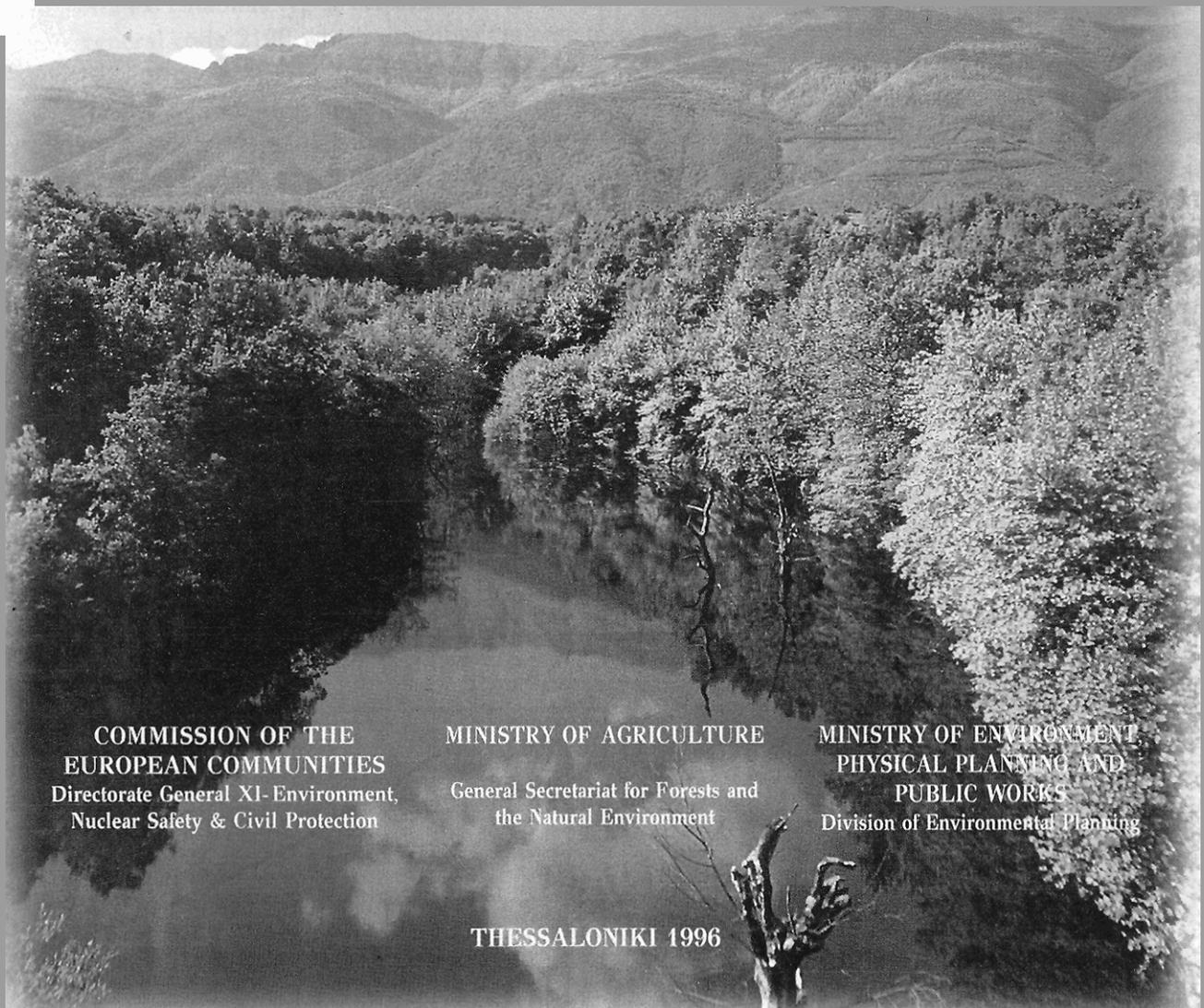




THE GOULANDRIS NATURAL HISTORY MUSEUM
GREEK BIOTOPE/WETLAND CENTRE

UNIVERSITY OF ATHENS - ARISTOTLE UNIVERSITY OF THESSALONIKI - UNIVERSITY OF PATRAS

Directive 92/43/EEC
THE GREEK HABITAT PROJECT
NATURA 2000: AN OVERVIEW



COMMISSION OF THE
EUROPEAN COMMUNITIES
Directorate General XI-Environment,
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C.2. HABITAT TYPES PRESENT IN GREECE

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C.2.1. Habitat types of Annex I to Directive 92/43/EEC

Data processing and analysis of the habitats of Greece was based on the information provided in the Standard Data Forms (SDFs), that is, the habitats of Annex I (field 3.1) and the overall habitat classes (field 4.1) for all 296 proposed sites distributed throughout Greece. These sites are representative of the natural environment in Greece. Limitations of data input in the database as well as the fact that several important habitats, found in Greece, are not included in the list of Annex I were taken into consideration during data interpretation. The Annex I habitat types occurring in Greece are 109 and correspond to 110 code numbers (the general code 2190 which describes "humid dune slacks" is represented in Greece by the special case of code 2195 "dune slack reedbeds and sedgebeds"). The habitat types were grouped to facilitate processing and interpretation of the voluminous data. The main idea was to have all ecologically relevant habitat types in one group so as to handle the data in a more efficient way, aiming to show the distribution of these types throughout Greece, the number of their occurrences, the area they cover and their relative importance.

Twenty five groups have been defined. The group numbers (1-25) and titles as well as the codes of the habitat types included within each group are shown in Table C.1; for practical reasons each habitat type has been assigned a *group code* as well. Certain groups consist of only one habitat type as in the cases of lagoons (habitat code 1150- group number 2) and sea cliffs (habitat code 1240 - group number 7), while others contain more, as for example group 13, which includes 12 habitat types.

TABLE C.1. Assignment of habitat types to habitat groups. The habitat types are assigned a group code and appear in ascending order of their occurrence within each group. Information on the area they cover is also provided. The asterisk (*) in column P indicates "priority habitat type".

Group No	Habitat Group Name	Group code	Habitat Code	P	No of records	Area (ha)
1	Marine	1.1	1110		29	6277
1	Marine	1.3	1130		32	10459
1	Marine	1.4	1140		32	17339
1	Marine	1.5	1160		35	26236
1	Marine	1.6	8330		38	2212

TABLE C.1. (continued)

Group No	Habitat Group Name	Group code	Habitat Code	P	No of records	Area (ha)
	Marine	1.2	1120	*	92	70548
2	Lagoons	2	1150	*	46	47274
3	Reefs	3	1170		62	10489
4	Salt marshes and salt pastures	4.1	1310		47	10317
4	Salt marshes and salt pastures	4.3	1420		57	24651
4	Salt marshes and salt pastures	4.2	1410		73	19536
5	Salt steeps	5.2	1520	*	3	117
5	Salt steeps	5.1	1510	*	9	1928
6	Shingle and sandy beaches & dunes	6.7	2230		1	0
6	Shingle and sand beaches & dunes	6.10	2270	*	3	294
6	Shingle and sand beaches & dunes	6.9	2260		4	2698
6	Shingle and sand beaches & dunes	6.5	2195		9	802
6	Shingle and sand beaches & dunes	6.6	2220		12	2086
6	Shingle and sand beaches & dunes	6.4	2130	*	12	2459
6	Shingle and sand beaches & dunes	6.8	2250	*	16	2012
6	Shingle and sand beaches & dunes	6.1	1210		46	4541
6	Shingle and sand beaches & dunes	6.2	2110		50	7300
6	Shingle and sand beaches & dunes	6.3	2120		56	7626
7	Sea cliffs	7	1240		73	14549
8	Running water	8.2	3240		1	584
8	Running water	8.1	3220		2	1140
8	Running water	8.3	3260		16	850
8	Running water	8.4	3280		16	16658
8	Running water	8.5	3290		86	9444
9	Standing water	9.1	3120		3	10736
9	Standing water	9.2	3140		18	1911
9	Standing water	9.3	3150		38	15102
9	Standing water	9.4	3170	*	48	4685
10	Bogs, calcareous fens	10.1	7110	*	2	848
10	Bogs, calcareous fens	10.3	7230		12	6112
10	Bogs, calcareous fens	10.2	7210	*	13	879
11	Riparian forests	11.2	91F0		7	2498
11	Riparian forests	11.1	91E0	*	22	6211
11	Riparian forests	11.3	92A0		59	15889
11	Riparian forests	11.5	92D0		90	21019
11	Riparian forests	11.4	92C0		100	22830
12	Phrygana	12.2	5331		12	4389

TABLE C.1. (continued)

Group No	Habitat Group Name	Group code	Habitat Code	P	No of records	Area (ha)
12	Phrygana	12.1	5320		12	5220
12	Phrygana	12.5	5430		12	28594
12	Phrygana	12.3	5332		26	25084
12	Phrygana	12.4	5420		152	245443
13	Matorral, maquis	13.12	9380		1	21
13	Matorral, maquis	13.9	5310		2	250
13	Matorral, maquis	13.6	5213		3	1808
13	Matorral, maquis	13.7	5214		4	734
13	Matorral, maquis	13.3	5210		6	3183
13	Matorral, maquis	13.8	5230	*	7	1360
13	Matorral, maquis	13.1	5110		10	5187
13	Matorral, maquis	13.2	5130		10	7252
13	Matorral, maquis	13.11	9320		31	24199
13	Matorral, maquis	13.4	5211		33	14615
13	Matorral, maquis	13.5	5212		39	19237
13	Matorral, maquis	13.10	6310		115	254448
14	Dry grassland	14.2	6210	*	1	38
14	Dry grassland	14.1	6110	*	5	2602
14	Dry grassland	14.4	6220	*	12	5464
14	Dry grassland	14.5	6230	*	12	14020
14	Dry grassland	14.3	6211	*	22	18323
15	Tall herb humid and mesophile grassland	15.2	6430		2	322
15	Tall herb humid and mesophile grassland	15.4	6510		2	323
15	Tall herb humid and mesophile grassland	15.3	6432		3	825
15	Tall herb humid and mesophile grassland	15.1	6420		21	5303
16	Alpine and sub-Alpine formations (grassland & heaths)	16.5	6175		2	3808
16	Alpine and sub-Alpine formations (grassland & heaths)	16.3	6170		3	3458
16	Alpine and sub-Alpine formations (grassland & heaths)	16.1	4060		6	4119
16	Alpine and sub-Alpine formations (grassland & heaths)	16.4	6173		35	56592
16	Alpine and sub-Alpine formations (grassland & heaths)	16.2	4090		41	116446
17	Deciduous forest	17.7	9180	*	1	174
17	Deciduous forest	17.6	9170		3	2438

TABLE C.1. (continued)

Group No	Habitat Group Name	Group code	Habitat Code	P	No of records	Area (ha)
17	Deciduous forest	17.4	9140		4	1695
17	Deciduous forest	17.8	91B0		5	1519
17	Deciduous forest	17.9	9250		6	4917
17	Deciduous forest	17.12	9310		7	309
17	Deciduous forest	17.5	9150		7	12335
17	Deciduous forest	17.2	9120		8	2782
17	Deciduous forest	17.13	9350		17	5016
17	Deciduous forest	17.3	9130		26	33000
17	Deciduous forest	17.10	9260		30	29556
17	Deciduous forest	17.1	9110		32	72403
17	Deciduous forest	17.11	9280		63	154450
18	Thermophilous coniferous forest	18	9540		68	137654
19	Montane coniferous forest	19.4	9562	*	1	389
19	Montane coniferous forest	19.6	9564	*	1	1112
19	Montane coniferous forest	19.7	9580	*	5	935
19	Montane coniferous forest	19.2	9290		11	15474
19	Montane coniferous forest	19.5	9563	*	15	4775
19	Montane coniferous forest	19.1	9270		33	53005
19	Montane coniferous forest	19.3	9536	*	48	76039
20	Montane and subalpine coniferous forest	20.2	9510	*	1	70
20	Montane and subalpine coniferous forest	20.1	9410		12	18279
21	Sclerophyllous evergreen woodland	21.2	9370	*	6	101
21	Sclerophyllous evergreen woodland	21.1	9340		29	27924
22	Calcareous and siliceous screes	22	8140		67	13733
23	Inland rocks	23.6	821A		5	3174
23	Inland rocks	23.9	8240	*	7	534
23	Inland rocks	23.1	821G		7	2742
23	Inland rocks	23.5	8219		10	2470
23	Inland rocks	23.7	8220		13	2488
23	Inland rocks	23.4	8218		14	6436
23	Inland rocks	23.8	8230		46	8605
23	Inland rocks	23.2	8216		46	12780
23	Inland rocks	23.3	8217		61	15686
24	Inland caves	24	8310		58	5330
25	Fields of lava	25	8320		5	2435

Prior to data analysis, we have considered necessary to present a brief description of most of these groups, pointing out the particular character and distinctive features of certain habitats, their distribution and the threats they face as well as to explain the context in which certain habitat codes have been used in this project. In addition, information is given about priority and unique habitat types (found only in one site). Where necessary, the relation of the habitat codes to the descriptions of the Corine Biotopes Manual 1991 (CBM) is mentioned. The analysis of the distribution of habitats in Greece was based on the division of Greece into 13 phytogeographical regions as defined in The Flora Hellenica project (Strid, 1991) (Table C.2).

TABLE C.2. Number of sites and area they cover per phytogeographical region in the Natura 2000 database. NE: North East, Pe: Peloponnisos, NC: North Central, StE: Sterea Ellas, WAe: West Aegean islands, KK: Kriti and Karpathos, SPi: Southern Pindos, NPi: Northern Pindos, IoI: Ionian islands, EAe: East Aegean islands, Cyc: Cyclades, EC: East Central, NAe: North Aegean islands (Strid 1991). The number of sites is given in two columns: the first includes the total number of sites registered in the database; from the second column, sites (SPA) included in larger proposed sites have been excluded. The numbers of the last column were based on this calculation.

