboreal species, prevails in peninsular Italy, especially along large and medium size rivers, with the presence of the Pedunculate oak, *Ulmus* sp. pl., *Fraxinus excelsior* and *F. angustifolia*, *Populus* sp. pl. and a rich understory of geophytes and lianas (91F0* - 79 SCIs).

A borderline case of the temperate forest is represented by the downy-oak forests (*Quercus pubescens*), present in many zones throughout Italy, but more characteristic of the central regions (91H0*). This priority habitat, present in 77 SCIs, becomes established on thin calcareous soils and on southern slopes, displaying a slow growing rate. A rich quota of bushes and shrubs are associated with these formations, which are also frequently reached by the xerophilic herbaceous species of the glades and grasslands.

92 Mediterranean deciduous forests

A few beech forests may have a particularly thermophilic character, so that they become established in Mediterranean contexts. The two priority habitats describing Apenninic beech forests with *Taxus baccata* and *Ilex aquifolium* (9210*), present in 194 SCIs, and Apenninic beech forests with *Abies alba*, or *A. nebrodensis* – the Sicilian variant - (9220*), present in 66 SCIs, are suitable examples. As a consequence of the demise both the Yew and the Silver fir have been subjected to in the past, these forests have become a true rarity: they bear witness to the forest typologies with very high biodiversity that were once extended to many submontane and low-montane areas of the peninsula.

A very rare vegetation form just for biogeographic reasons is the *Quercus trojana* forest (9250); the semideciduous oak is typical of the Balkans, and of limited sectors of Puglia as far as Italy is concerned. Only represented by

6 SCIs, it forms pure standings at times, or is accompanied by elements of downy-oak or holm-oak forests.

The chestnut woods (9260) are typified to a much larger extent, with their 246 SCIs, having availed themselves of the cultivation activities that have always been directed at the chestnut, both as a source of wood and fruit. The interest presented by the chestnut forests is not confined to the presence of the chestnut itself, rather it extends to all those forms of relict vegetation, mostly oriental, connected to the chestnut woods, which often have not been completely wiped out by cultivation practices.

The *Quercus frainetto* woods (9280) are much rarer instead, reported for 20 SCIs in central Italy, and, in particular, superbly represented in Lazio at diverse zones, both subcoastal and inland; the former are directly related to those precious environments subtracted from the drainings that have been mentioned when examining other habitat typologies. While on the subject of wetlands, as regards the watercourses of Mediterranean setting, they are characterized by *Salix alba* and *Populus alba* dominated gallery formations (92A0), represented by 244 SCIs. They are multilayered arboreal and shrub riparian formations, looking like wild forests, with the participation of *Acer* sp. pl., *Ulmus* sp. pl., *Alnus* sp. pl., *Tamarix* sp. pl. and sizeable contingents of lianes. The *Platanus orientalis* relict formations (92C0) again are connected to the rivers, but they are extremely rare (12 SCIs exclusive to Sicilia); in the past they had to be more widely distributed, also on continental land. The watercourses of southern Italy and Sardegna, such as the torrents, present a gallery-like vegetation morphology, dominated by Tamarisks and Oleanders, with many other shrubs and lianes (92D0). This habitat typology is present in 66 SCIs.

93 Mediterranean sclerophyllous forests

The evergreen sclerophyllous forests are the most typical imprint of Mediterranean environments, even though in the past they have been almost completely wiped out by man. An example is furnished by the formations dominated by *Olea europaea* and *Ceratonia siliqua* (9320), present both along the coasts and inland in 79 SCIs, and another example is supplied by evergreen oak formations. The Tyrrhenian cork forests (9330 – 47 SCIs), once reaching regularly far into the inland, today only rarely manage to survive there. The Holm oak is certainly not a rare plant in Italy (9340 – 392 SCIs), especially by virtue of its ecological plasticity that allows it to grow on very steep land; yet the plain holm-oak forests have become very spare, which once had to be widespread over Mediter-

anean inland plains, and where they would, in many cases, still represent the climax vegetation form.

Species such as *Quercus macrolepis* (9350 – 3 SCIs) or *Ilex aquifolium* (9380 – 9 SCIs) present an altogether different picture; the former is limited in Italy to few areas of Puglia, the latter assumes an arborescent habitus so as to give rise to small relict forests confined to Sardegna and Sicilia, together with *Taxus baccata*. These cases in fact are issues of biogeographic and paleoclimatic rarity, practically independent from the action of man.

94 Temperate mountainous coniferous forests

Just as the evergreen sclerophyllous forests characterize the Mediterranean forest formations, in the same way the conifer formations constitute the unmistakable distinguishing mark of the alpine forests. In order to survive to the frost and to the edaphic aridity caused by the high mountain climate of the Alps it is no longer sufficient to discard the leaves in autumn as the Beech does; only the gymnosperms, with their rigid brachiblasts, are adequately adapted.

On the montane and alpine levels the typical spruce forests are established, where *Picea abies* is accompanied by the usual parade of just as acidophilous species (eg. *Vaccinium* sp. pl.) (9410 – 132 SCIs). Larch and swiss-pine forests are the highest growing forests on the Alps. Both *Larix decidua*, almost exclusive to the Alps, and *Pinus cembra*, which finds on the Alps the westward limit of a range that is nowadays quite restricted and disconnected up to Asia, are two very interesting biogeographic and ecological cases, deserving to be protected in the 121 SCIs present throughout Italy (9420). The communities dominated by *Pinus uncinata* instead are quite rare, only represented by 15 SCIs; they are forests, often reduced to scrubs, very open and bright, frequently filled by *P. sylvestris* formations, or by larch and swiss-pine woods, very rich in understory acidophilous species.

95 Mediterranean and Macaronesian mountainous coniferous forests

Forest formations with prevalent gymnosperms are met with in non alpine contexts along the peninsula, too. Almost always it is the case of relict-like formations both in biogeographic terms and as man's action survivors.

The magnificent silver-fir woods dominated by *Abies alba* (9510*), reported in 16 SCIs, constitute a clear example of a forest that was once widely distributed all over the Apennine range, and is nowadays confined to spare nuclei, especially in Center and South Italy.

The Mediterranean pine forests with endemic black pines (*Pinus nigra*) and akin species (9530*), such as *Pinus laricio* in Calabria, on dolomitic substrates, are represented by 38 SCIs, both alpine and apenninic.

The ancient pine forests with *Pinus pinea* characterize a wide portion of Italian suburban landscape, and are protected, through a single habitat category (9540 – 90 SCIs over all), together with the littoral pine forests dominated by *P. pinaster* and *P. halepensis* and with the extremely rare formations with *P. leucodermis* characteristic of the Pollino massif.

And finally the forest relict formations with junipers (9560* - 9 SCIs) and those with *Taxus baccata* and *Ilex aquifolium* that are found in Sardegna (9580* - 8 SCIs) are extremely rare.

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