3.11. Changes and loss of biodiversity

Main findings

- Biodiversity of genes, species, ecosystems and habitats will remain under threat in the EU. Habitats will be decreased and fragmented, endangering many indigenous, rare, endemic and specialist species populations and ecosystem functions, although generalist and invasive species will continue to spread. A continuation in the recovery of a small number of endangered species and habitats can be foreseen.

- Although concerns for nature protection are beginning to be integrated in sectoral policies, negative impacts on biodiversity are expected to continue from agricultural intensification, land abandonment (this may be beneficial in intensively cultivated areas), monospecific forestry, urban and transport infrastructure development, climate change and the introduction of alien species (and possibly genetically modified organisms).

- More positively, reductions are foreseen in acidification and eutrophication, enabling species and habitats to show some recovery, although there will not be a full return to pre-pollution conditions, even after 2010.

- Over the next decade upwards of 10% of EU territory is expected to be designated for nature protection as part of the NATURA 2000 Network and provisions taken for protection of the most threatened species in the EU.

- The European Community Biodiversity Strategy (in the framework of the Convention on Biological Diversity) will function through action plans designed to integrate biodiversity in the European Commission's activities and in policies and programmes where there is a European Community competence.

1. Main economic sectors influencing European biodiversity

Biodiversity (species, habitats and gene pools) is mostly affected not only by one single pressure, but by a combination of pressures derived from all main societal sectors: agriculture, forestry, fisheries, as well as from urbanisation, industry, transport, tourism and recreation, energy use, chemicals and minerals.

1.1 Agriculture

In most European countries, agriculture remains one of the most important activities interacting with nature through land-use, pollution, species introduction and genetic selection. The observed polarisation (towards intensification or abandonment) of agricultural activities in areas of extensive (low-intensity) agricultural practices leads to ecological conditions of less value for nature conservation, while abandonment of intensive practices may lead to conditions of increased value. The effects on biodiversity of abandonment depends on the scale at which the process occurs, on the type of habitat whose management is being abandoned and on the end-habitat evolving.

In agriculture and forestry, exchange between cultivated and natural gene pools has occurred widely. Gene traits occurring naturally through hybridisation and spontaneous mutations have been traditionally selected and further developed through breeding to develop the present cultivated and domesticated species. New techniques for more direct gene modification (GMOs: Genetically Modified Organisms) permits more intensive and widespread use of a limited number of cultivated species variants (Council of Europe, 1993) (see Chapter 3.9). Data from different countries on GMOs (still a limited range of species) indicate that genes from crops can, and already have, pass into natural populations of wild relatives, but the process has also been seen in rapes and cabbages (*Brassica*) able to break through the species barrier into other species such as White Mustard *(Sinapis alba*) and Wild Radish (*Raphanus raphanistrum*) (Akeroyd, 1998).

Box 3.11.1. We face changes and losses in biodiversity. Does it matter?

Biodiversity is the 'variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (Convention on Biological Diversity, 1992). Biodiversity in its widest sense encompasses all aquatic species and habitats as well as the species and habitats of our highly cultivated and managed fields, forests, parks and gardens and all the less intensively used and cultivated (semi-natural) and natural areas.

The approach to biodiversity is complex: it relates not only to numbers of species and habitats, but also to variability, continuity, processes and patterns. Maintaining thriving natural systems is essential not only for economic or ethical reasons, but also for ecological, social, recreational, educational and aesthetic reasons. Recognition of this is the background for the growing awareness and development towards sustainable use and management of natural resources in most countries and sectors. But the rate and scale at which the environment is being altered have accelerated in recent decades to levels which, in many areas, may be close to the thresholds for securing a sustainable biological future despite the many counter measures. The larger and more rapid the changes, the smaller the chances for natural adaptation and development in species and ecosystems. In an increasingly changing environment, principles of precaution are therefore being advocated in many international and national programmes and policies, not the least because there is still limited knowledge of the function and resilience of both ecosystems and species (Heywood and Watson, 1995).