Phytogeographical region	No of sites (+ SPA)	No of sites (- SPA)	Cover (ha)
NE	53	50	427616
Pe	44	44	429183
KK	37	35	306328
StE	31	28	350934
NC	26	25	358820
Cyc	21	21	99350
SPi	16	16	212114
IoI	15	15	156162
EAe	14	14	149503
NAe	13	13	101723
NPi	10	10	171893
WAe	8	8	308114
EC	7	6	98707

Groups 1, 2 & 3: Marine habitats, lagoons & reefs

All marine habitats are included in code 11 of CBM. The directive, does not practically use any ecological criterion to properly define the marine habitats as it does with other habitat types, such as freshwater habitats. Their finer division is considered necessary, since they are of great significance for Greece due to its long coastline.

The ecological criteria used in order to distinguish these habitat groups, (*group codes 1, 2, 3*; see Table C.1) were the substrate and the hydrodynamism, with the latter acting as a limiting factor for the development of plant species.

Habitat type 1110 describes the upper layer of sandy beaches exposed to high hydrodynamism. In these areas communities of the angiospermes *Zostera noltii* and *Cymodocea nodosa* replaces *Posidonia* beds. Invertebrate communities of sandy sublittoral (polychaetes) also grow. A typical example of this habitat is the bay of Laganas in Zakynthos. This habitat is threatened by tourism development. Its proximity to significant terrestrial habitats such as sand-dunes, imposes the effective protection of this habitat type.

Posidonia beds (code 1120) are a priority habitat type. This habitat is found in sandy areas of the sublittoral zone and is characterized by the occurrence of the angiosperm *Posidonia oceanica*. The habitat may expand over the whole sea bottom from a depth of 1 m (upper limit) down to 40 m (lower limit). In the enclosed gulfs, like Thermaikos and Saronikos, this depth never exceeds 25-30 m as a consequence of the reduced water clarity.

Posidonia oceanica is endemic to the Mediterranean Sea. In Greece, *Posidonia* beds are the most widespread habitat of the sublittoral zone. They occur all through the Greek seas, except for the estuaries of large rivers (Evros, Nestos, Strymon, Axios, Sperheios), the semi-enclosed gulfs receiving large rivers (Amvrakikos and Maliakos) and very polluted areas (Elefsina and Thessaloniki Bay). *Posidonia* beds are considered as a high water quality indicator species. Furthermore, they contribute to the stabilisation of coasts, in the sense natural vegetation cover protects soils from erosion. The major direct threats they face are due to human activities which restrict their vertical distribution. The presence of *Posidonia* beds is also indirectly affected by eutrophication, the major consequence of which is their restriction to deeper waters. The protection of *Posidonia* beds is expected to have a positive effect not only on the species itself but on the complex communities it forms.

Habitat type 1130 is found in or near the mouth of large rivers, in the ecotones between the fresh and marine water. In these areas, the angiosperms *Zostera noltii* and *Ruppia maritima*, being tolerant to the fluctuating water salinity, replace the more sensitive *Posidonia oceanica* and *Cymodocea nodosa*. This habitat type suffers from the main threats affecting the wetlands.

Habitat type 1140 corresponds to the upper layer of the communities formed in mudflats of low water movement. Typical formations are found in Amvrakikos and Kalloni gulfs, Thessaloniki bay, and Elefsina bay.

Priority habitat type 1150* occurs in places where freshwater meets sea water but the formation is well isolated from the sea. Lagoons are characterized by the presence of *Zostera noltii* and *Ruppia maritima*, both angiosperms. At the bottom of the lagoons many fish species are found such as *Sparus auratus*, *Dicentrarchus labrax* and also some very valuable commercial species like the shrimp *Penaeus kerathurus*. When lagoons tend to dry up, resistant chlorophytes develop.

Habitat type 1160 comprises submerged meadows of the angiosperm *Cymodocea nodosa*. This community is relevant to *Posidonia oceanica* beds but is less species rich. The meadows start to develop from a depth of 0.5 m down to 5-10 m. In the meadows, chlorophytes such as *Caulerpa prolifera* and the angiosperm *Halophila stipulacea* also develop in some places. These meadows suffer from human activities, due to the fact that they occur in natural harbours which were exploited to construct ports and industrial infrastructures nearby. In addition, their fish resources were overexploited. Still, there are areas such as Kalloni and Maliakos gulfs which host quite representative examples of this habitat type.

Habitat type 1170 refers to the rocky bottoms of the sublittoral zone, usually dominated by macroalgal communities of the photophilous *Cystoseira* species. Chlorophytes such as *Ulva*, *Enteromorpha*, *Cladophora* and *Chaetomorpha* grow in polluted areas. The presence of many rocky

islets and reefs in the seas of Greece offers adequate protection to these habitats. However, increasing sea transportation creates an extra threat.

Group 4: Salt marshes and salt meadows

Habitat type **1310** describes *Salicornia* and other annuals colonizing mud and sand. This habitat is characterized by periodic inundation and is found throughout Greece. Representative habitats have been recorded in the estuaries of Acheloos (StE), Spercheios (StE) and Evros (NE), in Limnos (EAe), and at the NE end of Kriti.

Habitat type **1410**, Mediterranean salt meadows (*Juncetalia maritimi*), refers to the vegetation zone surrounding lagoons or salt marshes and is mainly dominated by *Juncus maritimus*. This habitat occurs all over Greece and is representative at the estuaries of Nestos (NE) and Pineios (EC), at Porto Lagos lagoon, at Ismaris (Mitrikou) lake (NE), at Kalloni gulf (Lesvos), etc.

Mediterranean and thermo-Atlantic halophilous scrubs (*Arthrocnemetalia fruticosae*), habitat type **1420**, are found in salt marshes and around coastal wetlands in areas periodically flooded for long periods. The dominant vegetation is characterized by woody glassworts such as *Arthrocnemum perenne*, *Halocnemum strobilaceum*, and/or *Arthrocnemum fruticosum*. This habitat is distributed all over Greece; it is representative at Axios and Evros deltas, the lagoons of Agios Mamas, Keramoti (NE), the salt marsh Kitros (NC), Atalanti wetland (StE), Geropotamos estuary, Tigani lagoon (KK), Mikro and Megalo Livari lagoons (WAe), Mesolongi lagoons and Acheloos estuary (StE), etc.

Group 5: Salt steppes

The priority habitat type **1510** describes Mediterranean salt steppes (*Limonietalia*). This habitat covers large areas or borders of the dry parts of salt marshes or inland marshes that are subject to extreme dryness in summer and permeated by salt water in winter. It is not a common habitat. It has been found at the estuary of Evros (NE), Mesolongi lagoons and Acheloos estuary (StE), Chortarolimni in Limnos and Kalloni gulf in Lesvos (EAe), Kalogria lagoon and the salt marsh of Aigio (Pe), Makronisi islet near Kasos (KK), and Palionis and Avlimon lagoons (IoI).

Habitat code **1520***, defined in Annex I as «gypsum steppes», although it describes the *Gypsophiletalia* of the Iberian peninsula in the CBM, has been used in this project to describe steppes on gypsum soils; notably, the esparto (*Lygeum spartum*) steppes at the region with hotter and drier climate of SE Kriti (Koufonisi), and the *Lygeum* formations at the dry area south of Timbaki and at SW Kriti near Elafonisi.

Group 6: Shingle and sand beaches and dunes

Habitat code **2110** refers to the annual vegetation of drift lines, a habitat found on many narrow sand or shingle beaches or on the drift line of sand-dunes, distributed all over Greece. It consists of therophytic communities often halonitrophilous since they are subject to inundation by seawater thus enriched in decomposing marine organisms (mainly algae and marine phanerogams) and with organic or inorganic drift material. They are also subject to human influence.

The primary (embryonic) shifting dunes, code **2110**, are distributed all over Greece. They are low sandy or gritty ripples or ridges representing the first stages of dune development, or

cordons or the first lines of large dune formations. They are flat or have a more developed micro-relief and are colonized by perennial plant species; in Greece they are characterized by the association *Agropyretum mediterraneum*. They generally constitute an intermediate zone between habitat types 1210 and 2120 which are often absent from the Greek shores due to the lack of extended sand dunes.

Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes), code 2120, represent the best developed phase of the coastal unstable dunes created by the accumulation of wind-carried maritime sands. At seashores lacking a continuous supply of sand, these habitats are located exclusively at zones with adequate sand particle deposition. In the absence of this habitat type, non-vegetated beaches or low coastal zones at immediate contact to the stabilized dune habitats appear.

Dunes with *Ammophila arenaria* are found: in West Greece, with *Echinophoro-Ammophiletum arundinaceae* (recorded with excellent representativity in western Peloponnisos sites); in East Greece, Makedonia, the Aegean Islands and Kriti with *Medicagini-Ammophiletum* (with excellent representativity in the South Aegean Arc, the Milos island complex and in many sites on Kriti); and in Thraki with *Ammophilo-Elymetum gigantei* (typically in the site of Ptelea lagoon). The sandy habitats of the islands off southern Kriti in the Libyan Sea (Chrysi, Koufonisi, Gavdos and Gavdopoula) are of special importance.

Codes 2130*-2220 of Annex I describe the same habitat type (corresponding to the same code, 16.224, in CBM): fixed dunes with herbaceous vegetation (grey dunes) and dunes with *Euphorbia terracina*. These dunes generally develop behind the habitats with *Ammophila arundinacea* where the stabilization of sand dunes has been allowed under natural conditions.

These communities occur on the western coasts of Peloponnisos with *Silene nicaensis* (typical at the sand dunes of Zacharo) and on the coasts of Makedonia and Thraki with *Ephedra distachya*. Similar formations regarding their position, but with different species composition have been recorded in West and East Aegean islands, and the Cyclades (with representativity C or D). This habitat type should also include the herbaceous vegetation of inner dunes with *Artemisia campestris*, a shrubby perennial occurring in Makedonia and Thraki.

Malcolmietalia dune grasslands, code 2230, are open communities of semi-unstable sands belonging to the class of Malcolmietalia where therophytes are dominant. They occur in dry patches of sand dunes or at their borders, where sand particles are still suspended in the air, but at much smaller densities. This habitat is found in N. Greece and in the Northern Sporades and, as concerns the Natura 2000 sites, has been recorded only once, on Skiathos island.

Habitat code 2250*, a priority one, describes dune juniper thickets. This habitat type consists primarily of *Juniperus oxycedrus* ssp. *macrocarpa* stands and secondarily of *Juniperus phoenicea* stands. The *Juniperus oxycedrus* ssp. *macrocarpa* matorral is usually found in ecotones of dune habitats but also develops on rocky seashores which are gritty, friable, of sedimentary origin or even on sandy pavements; also on cliffs or gravel pavements. The formations of this habitat are very representative on the islets off the southern coast of Kriti and on Gavdos island, in the Cyclades and on the western coast of Peloponnisos. The communities of *Juniperus schweinforthii* found on Rodos and Karpathos are found in environments richer in salt.

The habitat of dune slack reedbeds and sedgebeds, code 2195, includes the small *Juncus* stands or small reedbeds developing on slacks behind dune formations at locations flooded with freshwater for periods longer than for the previous habitats. Typical communities have been recorded from a few sites in Kriti (northeastern end and Georgioupoli) and in salt marshes in the Aegean and Makedonia.

Habitat code 2260 describes dune sclerophyllous scrubs. Generally, dune systems in Greece are rarely wide enough to allow the development of sclerophyllous scrubs with good structure. This habitat type has been recorded in the Aegean but mostly characterized as just fairly or not representative as these habitats do not conform with the description given in Annex I.

The priority habitat type 2270* is analysed under group 18, habitat type 9540.

Group 7: Sea cliffs

This group consists of one habitat type (code 1240), which refers to vegetated sea cliffs on the Mediterranean coasts (with endemic *Limonium* spp.). The vegetation of the rocky shores and cliffs includes chasmophytes and aerohaline species and, in general, belongs to the class Crithmo-Limonietaea. This habitat, with variations, occurs all over the Greek coasts.

Group 9: Standing water

Habitat type 3170*, defined as Mediterranean temporary ponds, is a special case of 3120 (oligotrophic waters containing very few minerals of West Mediterranean sandy plains with *Isoetes*) and describes temporary, usually small to tiny ponds. Quite often only relicts of the old vegetation remain. They have been studied little, although they include species that have mainly west European or west Mediterranean distributions and they are rare in the east Mediterranean region and especially in Greece (some of them are legally protected, such as *Pilularia minuta*).

In Greece, these habitats are located in depressions on metamorphic crystalline (hard schists, gneiss etc.) or volcanic (lava, etc.) substrate. They are flooded by water during the winter and they drain gradually during spring. The soil is sandy or gritty.

Mediterranean temporary ponds have been recorded mainly from the sites of the Aegean and Kriti, but also in Peloponnisos and central Greece. Habitat type 3120 has been recorded in only 3 sites, with excellent representativity in the artificial lake of Kremasta and at the lakes Yliki and Paralimni (StE).

Group 10: Bogs and calcareous fens

Bogs and fens are represented in Greece by three habitat types: raised bogs (7110), alkaline (7230), and calcareous (7210) fens. They are mostly unstable habitats thus requiring special protection; they are priority habitat types in Annex I. Alkaline fens are daval sedge fen communities usually at high altitudes. They were recorded on the mountains of Makedonia, most representative on Pindos range (Smolikas, Agrafa, Aspropotamos mountains), with excellent structure and high value in most cases. Calcareous fen beds with *Cladium mariscus* and *Carex davalliana* are usually found at lowland areas of lakes and lagoons. This habitat type was recorded in central and southern Greece with excellent representativity at Kourmas lake and Fasas valley (KK), Kalodiki marsh (SPi) and Kaiafa lake (Pe). Active bogs were recorded in only two sites, Voras mountain (NV) and Elatia mountain (NE). Although the area they cover is small, these two stations are of scientific interest since they represent the southern distribution limit of a typically northern habitat type. However, the vulnerability of bogs is mainly due to their small size.

Group 12: Phrygana

Phrygana is the most typical low shrubby vegetation in Greece. They are dominant in areas with dry Mediterranean climate. The shrubs are usually thorny or aromatic exhibiting seasonal dimorphism. They represent approximately 15% of the terrestrial ecosystems of Greece and they are mainly found in Attiki, Evvoia, SE Peloponnisos and the Aegean islands. Some thickets may be found in other areas of the country up to an altitude of 800 m.

The most common plant species participating in the phryganic formations are *Sarcopoterium spinosum*, *Coridothymus capitatus*, *Cistus* spp., *Phlomis fruticosa*, *Genista acanthoclada*, *Erica* spp., *Euphorbia* spp., *Satureja thymbra*, *Salvia* spp., *Ballota* spp., etc.

Five Annex I habitat types have been assigned to the phrygana group:

- habitat type 5420, which expresses the typical, most widespread phrygana communities of the Aegean, where the dominant species are *Sarcopoterium spinosum*, *Coridothymus capitatus*, *Genista acanthoclada*, and *Cistus* spp.
- habitat types 5320 and 5331, where *Euphorbia* spp. are dominant
- habitat type 5430 occurring on hilly and mountainous areas of Kriti with some endemic species such as *Verbascum spinosum* and *Berberis cretica*; this habitat occurs solely in Kriti.
- habitat type 5332, described in Annex I as «diss-dominated garrigues». was used to describe low -not exceeding 1 m-, sparsely covered *Quercus coccifera* garrigue (not including the species *Ampelodesmosus*). This does not conform exactly with the corresponding description of this code in CBM; however no code was assigned to this habitat type which constitutes an element of many Greek natural ecosystems.

Pure phryganic stands with *Euphorbia dendroides* are found in Peloponnisos, Sterea Ellas and the Ionian islands. Low grazed *Quercus* formations are found in Kriti, Sterea Ellas and the Cyclades.

The group of phrygana covers 9.7% of the overall surface of the proposed sites. The group's highest cover (40%) is in Kriti and Karpathos (KK), while this phytogeographic region represents only 10% of the overall sites area. Typical phryganic formations (habitat type 5420) are encountered in half of the sites and they constitute approximately 80% of the total phryganic formations. The most representative habitats, with high floristic diversity and cover, are found on the Aegean islands and in Sterea Ellas, while the phrygana of Kriti have a less diverse floristic composition and lower plant cover.

Group 13: Matorral and maquis

The other typical shrubby formation of the densely arranged low and sub-mountainous areas of Greece is the maquis (matorral), which consists of densely arranged evergreen sclerophyllous shrubs, taller than 1.5 m. They constitute 25% of the terrestrial ecosystems in Greece and they can be found over a great variety of soil types up to an altitude of 800 m. Their main domain is in the mainland, the islands of the Aegean and the Ionian Sea. The dominant plant species are *Quercus coccifera*, *Pistacia lentiscus*, *Ceratonia siliqua*, *Olea europea* var. *sylvestris*, *Arbutus unedo* and *A. andrachne*, *Erica arborea*, etc. In several sites they constitute the latest successional stage of the plant communities, especially under dry climatic conditions.

Habitat group 13 includes the habitat types 5211-5215 and 5130 for *Juniperus* formations, 5230* and 5310 for matorrals with laurels, and 5110 for matorral with *Buxus sempervirens* (these box-thickets occur only in northern Greece), mainly on serpentine rocks as

well as on calcareous-dolomitic rocky substrates, where they represent degraded stages of former extensive *Pinus nigra* ssp. *pallasiana* forests. The habitat type 9320 (which corresponds to forests in CBM) has also been included in this group, describing olive-carob (*Oleo-Ceratonion*) matorral, which is the form in which this habitat usually occurs in Greece. Habitat code 6310 has been used to describe *Quercus coccifera* and *Q. ilex* grazed arborescent matorral, or ungrazed *Q. coccifera* matorral, although this does not conform exactly with the corresponding description of the code in CBM. This habitat has not been assigned a code in the Annex, although it is one of the main formations of the Greek wildland. It should be noted that codes 9320 and 6310 have also been used to describe forests, as mentioned below (group 20).

Maquis constitute 9% of the overall surface area of the selected sites. Grazed *Quercus* formations are found in 1/3 of the sites and they represent 75% of the total surface covered by maquis. *Juniperus* matorrals (15% of the area covered by maquis) are distinguished in two types: that of the thermophilous matorral with *J. phoenicea* and *J. oxycedrus* ssp. *macrocarpa* found on the Aegean islands (very representative on Koufonisi and Gavdos off the eastern coasts of Kriti as well as on the rocky islets of the south Aegean arc) and Southern Greece, and secondly that of Northern and Southern Greece with *J. communis*, *J. excelsa* and *J. foetidissima*.

Habitat type 5230* that corresponds to the laurel maquis, covers only a limited area (this habitat is representative in Fre, north of Lefka Ori in Kriti).

Conservation of the habitat types of this group mainly depends on the grazing pressure they are subject to and on their resistance to this pressure. As an example of the habitats showing low resistance to grazing, we may consider the rare dense arborescent juniper thickets growing on sandy soils and dunes, such as those occurring on Gavdos and Chrysi. These habitat types are in imminent danger mainly due to the increase in tourism activities. Among the major threats that maquis face, we should mention continuous tree felling and land use changes.

Group 17: Deciduous forests

Broad-leaved deciduous forests cover approximately 30% of the forests of Greece (First National Survey of Forest Species 1992). They mainly occur in the vegetation zones of *Quercetalia pubescentis* (especially in *Quercion confertae*) and *Fagetalia* and they comprise xerophilous and hydrophilous forest ecosystems. The dominant types in Greece are beech (5%) and oak (22%) forests, while chestnut woods, distributed throughout Greece, cover only 0.5% and birch forests 0.02%. The floristic composition of these forests also includes other deciduous species such as ash, hornbeam, lime and elm, as well as sclerophyllous species such as junipers.

- **Beech (*Fagus*) forests** occur in many areas of Northern and Central Greece (*Fagus moesiaca* f. *tainiolepis* in the mainland of Greece above 1000 m, and intermediate forms with the subspecies *orientalis*, often called *Fagus moesiaca* f. *spatulolepis*, below 1000 m). Their distribution is fragmented and they occur on NNE and NW-exposures, mostly on calcareous and siliceous rocks. Their structure and species composition vary depending on the altitude, age, human influence, management, etc.

Pure *Fagus* forests in Natura 2000 sites cover 59% of the beech forests of Greece and include three habitat types. Acidophilous (*Luzulo-Fagetum*) beech forests, code 9110, have excellent representativity in the phytogeographical regions EC (Ossa, Pilio), NE (Pangaio, Ori Vrontous-Lailias, Treis Vryses), NC (Vernon, Vermio, Pieria), and SPi (Valia-Kalda,

Aspropotamos). Neutrophilous (Asperulo-Fagetum) beech forests, code 9130, were recorded mainly in northern and central Makedonia and Thessalia. Calcareous beech forests (Cephalanthero-Fagion), code 9150, were only recorded in the phytogeographical region NC, having the highest "global assessment" values on the mountains of Olympos and Tzena.

Mixed *Fagus* forests with *Ilex* sp. and *Taxus* sp., code 9120, and subalpine beech woods with *Acer pseudoplatanus* (sycamore) and *Rumex arifolius*, code 9140, cover small areas mainly in Makedonia, the latter being representative on the mountains Vermio and Pieria.

Beech forests have suffered from inappropriate management, i.e. over-exploitation, overgrazing, which has resulted in degradation of their structure and regeneration ability. An appropriate management, encouraging natural regeneration of the aged clumps and aiming at forest restoration, is necessary and falls within the priorities of the Natura 2000 Network.

- **Oak (*Quercus*) forests** are found at intermediate altitudes on the Greek mountains and are distributed in continuous zones. They form either pure or mixed forests with representative species composition. In Natura 2000 sites they have been included in five habitat types and cover 168,708 ha (11.5 % of total cover in Greece).

Quercus frainetto, code 9280, is the main oak wood species found in Greece. It constitutes 94.5% of oak forests in Natura 2000 sites, with its largest cover in Ipeiros, Makedonia, Thessalia and smallest cover in Sterea Ellas and Peloponnisos. *Quercus pubescens* and *Q. cerris* often participate in the floristic composition of these forests, as well as other deciduous species. The vigour of these forests depends mainly on the topography and relief of the area, the substrate, inclination, accessibility, distance from urban areas etc. *Q. dalechampii* forests rich in lime, code 9170, also occur in mainland Greece, and were only recorded in three sites, with excellent "global assessment" value on Mount Ossa and greatest cover on Smolikas.

Quercus macrolepis forests, code 9350, occurring within the Thermo- and Meso-Mediterranean vegetation zones, were recorded mainly in the Aegean region (Cyc, EAe, KK), but also on the mainland. They are in need of protection since their general condition is problematic.

Another two oak forest habitats deserve special attention since they have a very restricted distribution and vulnerable structure combined with poor management practice. *Quercus trojana* woods, code 9250, were recorded in 6 sites in northern Greece, with excellent (A) representativity, conservation and global value and greatest cover in Prespes (NC). Forests of *Q. brachyphylla* (currently included in *Q. pubescens* ssp. *pubescens*), code 9310, were recorded mainly in Kriti (Prassiano farangi, Drapano-Kourna).

- **Chestnut (*Castanea sativa*) woods**, code 9260, grow in the zone of deciduous oak forests forming dispersed clumps or vegetation 'islands'. They are native in Greece, consisting of resprouting or seed regenerating individuals and possess a special structure especially when they form pure forests. Representative chestnut woods with excellent "global assessment" value occur in the phytogeographical regions EC (Ossa, Pilio, Mavrovouni), NC (Vermio), NE (Athos, Stratonikon), WAe (Dirfys), EAe (Lesvos), Pe (Parnon), KK (Topolia-Sasalos-Agios Dikaios). Apart from the typical pure woods, mixed stands form with various broad-leaved species such as lime and ash (Tilio-Castanetum) in cool ravines and valleys, or oak (*Q. cerris*) at higher and colder stations (Castaneto-Quercetum *cerris*). Tree, bush and herb species, commonly found in oak forests, may also be found among the chestnut woods.

- **Tilio-Acerion** ravine forests (sycamore-lime-ash-elm forests), code 9180, have been recorded only on Mt. Olympos, covering a small area of 170 ha.

Group 18: Thermophilous coniferous forests

This habitat group includes code 9540, a habitat type which, in the context of the Directive 92/43/EEC, Annex I is described as «Mediterranean pine forests with endemic Mediterranean pines, including *Pinus mugo* and *Pinus leucodermis*», is represented in Greece by the three following natural forests: *Pinus halepensis*, *P. brutia* and *P. pinea* forests.

- The *Pinus halepensis* (Aleppo pine) forests are widely distributed on the Ionian islands, the western coasts of Ipeiros, the regions of Thessalia, Attiki, NW and NE Peloponnisos, central continental Greece, the islands of Evvoia and Skyros, the Chalkidiki peninsula and the Northern Sporades islands. They are generally well-structured forests of high aesthetic value. These thermophilous conifer forests occur on a great variety of geological substrata and soil types (marls, soft and hard limestones, serpentines, sandy soils), although they exhibit a special preference for certain substrates (e.g. marly limestones) where they show their optimum development. The altitudinal distribution limits range between 0-600(800) m, depending on latitude, exposure and other physiographic factors, subsequently incorporated in the Thermo- but also the Meso-Mediterranean vegetation zones.

- The *Pinus brutia* forests are distributed to the east of the Aleppo pine forests; specifically, in the prefecture of Evros, on the Northern and Eastern Aegean islands (mainly on Lesvos, Samos, Chios, Thassos, Rhodos, Samothraki, and Karpathos), as well as on some of the Dodekanisa islands (Symi, Kos, Leros, Icaria). In comparison with the Aleppo pine forests, they comprise taller, more luxuriant and often extensive formations.

- The *Pinus pinea* forests are characterized by limited occurrence (in the form of extensive forests), in the following areas of Greece: Strofilia area in Peloponnisos, Skiathos island in the Northern Sporades, and Northern Sithonia in the Chalkidiki peninsula of Northern Greece. More sporadically or sometimes as isolated individuals, *Pinus pinea* is distributed on Kriti, in Attiki, Mount Athos in the Chalkidiki peninsula, and the islands of Lesvos, Ios, Naxos, Rhodos, Samos, Kefallinia, Kerkyra, etc. It mainly occurs in littoral areas and its altitudinal distribution ranges from 0 to 300 m a.s.l., within the Thermo- and Meso- Mediterranean vegetation zones. Habitat type 2270*, *P. pinea* forests on sand dunes, has been recorded only in three sites: the coastal areas of Kantili and Koukounaries Skiathou (WAe) and Schinias (StE). In the last two sites, the small forests are fairly degraded.