Loss of biodiversity, considered at three scales: genes, species/populations, habitats/ecosystems, has been recognised as an issue of urgent concern both in the EU Fifth Environmental Action Programme and through the adoption of the Convention of Biological Diversity by most governments in the world. This problem ranks alongside global impacts such as climate change, ozone depletion and desertification.

Agriculture was identified as a major impacting sector on biodiversity within the 5EAP. Integration of environmental issues in agricultural policy was boosted by the 1992 Common Agricultural Policy (CAP) reforms, and the process is likely to continue with the accession of eastern and central European countries. In March 1999 global agreements were reached between the EU ministers for agriculture on a reform of CAP within the framework of Agenda 2000 on the balance between production, environmental and social function of agriculture in Europe (see below and Chapter 3.13).

1.2. Forestry

Forestry is another major driving force for biodiversity. The importance of forests and forest management may increase in the future (see Box 3.11.2), showing different directions of development simultaneously: a continuing main trend towards monospecific managed forests, often based on exotic species, while at the same time an increasing use of native species and gene pools; a continuing decrease in old forest areas while interest in their conservation increases; a potential use of genetically modified trees; a continuing fragmentation of forests, while in other areas afforestation programmes serve to link forests into complexes; a continuation of forest damage observed during the past decades; shifts in species composition of forests and foreseen changes in growing seasons due to climate change with unknown consequences for the composition and structure of related species communities (as for many other ecosystems); risks of spreading disease in forest trees both with changing climate and increasing transportation of forest products; and an increase in European forest biomass, with still unknown consequences for biodiversity.

Box 3.11.2. Climate change: forests as carbon sinks

Measures envisaged under the Kyoto Protocol (see Chapter 3.1) for increasing the carbon sink capacity are likely to lead to changes in forest areas and stands, such as the extension of plantation area, the maintenance of young, productive stands at the expense of habitats of high biodiversity value (grasslands and pastures, steppes, old-growth forests), and the choice and development of tree species or species varieties related to carbon sink capacity. Indications are that coniferous forests have a higher carbon sink capacity than deciduous forests; but mixed forests are recognised as more healthy and damage-resistant than monospecific cultures. Active choice of tree species selection and development of genetically modified trees may have significant impacts on European forests in the future.

ETC/NC-European Forest Institute, 1998

Afforestation programmes initiated under the 1992 CAP reform (Council Regulation (EEC) No 2080/92) have been applied differently in Member States (see Chapter 3.13). Four EU countries (Spain, the United Kingdom, Ireland and Portugal) have actively implemented these programmes, accounting for more than 80% of the total area afforested under the regulation. In many cases, fast-growing species, including exotic species, have been used, often at the expense of habitats of high biodiversity value (ERM, 1996; Lierdeman and Soufi, 1997).

1.3. Other impacting sectors

Urbanisation (see Chapter 3.12) and development of heavily impacting infrastructure (e.g. transport, energy and water supply) lead to a steep decrease in the extent of many natural and semi-natural habitats, and to high fragmentation and isolation. There is also increasing evidence of the impact of high noise levels such as around motorways, disturbing breeding birds. On the other hand, the plantation of trees and the use of wild and cultivated flowers create new species and often rich habitats.

Though stabilizing or decreasing, pollution – with resulting eutrophication, acidification and pesticide loads – has increasingly perceptible effects on biodiversity caused by long-term chemical influences.

Despite strict conservation measures, fisheries is still a major impacting sector with direct and indirect effects on species (by overexploitation of target species, mortality, injury and stress on other species such as dolphins, auks, terns, cormorants) and on the marine ecosystem (by disturbance of sediments, communities and the food-chain).

Marine aquaculture (see Chapter 3.14) is a rapidly expanding industry in the coastal zone where biodiversity is high (estuaries, coastal marshes) and where human pressures are increasing and complex. Though initially judged negligible, the impact on biodiversity through feeding (additional nutrients), pests and escaping species (with consequent genetic change in wild populations) is considered severe locally.