Group 19: Montane coniferous forests

This habitat group, as defined here, includes a great variety of habitat types either occurring in various phytogeographical regions of Greece or with limited occurrence in one phytogeographical region. These habitat types are represented by the following Natura 2000 codes: 9270 (Hellenic beech forests with *Abies borisii-regis*), 9290 (Cypress forests of *Acero-Cupression*), 9536 (Pallas pine forests), 9562 (Greek juniper woods with *Juniperus excelsa*), 9563 (*Juniperus foetidissima* woods), 9564 (*Juniperus drupacea* woods) and 9580 (*Taxus baccata* woods).

- The forests with *Fagus moesiaca* in combination with forests of *Abies borisii-regis*, are widely distributed in Central and Northern Greece either as pure forests or as mixed forests of these two ecologically significant species. It should be noted that code 9270 has also been used to describe pure *A. borisii-regis* forests, for which no separate code is assigned neither in Annex I nor in the CBM. The beech forests (pure *Fagus* forests are referenced in detail under group 7) are widespread on the mountains of Northern and Central Greece, generally in the altitudinal zone between c. 800 and 1800 m extending southwards to Mt. Oxia in Sterea Ellas.

They are distributed from the Supra- to the Mountain- Mediterranean vegetation zones even up to the Mountain Central-European vegetation zone on the high mountains of Northern Greece and close to the country's borders. Moving further to the north, the floristic composition of these forests exhibits a Medio-European character. The most characteristic beech forests of the above-mentioned habitat type, with great coverage in the proposed sites, occur on the following mountains: Central and Southern Pindos, Smolikas, Grammos, Hasia and Olympos. The forests with *Abies borisii-regis* of this habitat type belonging to the Fagion hellenicum alliance, are mainly distributed on the Southern and Central Pindos mountains as well as partly on the Northern Pindos mountains growing within the Supra- and the Mountain-Mediterranean vegetation zones. Moreover, the *Abies borisii-regis* forests, ascribed, from a phytosociological point of view, at different high-rank syntaxa, are distributed in the mountainous areas of East Central, North Central and North Eastern Greece. Their altitudinal distribution ranges between 600 and 2000 m.

- The Cretan forests dominated by *Cupressus sempervirens* and *Acer sempervirens* and locally by *Zelkova abelicea*, are distributed within the altitudinal limits of the Supra- and Mountain- Mediterranean vegetation zones (1200-1700 m). The associations recognised within the alliance *Acero sempervirens-Cupressetum sempervirentis* are climatic mature stages occurring on limestones, schists and marls, generally on rather deep soils. From a bioclimatic point of view, these forests are present in the interior of the sub-humid and humid bioclimatic zone on the northern and southern slopes of the mountains of Kriti.

- The *Pinus nigra ssp. pallasiana* forests in combination with the *Abies cephalonica* (Greek fir) forests, constitute the dominant montane coniferous vegetation in Southern and Central Greece and cover about 25% of the total area of the Greek forests. As it concerns the total distribution of *Pinus nigra ssp. pallasiana* in Greece, it occurs on the high mountains of Peloponnisos, in Sterea Ellas, S and N Pindos, NC and NE Greece, as well as on the Aegean islands of Samos, Lesbos and Thasos. The Pallas pine forests either form pure or mixed forests with the Greek fir when these two species coexist in a small number of sites, e.g. Mts. Killini, Chelmos, Taygetos, Parnon, Olympos, Athos, etc. The altitudinal limits range from 600 to 2150 m (upper limits of the Meso- to the upper limits of the Montane- Mediterranean vegetation zones), on limestones, dolomites and serpentines.

- The *Juniperus excelsa* woods ascribed to the plant association *Juniperetum excelsae* belong to the alliance *Ostryo-Carpinion*, and are characterised by their unique occurrence around Lake Prespa within the site "Ethnikos Drymos Prespon". These woods form either pure or mixed formations (with various forest species of which *Quercus trojana* is the main co-dominant) to the zone around the lake, up to an altitude of 1000-1100 m and locally higher. A differentiation in the floristic composition of these woods is observed according to slope exposure (northern and southern slopes) which is also obvious on the basis of their physiognomy. These forests, unique in Greece, are distributed within the Meso- and Supra-Mediterranean vegetation zones, and cover only a relatively small surface area of the site (2% of its delimited surface which comes to 19,470 ha). They are considered very representative as it concerns their structure. Their elements are well conserved, thus even the small degraded woods have a high potential for restoration.

- The *Juniperus foetidissima* woodlands are distributed in various mountainous areas throughout most of the phytogeographical regions of Greece (Peloponnisos, Sterea Ellas, Southern Pindos, Northern Pindos, North Central, North East Greece, and the Aegean islands), at altitudes between 800 and 2300 m. This habitat type participates in the vegetation mosaic of the Supra-, the Mountain-, and the Oro- Mediterranean vegetation zones all over Greece, at the

same altitudinal levels as the montane coniferous forests or the deciduous oak forests. They generally grow on superficial eroded soils which originate from various types of limestone substrata. The main threats come from grazing, and especially cutting for firewood.

- The *Juniperus drupacea* woods occur exclusively on the northern slopes of Mount Parnon in Greece on calcareous rocky substrates, at altitudes 550 - 1300 m, i.e. from the Meso- to the Supra- Mediterranean vegetation zone. These ecologically significant open stands have a disjunct, phytogeographically interesting distribution range, since their main distribution is mainly in the East (Anatolia on the Taurus mountain range, Syria and Lebanon), and they possess a high ecological value which must be maintained through sustainable management practices.

Group 20: Montane and subalpine coniferous forests

Abies alba and *Picea excelsa* (code 9510*, a priority habitat type) are important north European forest species, represented in northern Greece by stands at their temperature limit. This habitat type has been recorded only once in Elatia (Rodopi), with representativity "D" (not the typical natural habitat as described in Annex I).

The acidophilous forests (Vaccinio-Picetea) with *Picea abies* (code 9410) constitute more typical montane and subalpine coniferous forests. This habitat type has also been used to describe the birch and *Pinus peuce* forests, species found in Makedonia at their temperature limit. Extensive forests with excellent structure are formed on the eastern side of Rodopi ridge, especially at Elatia, Chaidou, Frakto as well as on other mountains of Makedonia (Orvilos, Voras, Tzena, Paiko).

Group 21: Sclerophyllous evergreen woodland

The Mediterranean sclerophyllous forests occupy areas with Mediterranean climate in Western and Northern Greece, from 0 to 700 m and from 0 to 1000 m in Kriti. They are considered as the mature stage of succession in the Meso-Mediterranean vegetation zone.

The group includes the habitat types 9340, for *Quercus ilex* forests and arborescent matorral, and 9370* for palm forests with *Phoenix theophrastii*. The habitat type 6310 has been used for the description of the kermes oak forests of Kriti; however, a special code should be foreseen for the description of those particular *Quercus coccifera* formations of Southern Greece. Also, code 9320 has been used for the rather rare olive-carob woodland.

This habitat group covers 2.1% of the overall area of the proposed sites. *Quercus ilex* forests are found in most phytogeographic regions of Greece, though with a small cover. *Quercus coccifera* forests are frequent in Kriti (recorded on Dikti, Lefka Ori, Asfendou-Kallikkratis) and Peloponnisos.

Palm groves are found exclusively on Kriti, with the thickest populations in Vai and Kourtaliotiko gorge, where they face a major threat from increasing tourism activities and unwise groundwater management.

Groups 22 & 23: Balkan screes & Inland rocks - Group 25: Fields of lava

Inland rocks with typical chasmophytic vegetation and screes constitute habitat groups found throughout Greece: at the plains and the sub-montane zone of the continental region and of the islands, at the montane zone of continental Greece, and on the vertical cliffs of the islands. The substrate is usually limestone but there are also serpentine rocks and screes. The

plant communities colonizing the rock fissures and the steep, almost vertical, slopes present great diversity and are extremely rich in endemics, both in the continental mountainous zone and in the Aegean. The screes are also rich in endemic plant species.

The habitat types of the inland rocks group included in Annex I have been identified by: (a) geographical criteria, with the corresponding plant associations in most cases: 8216 for the cliffs of the Mediterranean continental zone, 8217 for the Aegean region, 8218, 8219 and 8219A for the montane zone of Southern, Central and Northern Greece, respectively; or (b) ecological criteria: 8230 for the pioneer vegetation of rock surfaces with *Sedum* spp. (this does not conform with the corresponding plant communities description in the CBM), 8210 and 8220 for the calcareous and siliceous subtypes, respectively, and 8240 for the limestone pavements.

The inland rocks group covers 1.7% of the total surface area of the proposed sites and has been recorded mainly in Southern Greece and the Aegean, with fewer records in the Ionian, Macedonia and Thraki and North Aegean. The Aegean cliffs (8217), recorded in 61 sites, have the most important occurrence and the largest cover (28%). The Eu-Mediterranean cliffs (8216) and the pioneer vegetation of rock surfaces (8230) have also been recorded in many sites (46), covering 23% and 16% of the group's total percentage respectively. Notably, type 8230 occurs mainly in the Cyclades and Kriti. The priority habitat type 8240 is rare and found only at the subdivisions of Kriti, the Cyclades, Peloponnisos and Sterea Ellas.

The screes, both calcareous and siliceous are described by code 8140, which in the CBM describes screes of high altitudes of mainland Greece and Kriti. Especially for the Aegean islands, this code has been used to describe screes of low altitude with predominantly annual plants and some perennials. Their presence is more prominent in the Cyclades and in Kriti (the distinguished screes of Karpathos and of the Cretan mountains). Representative screes with characteristic plant communities and large cover have been recorded from Peloponnisos (Taygetos, Kyllini), Sterea Ellas (Oiti), Pindos (Aspropotamos), and North Central Greece (Olympos, Siniatsiko).

Group 25 includes habitat type 8320 which is defined in Annex I as «fields of lava and natural excavations» and the corresponding description in CBM does not include the volcanic features occurring in Greece. Consequently, the code has been used to describe habitats on substrate of volcanic origin (barren lava fields etc.) occurring in the Cyclades island complex (Milos, Santorini) and the East Aegean (Nisyros and Strongyli).

C.2.2. Habitat types not included in Annex I to Directive 92/43/EEC

In order to complete the reference to the habitats which are considered essential to the conservation of biodiversity and have guided the selection of the proposed sites we will refer to certain habitats that are considered important in the natural landscapes of Greece, but nevertheless are not included in Annex I.

Coastal sand, shingle and rock habitats

- I. The embryonic dunes with *Ipomoea stolonifera* and *Elymus farctus* are rare in Greece and Europe and are only found on the islands of Rhodos and Samos although they are well developed mainly in the Middle East.

- II. The unique community with *Limoniastrum monopetalum* and *Zygophyllum album* on stabilized dunes immediately neighbouring the sea; this habitat occurs on the dunes of the small islets of the Libyan Sea (Chrysi, Koufonisi).
- III. The habitat formed by the postdunal communities of *Centauera spinosa*, which often develop on sandy seashores as autonomous communities accompanied by phryganic and ammophilous species, is typical in the Aegean Sea.
- IV. The habitat that develops on the rocky coasts of Dodekanisa and Kriti and is characterised by woody aérohaline, almost phryganic, communities dominated by the spiny *Cichorium spinosum*.

Karstic dolines with freshwater communities

A special habitat type, not included in Annex I, is the one of the wet dolines of the mountains of Kriti (Lefka Ori, Idi, Dikti). They are characterized by scanty vegetation of annuals common in other places but rare on Kriti or in Greece, such as the vegetation with *Trifolium ornithopodioides*, a species which in Greece, occurs only on Kriti.

Reed beds

The water-fringe vegetation which develops in fresh as well as in brackish waters and consists of hydrophytes and helophytes, is represented by the class Phragmitetea and occurs in the wetlands of mainland Greece. This vegetation is interesting from a floristic and an ecological point of view. The dominant species is *Phragmites australis* (*P. communis*), forming compact, mixed (e.g., with *Scirpus* sp. or *Typha* sp.) or pure communities known as reed beds («kalamones»). A common feature of almost all the studied plant communities is the low species number.

Reed beds grow in the shallow waters of lakes, lagoons and canals. They are also found on the seashore, on turfs mainly on the wet sides of sand dunes, and at the mouth of rivers, as well as in marshes close to the sea with brackish waters of low salinity. Finally, they occur in wet and shady locations of watercourses (streams and rivers).

According to our observations, these formations reach their optimum development in the shallow waters and marshes of the lakes Vistonis and Ismaris (Mitrikou), as well as in the estuaries of the rivers Nestos and Strymonas. On the other hand, in the lagoons of NE Greece and at other wetlands, only small turfs form when conditions are favourable. In Kriti, reed beds are generally species poor and not well developed. They are restricted to lowland plains, especially at river mouths.

Maritime brackish reed beds, growing at the borders of salt marshes or covering large areas (reedmace beds with dryness and pollution tolerant species), are of special interest. They occur at Amvrakikos gulf, Kalamas delta (SPi), Messolongi lagoon, Spercheios delta (StE), Axios and Evros deltas (NE), Kotychi lagoon and Strophilia (Pe).

Although Annex I includes only one type of reed beds, i.e. those growing on dune slacks (code 2195), we consider the conservation of this habitat, which is closely related to other Annex I habitats such as lagoons, deltas, sand-dunes, etc., very important.

Greek fir (*Abies cephalonica*) forests

Abies cephalonica is an endemic Greek species, forming either pure or mixed forests with *Pinus nigra* ssp. *pallasiana* in areas where they co-exist. *Abies cephalonica* forests are distributed in several phytogeographical regions of Greece: Peloponnisos, Sterea Ellas (the most typical fir forests occur on the mountains of these two regions), S. Pindos, North Central, North East and the island of Kefallinia.

The altitudinal distribution of these forests ranges from (750)900 to 1800(2100) m, that is, from the upper parts of the Meso-Mediterranean zone to the upper limits of the Mountain-Mediterranean vegetation zone. On high mountains, fir forests form the upper timberline. Depending on exposure, microclimatic conditions and anthropogenic pressure, the upper timberline ascends to 1900 or 1600-1750 m on W-NW or N-NE-faced slopes on Mt. Killini, and 2100-2150 m on Mts. Chelmos, Parnassos and Giona. These montane conifer forests represent the potential natural vegetation of these altitudinal levels.

At the middle and upper level of the fir forests (Supra- and Mountain-Mediterranean vegetation zones), fires are quite uncommon and anthropogenic pressure is moderate. Logging and grazing, although forbidden, are the most frequent activities. The composition of these fir forests is characterised by a high number of species and a high percentage of endemics (30-40%).

The conservation of the fir forests may be achieved through the establishment of protection zones, the decrease in the intensity of human disturbances, and the implementation of sustainable management plans.

Quercus forests

Annex I includes several types of oak forests, however we should point out certain types that are missing: the *Quercus pubescens* and *Q. cerris* dominated forests of mainland Greece, the *Q. coccifera* forests of Southern Greece, and *Q. dalechampii* of Northern and Central Greece (see group 21).

C.2.3. Data Analysis

The number of occurrences (frequency) of the 109 habitat types and their cover -in hectares- are shown in Fig. C.1. Note that in this figure the habitat types are arranged in groups and denoted by their *group code* (see Table C.1). Some of the habitat types are quite frequent such as habitat types 12.4 (Aegean phrygana) and 13.10 (*Q. coccifera* maquis), and also have a high cover indicating their dominant presence throughout Greece. Some others may have high frequency but their cover is relatively small, such as the ones belonging to groups 6 (sand and shingle beaches), 8 and 9 (running and standing water) e.g. the widespread intermittent streams and temporary ponds. The reverse situation also occurs - high cover, small frequency - as in group 16 (alpine and subalpine grassland and heaths), a habitat found only on the mountains of the mainland.

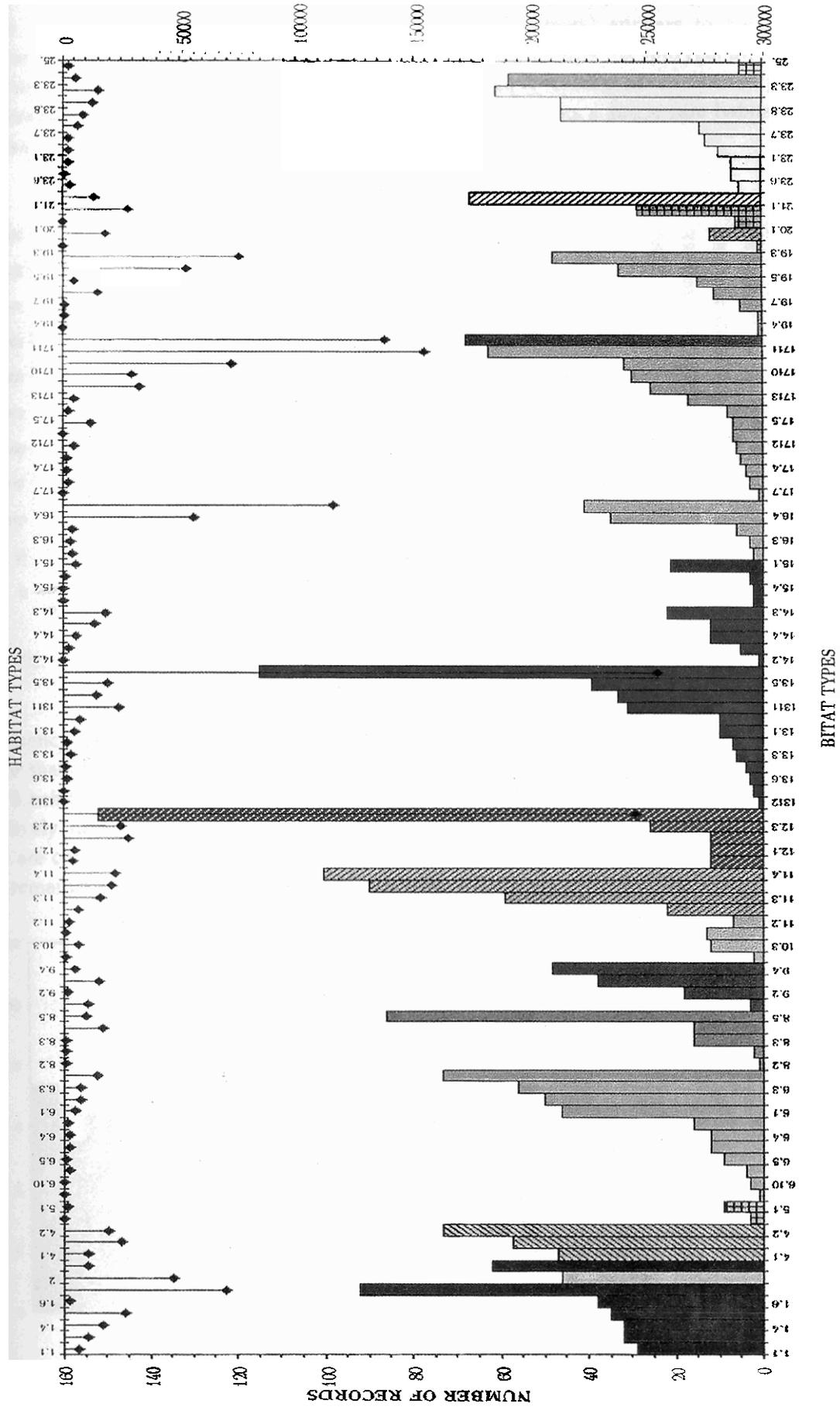


Fig. C.1. Number of records (bars) and cover (symbols) of habitat types in the proposed Natura 2000 sites. The legend of habitat types (group codes) and the habitat groups they belong to are given in Table C.1 where habitat types are listed in the order they appear in this figure.

The number of records (frequency) of the habitat groups is plotted against habitat groups cover in ascending order. Habitat group 11 (riparian forests) appears to have the highest frequency and a relatively small cover whereas habitat groups 13 (phrygana), 12 (matorral, maquis) and 17 (deciduous forests) show both high frequency and cover. Habitat group 25 has the lowest frequency and very low cover: actually it represents a single rare habitat type, fields of lava, with a very restricted distribution as noted above.

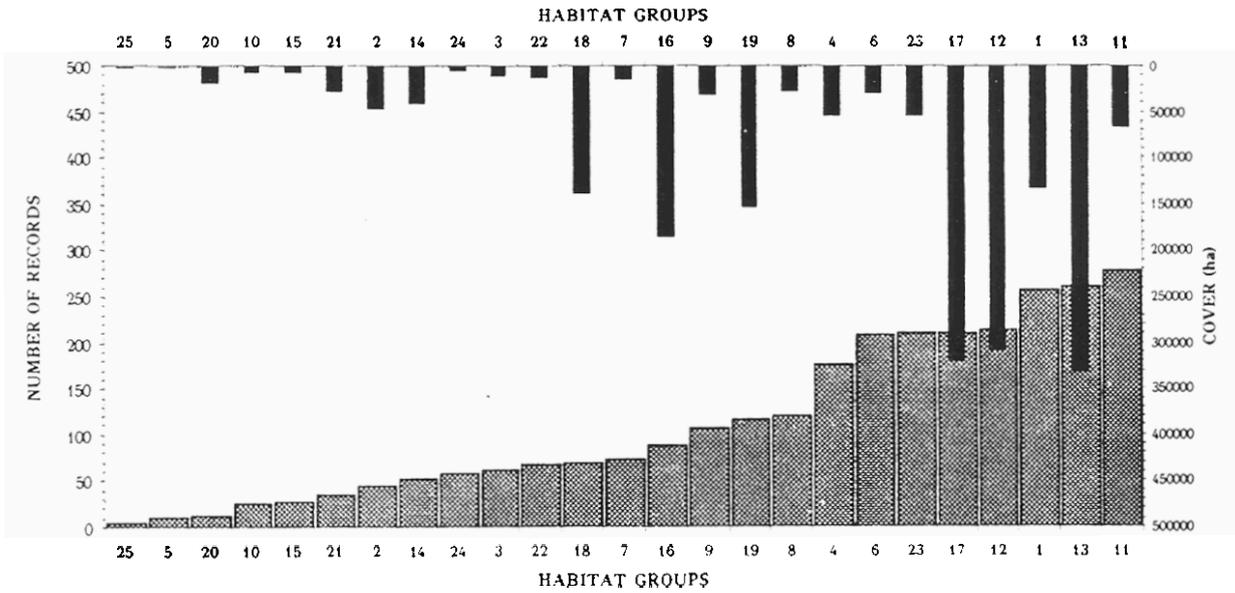


Fig. C.2. Number of records (wide bars) and cover (narrow bars) of habitat groups in the Natura 2000 database. Abbreviations are given in Table C.1.

Frequency distribution of habitat types is shown in Fig. C.3. Very few habitat types occur in more than 100 sites, while 12 of them have been recorded up to 35 times. We may consider the 8 habitat types appearing only once as rare, and the ones encountered from 2 to 7 times as relatively rare. Overall, approximately 8% of the habitat types have been recorded only once and are considered rare, about 30% appear 2-10 times and are considered relatively rare, while the remaining 60% have been recorded more than 10 times and are considered as common.

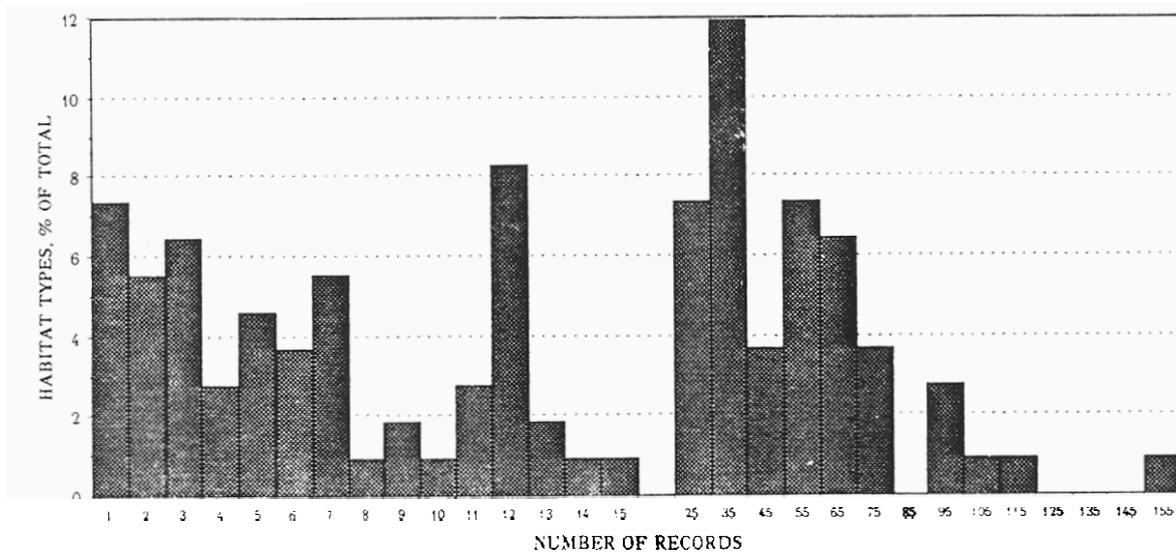


Fig. C. 3. Frequency of habitat types in the NATURA 2000 database.

The number of sites proposed for inclusion in the NATURA 2000 network and the area they cover per phytogeographical region are shown in Table C.2. Most of the sites (60) are encountered in North East region with a high cover as well, and the least (7) in the East Central region. Although the number of sites in Kriti and Karpathos is approximately half of those in North East, their relative cover is not much smaller. This is also observed in the case of the West Aegean islands; however this is due to the National Marine Park of Northern Sporades, a site with an area of 251,440 ha, 94% of which is marine area. The coverage of the sites over the cover of the phytogeographical regions could not be estimated as the authors did not have access to the information on the actual cover of the terrestrial and marine part per phytogeographical region.

The number of habitat types and their cover in the 13 phytogeographical regions are shown in Fig. C.4. The lower part of the figure presents the number of Annex I habitat types occurring in each region, in descending order. The upper part of the figure shows the cover of these habitat types as well as the cover of cultivations, and of the remaining area (characterised as "other") of the sites recorded in each phytogeographical region. The greatest number of priority habitat types has been recorded in North Central region, Sterea Ellas and Peloponnisos while their cover does not follow this order. It seems that priority habitat types have a higher cover in NC (that coincides with their number), NPi, NE and NAe. In the cases of KK, EC and EAe a relatively high number of priority habitat types has been recorded although these habitats are characterised by low cover. This is quite interesting as it could indicate the areas where several habitats are relatively restricted or isolated and hence they could become more vulnerable. Another interesting point concerns the area covered by natural habitats not included in Annex I. This is prominent in at least 3 regions: WAe, NE and IoI. In WAe, as noted above, this is due to the large marine area, which nevertheless is protected as an important marine biotope. In the regions StE and Pe, the main distribution areas of *Abies cephalonica*, the greek fir forests account for the large proportion of non Annex I habitats. Therefore, updating of Annex I habitats list in order to include these habitat types missing from the initial version becomes evident.