As one of the fast-growing sectors world-wide, tourism in many areas has heavy direct destructive impacts on habitats and disturbance of species, and indirect impacts through pollution and water demand, particularly in coastal and mountain areas (see Chapters 3.14, 3.15). Increasing interest in 'ecotourism' raises awareness of nature and biodiversity, but it has already had damaging impacts on areas that were once remote.

2. From awareness to policy

Biodiversity protection has evolved significantly over time:

- from protection of species, towards protection of habitats;
- from conservation in-situ towards com-

Main Community initiatives of relevance for biodiversity — Table 3.11.1.

General frame
Fifth Environmental Action Programme Towards Sustainability
Agenda 2000
European Community Biodiversity Strategy
Communication on a Forest Strategy for the European Union
European Spatial Development Perspective
Community Directives and Regulations
Directive 79/409/EEC on the conservation of wild birds (Birds Directive)
Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
Regulation (EEC) N°1973/92 establishing a financial instrument for the environment, as amended by regulation (EC) n°1404/96: LIFE funds
Regulation (EEC) N° 938/97 implementing Regulation (EEC) N°338/97 on the protection of species of wild fauna and wild flora by regulating trade therein
Directive 85/337/EEC on environmental impact assessment, as amended by Directive 97/11/EC
Directive 75/268/EEC on mountain and hill farming and farming in certain Less Favoured Areas
Regulation (EEC) N° 2078/92 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside
Regulation (EEC) N°3528/86 on the protection of the Community's forests against atmospheric pollution
Regulation (EEC) N°2158/92 on protection of the Community's forests against fire
Directive 78/659/EEC on the quality of fresh waters needing protection or improvement in order to support fish life
Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
Directive 91/271/EEC concerning the protection of water against pollution caused by nitrates from agricultural sources
Framework Directive on Water Quality (under development)
Directive 77/93 /EEC on protective measures against the introduction into the MS of harmful organisms of plants or plants products
Directive 90/219/EEC on the contained use of genetically modified micro-organisms
Directive 90/220/EEC on the deliberate release into the environment of genetically modified organisms
Amendments adopted in December 1998 to the Directives related to the marketing of seeds (66/400/EEC, 66/401/EEC, 66/402/EEC, 66/403/EEC, 69/208/EEC, 70/457/EEC, 70/458/EEC) for *in situ* conservation and sustainable use of plant genetic resources, through growing and marketing of land races and varieties adapted to local and regional conditions
Regulation (EEC)N°1467/94 on conservation, characterisation, collection and utilisation of genetic resources in agriculture
Regulation (EEC) N°2100/94 on Community plant variety rights

plementary ex-situ measures;
- from protection of species and habitats, towards protection of natural processes;
- from nature protection as an isolated exercise, towards integration of nature-conservation into planning and management of terrestrial and marine environment as a whole, and into each economic sector, based on the principle of sustainability;
- from isolated local or national initiatives, towards co-ordinated programmes of international co-operation, with standards and criteria agreed internationally;
- from conservation of nature for its scientific and aesthetic qualities towards recognition of the importance of ecosystems as a whole, rather than of elements known specifically to be at risk; and,
- from habitats and ecosystems to conservation of landscape patterns.

The Pan-European Biological and Landscape Diversity Strategy (PEBLDS; Council of Europe, 1996) aims at supporting and co-ordinating national actions to maintain and enhance biological and landscape biodiversity, in conjunction with the Global Convention on Biological Diversity (CBD).

Many reports, the Dobris Report (Stanners and Bourdeau, 1995), Europe's Environment: The Second Assessment (EEA, 1998), Existing agreements and initiatives in developing the Pan-European Network (Bennett, in prep.) provide overviews on international conventions and initiatives. In addition, national reports under the Biodiversity Convention review initiatives undertaken at national level.