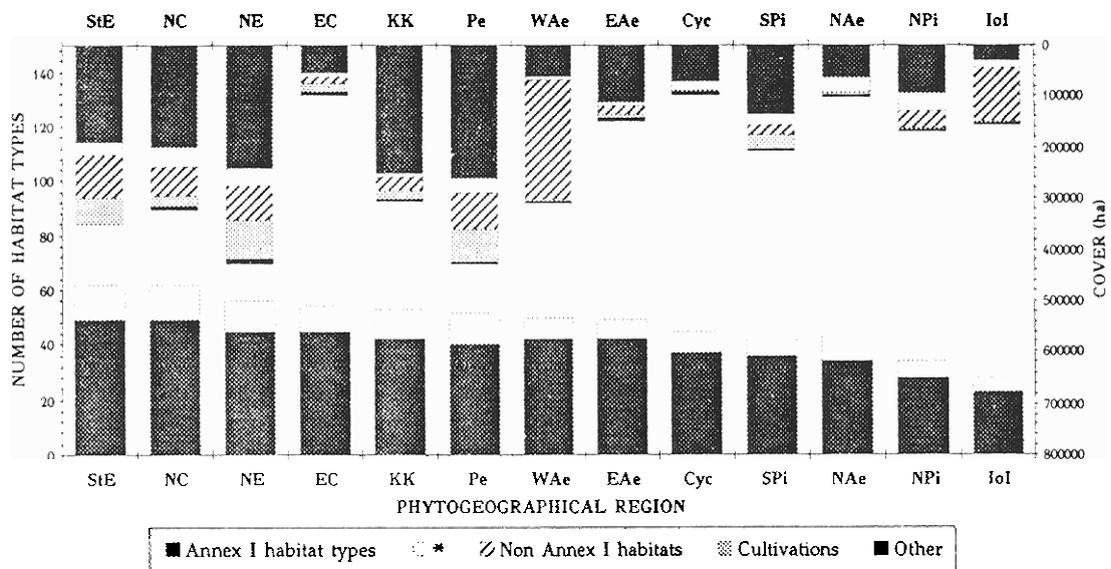


Fig. C. 4. Number of habitat types included in Annex I (lower part) and their surface areas in ha (upper part) in each phytogeographical region in the sites included in the NATURA 2000 database. Priority habitat types (*) number and cover as well as cover of non-Annex I habitats, cultivation (extensive cereal cultures, ricefields, improved grassland, other arable land, artificial forest monoculture and non-forest areas cultivated with woody plants), and other (towns, villages, roads, waste places, mines and industrial sites) are also shown.

At this point we should mention that the overall conclusions may be biased, i.e. overestimated or underestimated cover of some habitat types or groups compared with their total cover in Greece, for reasons related mostly to the site selection process (for initial site selection rules see relevant article in the same volume) and to the fact that many habitat types existing in Greece were not included in Annex I. This becomes clearer in the analysis of selected habitat types. Nevertheless, we believe that bias does not drastically change the overall picture of habitat distribution in Greece.

On the basis of the phytogeographical subdivision of Greece, the number of records of the habitat groups in each phytogeographical region is shown in Fig. C.5. Certain habitat groups have been recorded only few times in the phytogeographical region in which they occur like habitat groups 25 (fields of lava) and 5 (salt steppes). On the other side, habitat groups 11 (riparian forests), 13 (matorral, maquis) and 1 (marine habitats) have been recorded in high numbers in all phytogeographical regions (except group 11 in IoI). Some habitat groups do not appear in certain phytogeographical regions, such as habitat group 1 (marine habitats), the related groups 6 and 4 (shingle and sand beaches and salt marshes) in NPi, and group 18 (pine forests) in the Cyclades. Worth mentioning are: the high frequency of group 23 (inland rocks) in NC and NE; the relatively higher frequency of groups 22 (scree) and 12 (phrygana) in Pe, KK, and Cyc (see also reference in group 22); as well as the high occurrence of group 4 (salt marshes) in NE region.

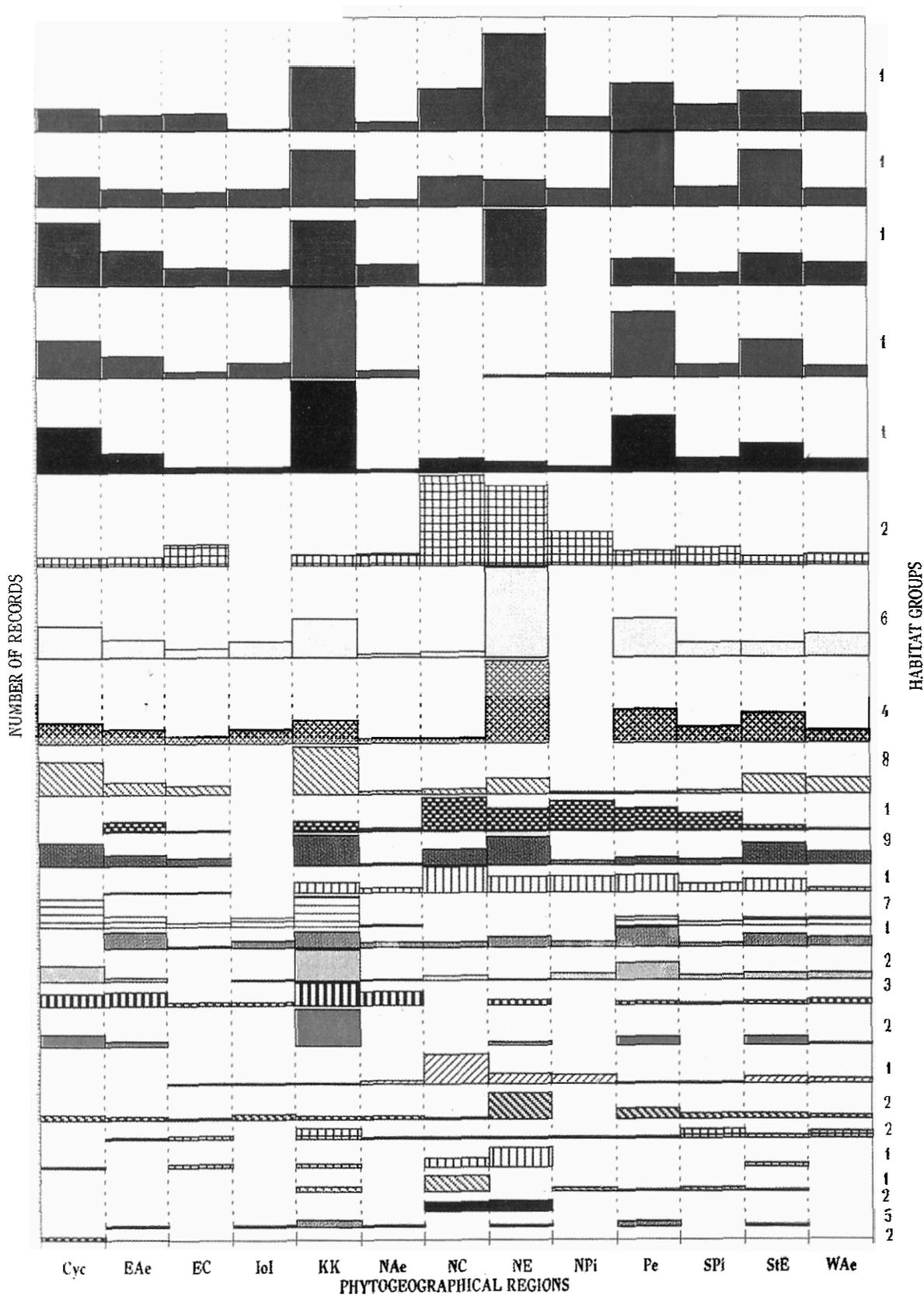
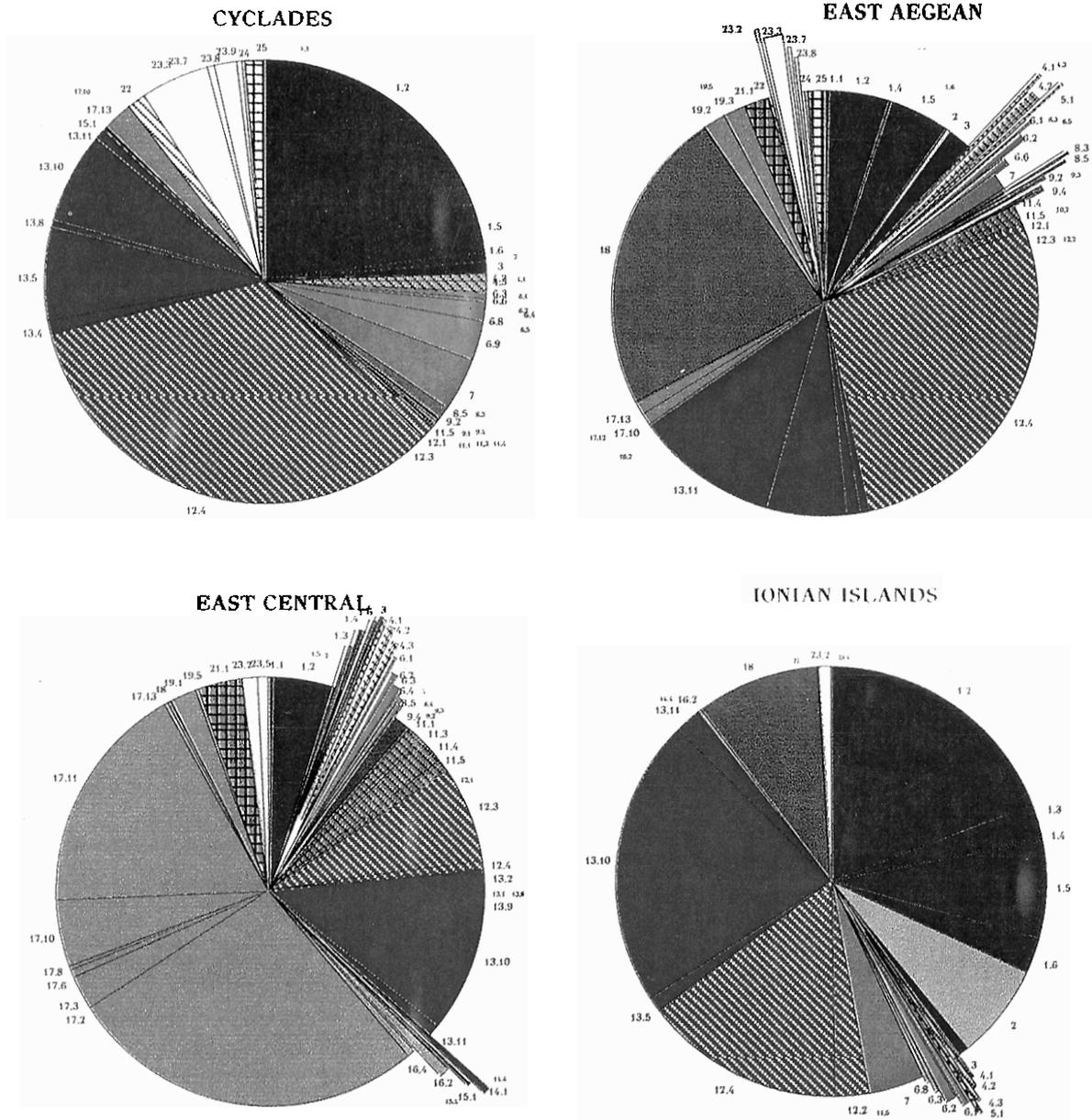


Fig. C.5 Distribution of habitat groups in the phytogeographical regions. Each tick on y-axis represents one record. (For abbreviations see Tables C.1, C.2).

The relative cover of each habitat type in the 13 phytogeographical regions is presented in Fig. C.6. (where the habitat types are indicated -for practical reasons- by their group code).