A comprehensive review of Community policies related to biodiversity is provided in the first report on the implementation of the Convention on Biological Strategy by the European Community (European Commission, 1998a). Some of them are summarised in Table 3.11.1.

3. What is special about Europe and biodiversity?

3.1. European issues in comparison to the world

Biodiversity loss due to fragmentation is a special cause of concern in many regions of Europe: fragmentation and coastal degradation are likely to increase, while other environmental problems such as air and water pollution are likely to remain more stable or decrease slightly (Table 3.11.2).

3.2. European influences on biodiversity in the rest of the world

3.2.1. Europe shares responsibility with other continents for migratory species

Europe is the seasonal home to and an important crossroads for huge populations of migratory species, sharing these species with other continents such as Africa, Near East and North America. This responsibility is translated, among others, through the Convention on Migratory Species (Bonn Convention) and its underlying agreements, which has provided a global frame for EU nature-protection directives. Success or failure to provide sufficient resting, feeding and breeding grounds in Europe will influence biodiversity in these other continents just as successes and failures there will influence Europe's biodiversity.

3.2.2. European trade and technology transfer

European trade and technology transfer have led to significant impacts on global biodiversity:

- Just as there are serious ongoing concerns about species introduced to Europe from other global regions becoming invasive and about the introduction of GMOs, Europe has induced radical changes in biodiversity in other continents through the introduction of European species during the past two centuries (such as birds and trees in New Zealand); GMOs from Europe may also spearhead changes.
- At present western Europe shares with the United States and Japan the consumption of half of the world's timber harvested for industrial use.
- In the Amazon area, transportation corridors created for timber products facilitate conversion of forests to agriculture for commodities bound for Europe. The total area deforested per year has increased from 30 000 km^2 in 1975 to at least 600 000 km^2 at present, with twice as large an area affected biologically (Brown, 1998).
- Trade in wild flora and fauna species effects global biodiversity. World imports of threatened wild plants and animals are regulated by CITES (the Washington Convention), and the EU has been closely involved in implementation of the Convention. However, the EU is among the world's leading importers of several groups of species and species products (Figure 3.11.1).

3.3. Species in Europe

Importance and trends of environmental issues by continent or large region Table 3.11.2.

*Importance : *** Critically important ; ** Important ; * Lower priority; 0 Negligible.*

Regional environmental trends : ↗ Increasing; → Remaining relatively stable; ↘ Decreasing ; – Not applicable

Environmental problems	Africa		Asia-Pacific		Europe & Former USSR		Latin America & Caribbean		North America		West Asia		Polar region	
Land: degradation	***	↗	***	↗	**	→	***	↗	**	↘	***	↗	*	→
Forest: loss, degradation	***	↗	***	↗	**	→	***	↗	*	→	*	↗	0	-
Biodiversity: loss, fragmentation	**	↗	***	↗	***	↗	**	↗	**	→	**	↗	**	→
Fresh water: access, pollution	***	↗	***	↗	***	→	**	↗	***	→	***	↗	*	→
Marine and coastal zones: degradation	**	→	***	↗	***	↗	**	↗	**	→	***	↗	*	→
Atmosphere: pollution	**	→	***	↗	***	→	***	↗	***	→	**	→	**	→
Urban & industrial: contamination, waste	**		***	↗	***	→	***	↗	***	→	***	↗	*	-

Source: Modified from UNEP, 1998a

The present diversity of species in Europe results from a complex combination of species occurring naturally within their ecological range, of those used and introduced through centuries for economic or recreation purposes (agriculture, horticulture, forestry, hunting, and fisheries) and of a large range of species which follow cultivation or transport. At all times low numbers of new species spread naturally to Europe and within Europe's regions (Figure 3.11.2).

Some native species are spreading or their populations are increasing, due to protection laws, restoration programmes (Skotte Møller, 1995) and reintroductions: these include most raptors, geese, butterflies locally, and in certain areas large carnivores (wolf, bear). Some species benefit from new environmental conditions (newly created habitats as in urban areas, more availability of food), and some even have dramatic increases in their populations, such as in the case of several opportunistic or generalist species.

However, many more native species are declining, although so far the rate of total species disappearance (extinction) has been low in Europe, except for endemic species. Instances of species under pressure include:

- 64 endemic plants of Europe (including the Macaronesian islands) have become extinct in nature (8 in the 1980s and 9 in the 1990s), among which only 27 have been saved in cultivated form (conservation ex-situ) (Lesoueff, in prep.);

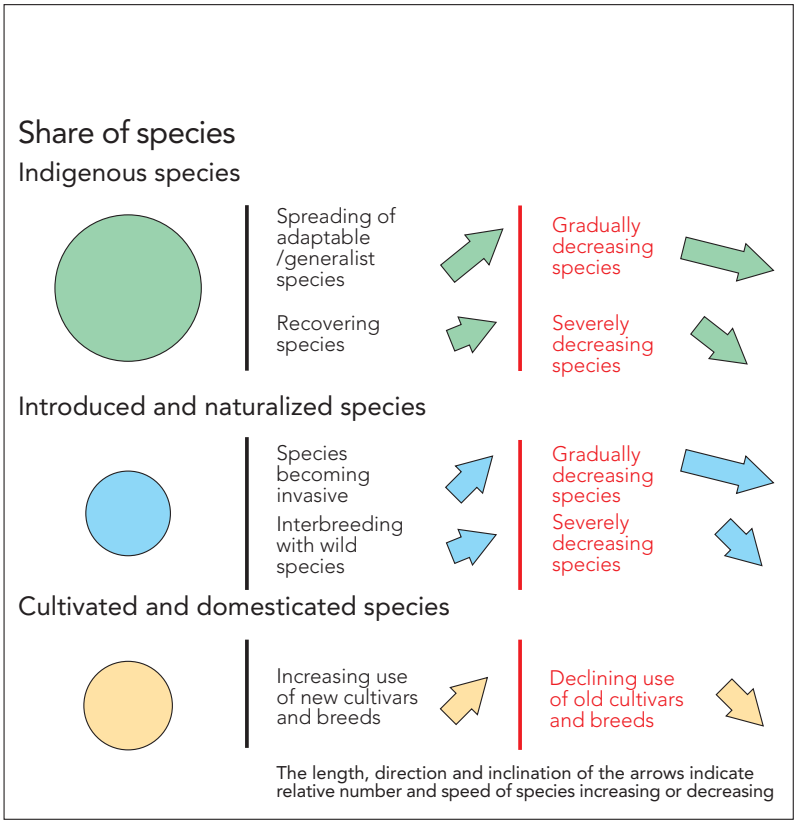
World imports of CITES specimens by the EU12 during the period 1990-1994 Figure 3.11.1

Specimen type	EU imports/ total world imports	Ranking of importance of EU imports worldwide	Origin of imports
Live African Finches	89%	1st	Africa
Live Parrots	74%	1st	
Nile Monitor skins	72%	1st	Africa
Alligator skins	59%	1st	USA
Reticulated Python skins	36%	1st	South-East Asia
Live primates	29%	2nd	
Nile Crocodile skins	28%	2nd	Africa
Caiman skins	17%	2nd	South America
Live Chameleons	13%	2nd	Africa
Live Poison Arrow Frogs	8%	2nd	South/Central America
Water Monitor skins	1%	6th	South-East Asia

Source: compiled from the annual reports of CITES Member States, Cites trade statistics; WCMC (Council of Europe, 1997)

- 38% of birds species are threatened, with vulnerable or endangered populations (Tucker *et al.*, 1994);
- 45% of European butterflies are threatened, with vulnerable or endangered populations (van Swaay *et al.*, 1997);
- of the 3 200 species of land and freshwater molluscs present in Europe, 145 species are considered as threatened at

Figure 3.11.2 **Important relative trends in vertebrates and vascular plants in Europe**



Source : ETC/NC; EEA

global level (Bouchet *et al.,* 1998);
- of the 1687 species and subspecies of Bryophytes occurring in Europe, at least 24% are threatened (European Committee for the Conservation of Bryophytes, 1995).