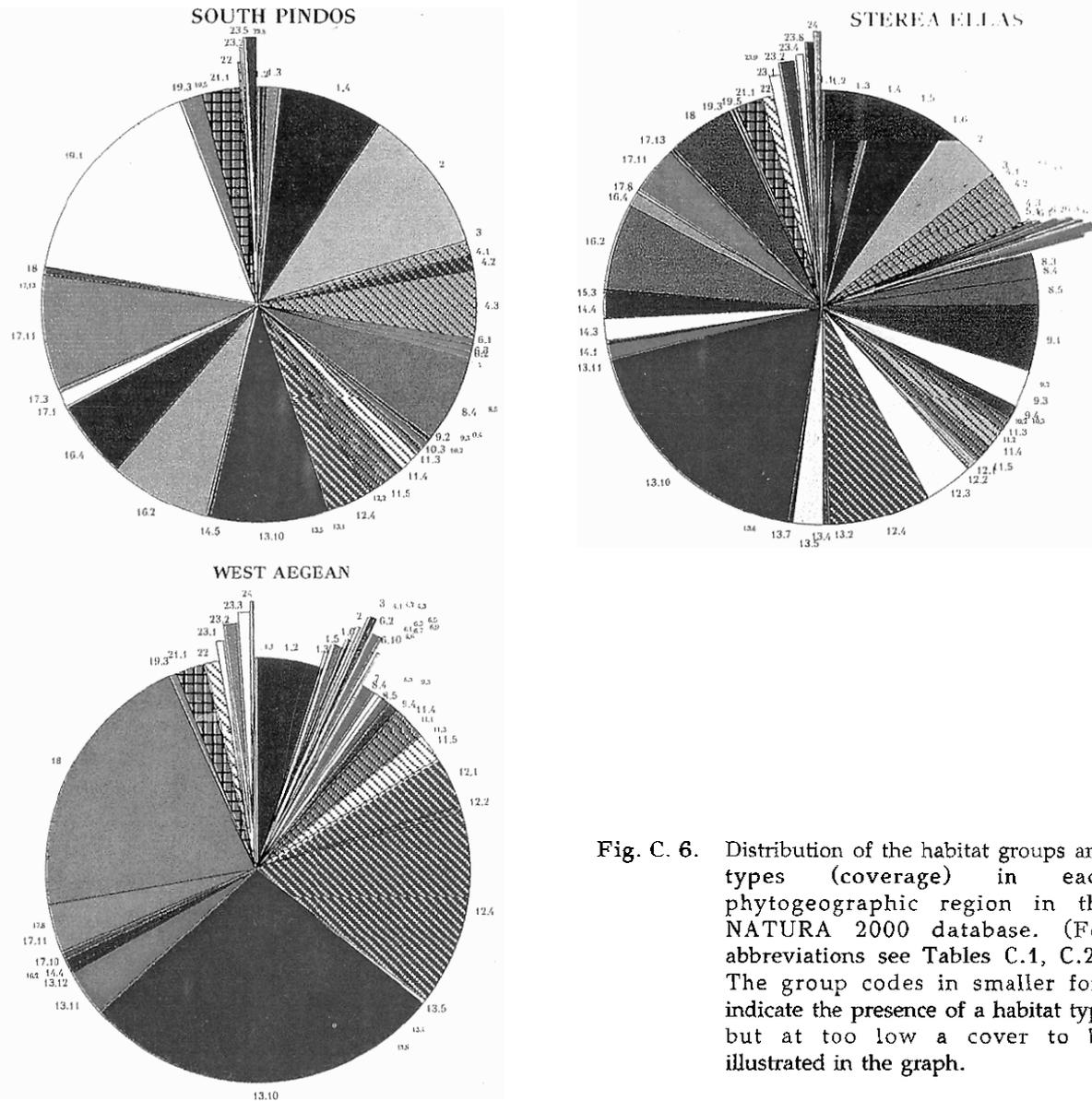


Fig. C. 6. Distribution of the habitat groups and types (coverage) in each phytogeographic region in the NATURA 2000 database. (For abbreviations see Tables C.1, C.2). The group codes in smaller font indicate the presence of a habitat type but at too low a cover to be illustrated in the graph.

Each phytogeographical region is characterised by the dominance of certain habitat types and groups. The East Aegean region is dominated by habitat group 12 which corresponds to phrygana and more specifically to those with *Sarcopoterium spinosum*. Group 18, corresponding to endemic Mediterranean pines (habitat type 9540) is also dominant in the region. West Aegean is dominated by habitat groups 12 and 13, phrygana and matorral respectively, while pine forests (group 18) are also abundant. The Cyclades complex is dominated by habitat group 12 and more specifically 12.4 (habitat type 5420: phrygana with *Sarcopoterium spinosum* and notably with the endemic *Centaurea spinosa*), while the marine habitat group 1, mainly represented by habitat 1.2 *Posidonia* beds (priority habitat type 1120), is also prevalent. The East Central region is dominated by habitat group 17, which corresponds to the deciduous forests. North Aegean is dominated by thermophilous and montane coniferous forests (groups 18 and 19) and deciduous forests (group 17) as well as by *Posidonia* beds (group code 1.2). Kriti and Karpathos are dominated by habitat group 12 (phrygana) represented mainly by habitat types 5420 (*Sarcopoterium spinosum* phrygana), and 5430 (phrygana with endemic Cretan species). The Ionian islands are clearly dominated by *Posidonia* beds (due to the inclusion of a large marine area in site GR2220003), followed by habitat groups 13 (matorral)

and 12 (phrygana). The regions North Central and North East are dominated by deciduous forests of various types (group 17). Peloponnisos is dominated by matorral (group 13). *Sarcopoterium spinosum* phrygana (mainly group code 12.4) and group 16 corresponding to habitat types 6175, 6170, 4060, 6173 and 4090 of the alpine and sub-alpine formations of grasslands and heaths. South Pindos is a phytogeographic region in which none of the habitat groups could be considered as prevalent, except that of the montane coniferous forest habitat group 19. Finally, Sterea Ellas is dominated by habitat group 13 (matorral).

From the above we may shape the ecological map of Greece in terms of the distribution and the prevalence of the habitat types. The islands of the Aegean and Sterea Ellas are characterised by the typical Mediterranean habitats of low phryganic shrublands and maquis (matorral). Northern Greece is occupied by deciduous forests indicating a more diverse environment. The Ionian islands seem to be one of the main centres for *Posidonia* beds, while Peloponnisos is rather similar to the Aegean islands.

As far as it concerns the presence of the priority habitat types in the 13 phytogeographical regions of Greece, it seems that all regions host priority habitat types (Fig. C.7). The majority of them -in number of records- is observed in NE, KK, NC and Pe. However, the relative

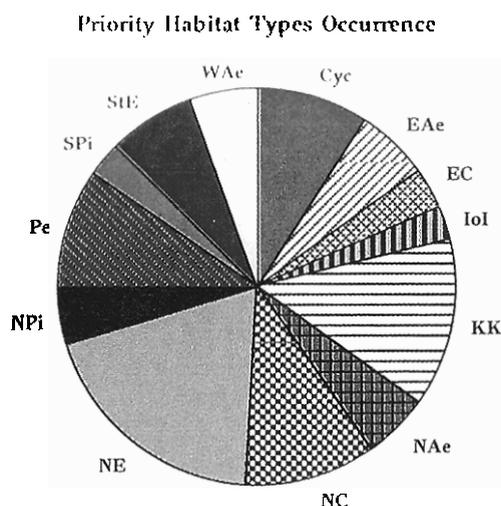


Fig. C.7. Number of records of the priority habitat types in the 13 phytogeographical regions. (For abbreviations see Table C.2).

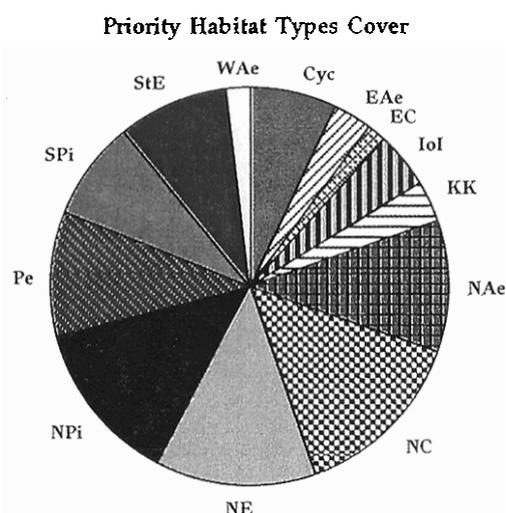


Fig. C.8. Area covered by priority habitat types in the 13 phytogeographical regions. (For abbreviations see Table C.2)

importance of the priority habitat types in terms of the area they cover does not entirely coincide with their occurrence. In other words, priority habitat types seem to cover a large area in NC, NE, NPi, Pe and NAe (Fig. C.8). Concerning the number of priority habitat types contained in each group, it seems that most of them (18%) are concentrated in habitat groups 14 (dry grasslands) and 19 (montane coniferous forest), while habitat group 6 (shingle and sandy beaches dunes) follows with 12% of the total (Fig. C.9).

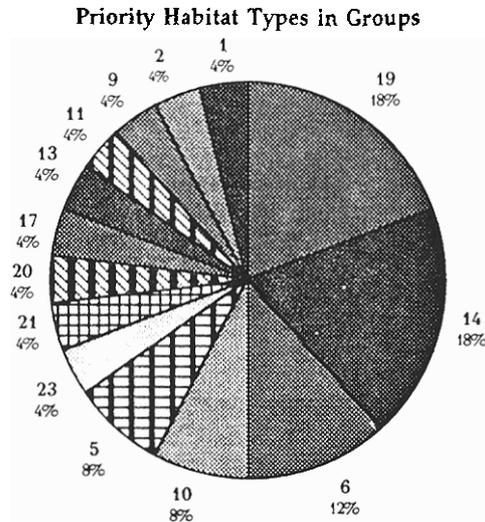


Fig. C. 9. Distribution of the priority habitat types (%) in the 25 defined habitat groups. (For explanation of the group codes see Table C.1).

More detailed information for 9 representative priority habitat types is provided in Fig. C.10. - C.18. In these figures, the number of records of each habitat type, the area it covers and information on the degree of representativity, conservation status and the value of global assessment for each habitat type per phytogeographical region are shown.

Posidonia beds, habitat type 1120, is found in sandy areas of the sublittoral zone and is characterised by the occurrence of the marine phanerogame *Posidonia oceanica*. This species is endemic to the Mediterranean Sea. In Greece, *Posidonia* beds are the most widespread habitat type of the sublittoral zone (Fig. C.10).

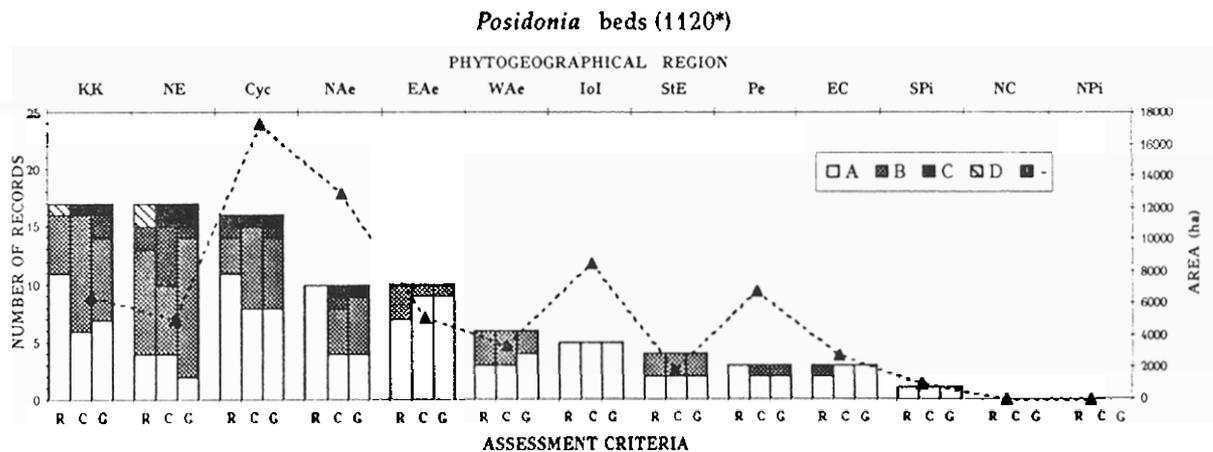


Fig. C.10. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Figure C.10. reveals that most records are reported from the phylogeographical regions KK, NE and Cyc, while the largest area covered is reported for Cyc. It is interesting that *Posidonia* beds are assessed as having A in representativity (R), conservation status (C), and global assessment (G) in IoI region, although their recorded frequency and cover are not among the highest.

Lagoons are found in almost all phylogeographical regions (Fig. C.11.). They prevail in NE and Pe, while their highest area covered is observed in SPi, NE and StE. Concerning their assessment the NE region exhibits the higher values.

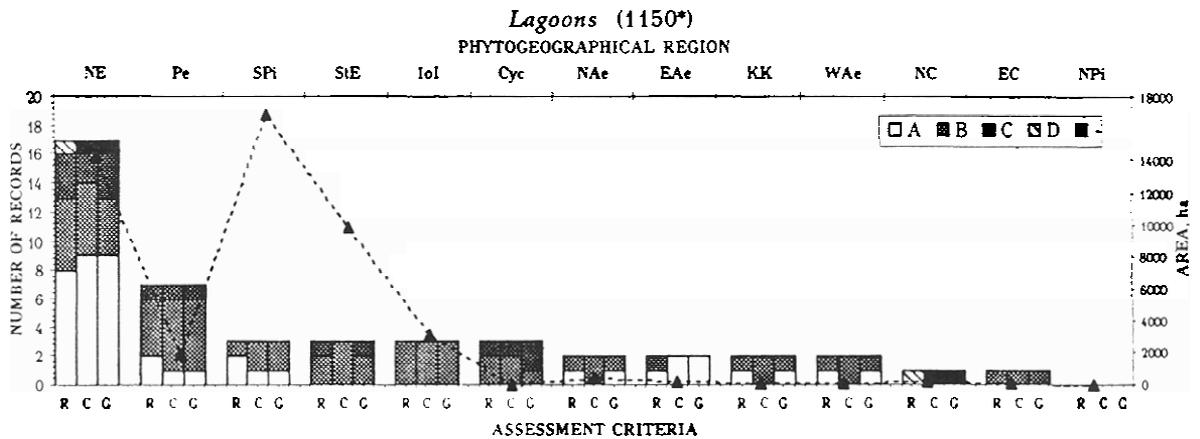


Fig. C.11. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Matorral with *Laurus nobilis*, habitat type 5230, is another priority habitat type found in 7 out of the 13 phylogeographical regions with the same number of records (frequency) but different area covered (Fig. C.12). The highest cover is observed in KK and the lowest in WAe. As far as its assessment is concerned, it seems that the best status is observed in the Cyclades, where, although its representativity is B (A was not observed in any of the sites), its conservation status and global assessment values puts it at the highest rank.