Meanwhile, more and more species, particularly plants, are introduced for economic or recreational purposes, sometimes with dramatic consequences in the case of invasive alien species, particularly in marine and freshwater ecosystems, and also in grasslands.

Interactions between species are disturbed, particularly prey/predator relations (herbivores/carnivores, hosts/parasites), leading to food web changes and general disturbance of the ecosystem. Species related to old habitats decline, while species related to young habitats with short rotation periods spread. There are also effects on indigenous gene pools, and increased risks of epidemics.

3.4. Habitats in Europe

In large areas of Europe, semi-natural and natural habitats are heavily affected by urbanisation and infrastructure, intensification or abandonment of agriculture, pollution, drainage and introduction of species. The small remaining area of natural, untouched habitat-types (mainly in high latitudes and mountain areas – see Chapters 3.13, 3.14, 3.15) are normally considered of very high conservation value and form central parts of national, European Union and international nature-conservation efforts. If these habitats are not secured, most of them will disappear.

But not only the untouched habitats are considered valuable for biodiversity. Many habitats of high biodiversity conservation value – the so-called semi-natural habitats – depend on long-term extensive management. Thus, out of the 198 habitat-types covered by the Habitats Directive, up to 29 are partly of anthropogenic origin and their maintenance depends on continued management in a fragile balance. These are, for example, extensive haymeadows, moorland and pastures subject to low-intensity grazing, chalk downs or scrub heathland grazed by sheep, and chestnut woods. Other habitat-types, though of natural origin such as dunes, salt meadows, steppes, bogs, several forest-types, are managed in an extensive way. Any drastic change in land use either towards intensification or abandonment, so-called polarisation, represents a threat for these habitat-types (Ostermann, 1998) (Table 3.11.3).

4. Habitats and ecosystems: integrating environmental changes

4.1. Habitat and ecosystem functionality: a condition for sustainability

Ecosystems and habitats are increasingly recognised for their functional role (Mooney *et al.,* 1996), and the need for sustainable management and use is becoming a general issue.

At global level, within the Convention on Biodiversity, major concerns focus on four types of ecosystems: agroecosystems, marine and inland waters, and forest ecosystems. At European level, the Pan-European Biological and Landscape Diversity Strategy (PEBLDS) recognises the importance of specific actions on forests, wetlands (including rivers), grasslands, mountains, and coastal and marine ecosystems. PEBLDS also stresses the importance of landscapes, in which ecosystems such as forests, lakes and rivers form a major structuring and functional role.

Forests and wetlands are illustrative examples of the importance of ecosystem functions

(Table 3.11.4).

Ecosystems continuously react on the multiple pressures exerted upon them and in doing so integrate varying kinds of changes in the environmental conditions, while also changing functionality (see Box 3.11.5).

4.2. Threatened habitats and ecosystems

There is no available 'European Red Book' of habitats. Annex I of the Habitats Directive as well as habitats considered for the EMERALD Network (Bern Convention, see Box 3.11.4) represent only a selection of habitats of European concern (Box 3.11.3). However, regional co-ordinated assessments are now developed in the framework of Conventions on marine habitats (Helsinki (Nordheim *et al.*, 1998), Barcelona and North Sea Conferences and OSPAR).