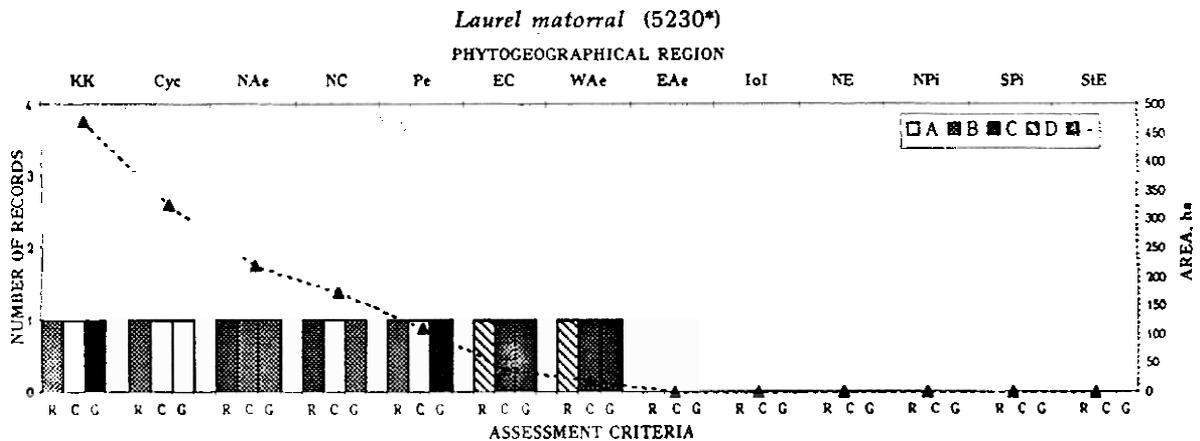


Fig. C.12. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Pallas pine forests, habitat type 9536, are recorded in 9 out of the 13 phytogeographical regions of Greece (Fig. C.13). NC and Pe have the highest number of records, while the highest area covered is observed in NPi. As far as their assessment is concerned, these are not ranked highly in any of the regions.

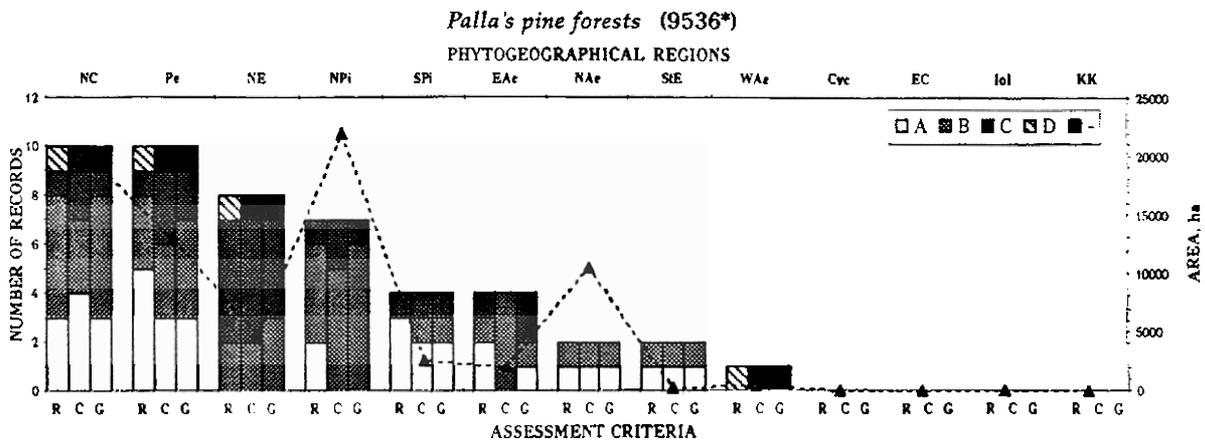


Fig. C.13. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Stinking juniper woods, code 9563, are most frequent in Pe and NPi regions, where they also have the highest cover (Fig. C.14). However, their assessment values are rather low in all regions in which they have been recorded. In addition, dune juniper thickets, code 2250, have been reported in Southern Greece, with the best assessment values and largest cover in Cyc (Fig. C.15).

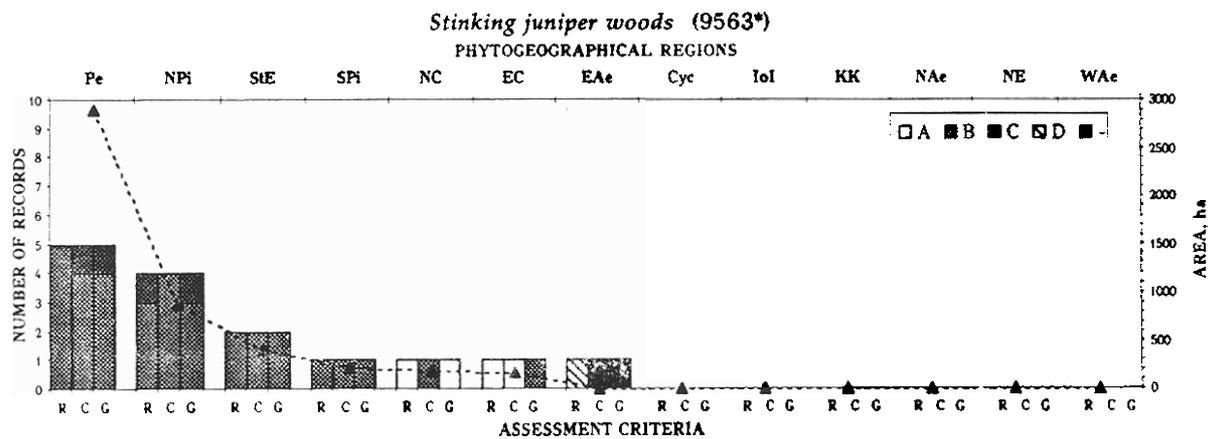


Fig. C.14. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

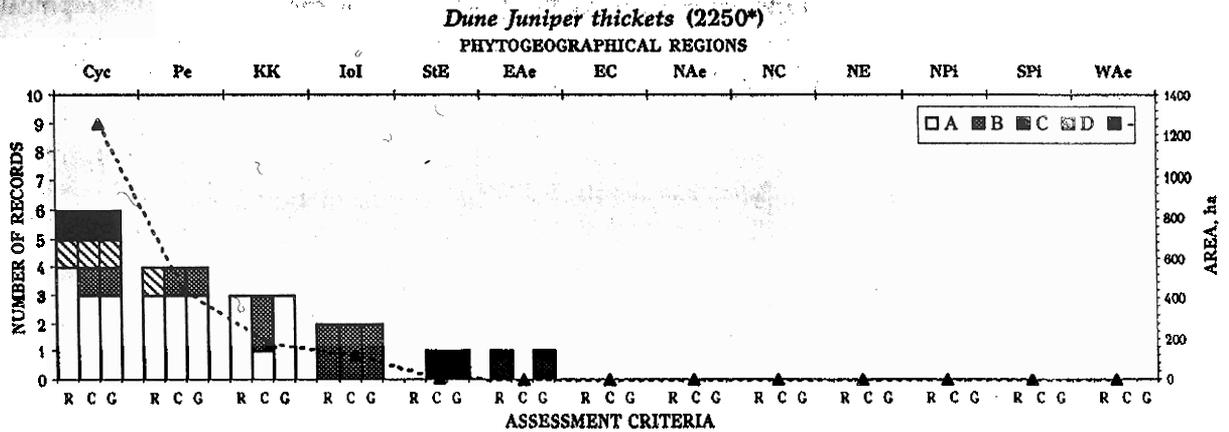


Fig. C.15. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Salt steppes, code 1510, have been reported in few sites (9) with less than excellent representativity in eight of them: most of the sites belong to Pe phytogeographical region. Salt steppes have the highest cover in StE, although the best assessment values were reported for the site of Karpathos (Fig. C.16). A similar situation is noted for the active raised bogs, code 7210, with the higher assessment values in Kriti (Fig. C.17.).

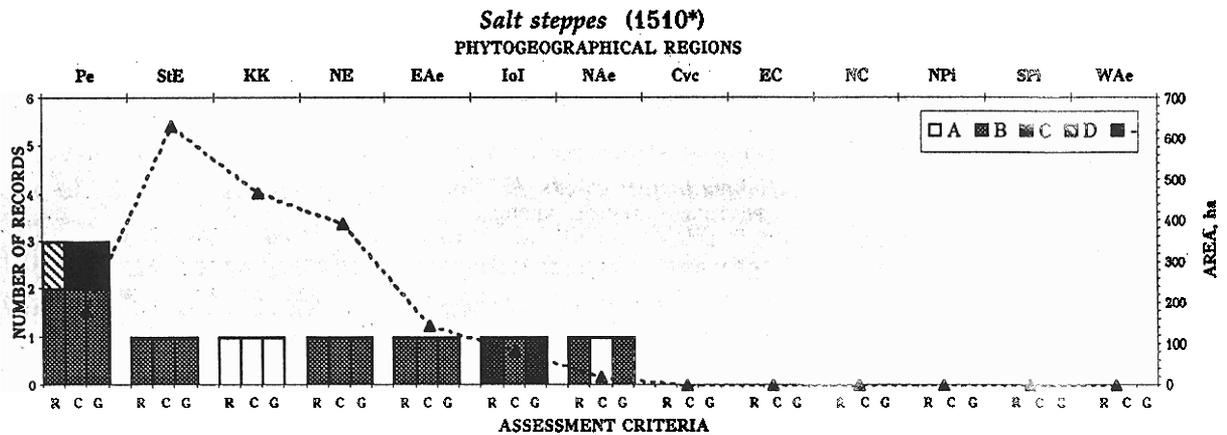


Fig. C.16. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

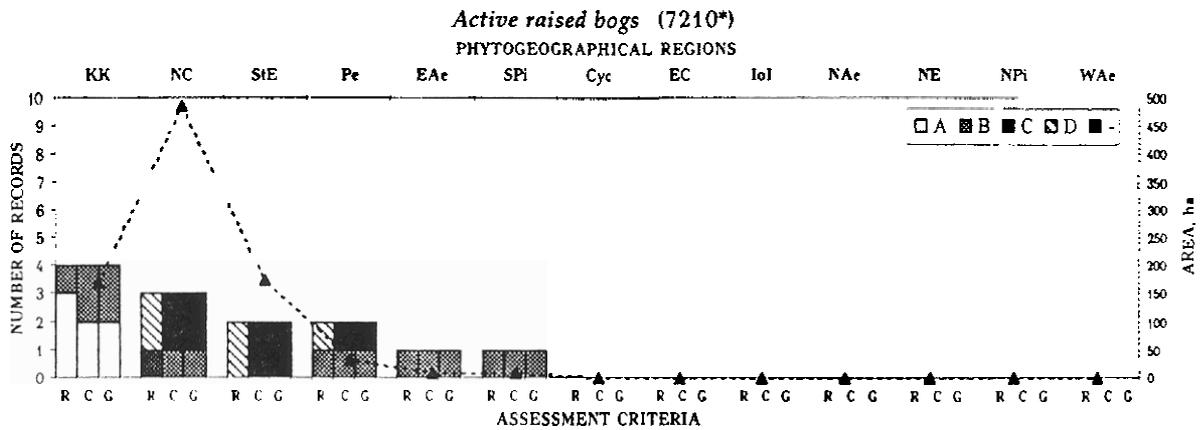


Fig. C.17. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

Mediterranean temporary ponds (code 3170) show a wide distribution, being present in most of the phytogeographical regions, mainly in the Aegean and Sterea Ellas, where they have the highest frequency and the best assessment.

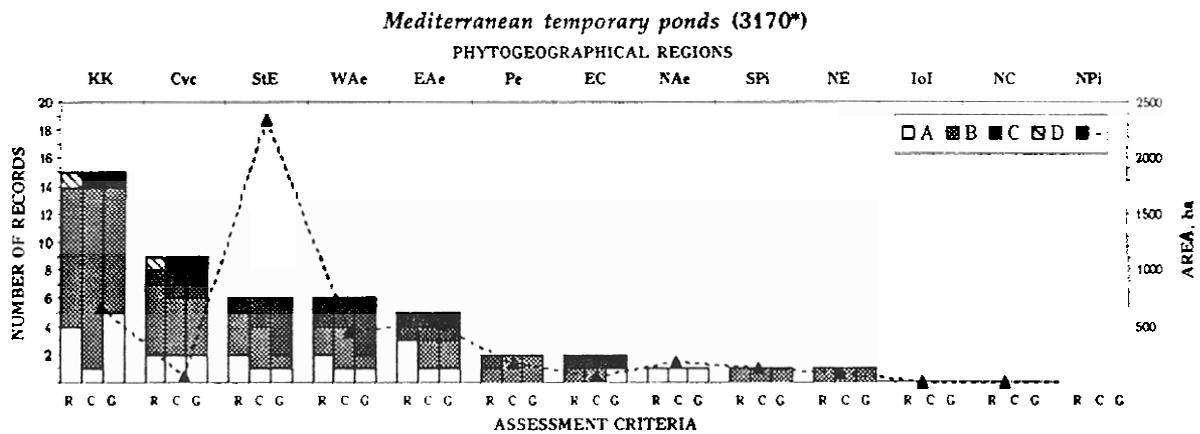


Fig. C.18. Number of records (bars), area covered (symbols) and assessment values (A, B, C, D), in line with the explanatory notes of the Standard Data Form Natura 2000, according to the following criteria. R: representativity; C: conservation; G: global assessment . - : no assessment

C.2.4. Conclusions

- There is a large variety of habitat types from the north to the south and from the west to the east of the country. This is mainly due to the dissected geographical relief, which creates a number of microhabitats and microclimates. This results in an alternation of a variety of habitat types in comparatively small areas (for example, 29 habitat types can be found in an area of 14,500 ha).
- Several habitat types and groups are concentrated locally, e.g. phrygana in the Aegean, deciduous forests in North Greece.
- Several important habitat types are not included in Annex I. Therefore, updating of the Annex I list should be scheduled .
- Most of the habitat types are threatened by rural and tourism activities.
- The selection of sites for inclusion in the National List must, among others, take into consideration the frequency, cover, isolation, representativity, and conservation status of the habitat types present.