At national level, Germany was one of the first European countries to produce a Red Book of endangered habitats (Rieken *et al.*, 1994). The survey, published in 1994 shows that among the 509 habitat-types (excluding habitats such as buildings) which are found in Germany, more than two-thirds can be considered endangered, mostly those established in extreme ecological conditions such as peat bogs, moorlands, coastal habitats, or those resulting from long, traditional agricultural or forestry management. Of the remaining third, not endangered habitats, only 6% are of interest for direct nature conservation (Figure 3.11.3). As a result of shrinkage of natural and near-natural habitats, especially in the past five decades, today about

Threats by change in land-use to habitat-types listed in Annex I of the Habitats Directive (EU) — Table 3.11.3.

Threat to habitat-type from polarisation of the existing land-use	Number of Annex I Habitat-types threatened by land-use intensification	Number of Annex I Habitat-types threatened by abandonment of land-use
grazing	65	26
forage/hay	6	6
crops	4	1
forestry	57	–

Many Annex I Habitat-types will be threatened if the intensity of the land-use is chan-ged (intensification or abandonment). Total number of Habitat-types in Annex I = 198
Note: Several habitat-types can be subject to more than one of the land uses mentioned.

Source: ETC/NC

Importance of ecosystem functions: Forests and Wetlands — Table 3.11.4.

Functions	Forests	Wetlands
Production	wood, resins, tannins, latex, cork and bark, game fowls, mushrooms, berries etc.	fish, shellfis and crustaceans, game fowls, peat, water reed, spartina, salt
Recreational & social	aesthetic and spiritual values, hunting, fishing, bird-watching , sports, rural and urban landscape	
Regulation	climate moderation, carbon sink (forests, peats), air quality, water regulation and quality, soil reconstitution	
Protection	against natural risks, soil erosion, landslides, avalanches, noise, visual disturbance	diminish destructive effects of floods
Conservation of biological diversity	maintenance of current, and support of future biological diversity at genetic, species, habitat levels conservation of evolution potential	
Structuring	landscape structuring and linkage of natural areas in networks	

Source: Adapted from ECOFOR, 1997 and COM(95)189 final (European Commission, 1996)

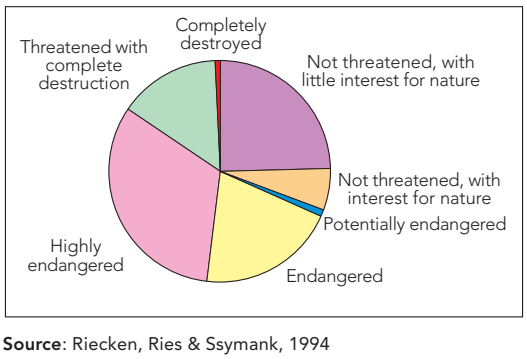
Box 3.11.3. Wetlands – a continuing cause for concern

Wetlands continue to be under particular pressure, with the drainage of extensive lowland areas for agriculture, forestry and urban development; the regulation of major river systems for power generation, water storage, navigation and flood control; and peat mining. In addition, wetlands suffer from heavy eutrophication and acidification, which was exacerbated during the 1970s, and from increasing consumption of groundwater (see Chapter 3.5). Another potential threat to coastal wetlands is a rise in sea level, due to climate change.

Wide differences in pressures exist across Europe. In general terms, industrialisation in north and west Europe has resulted in the greatest loss, degradation and fragmentation of wetlands, while agricultural intensification has reduced the area of wetlands by some 60% (European Commission, 1996). In the south of Europe, the long history of occupancy and often intensive use of Mediterranean wetlands place these areas under special stress, which in recent years has been exacerbated by low winter rainfall (Hails, 1996).

In central and eastern Europe, and in Fenno-Scandia, the lower degree of industrialisation, urbanisation and intensive agriculture means that far more extensive areas of natural and semi-natural wetlands remain. However, in Lithuania, 70% of wetlands have been lost during the past 30 years (Baskyté et al., 1998). The expected changes in central and eastern European countries – such as the expansion of industrialised agriculture – are a potentially severe threat to the many nearly intact wetlands.

Threat status of the German habitats — Figure 3.11.3



Source: Riecken, Ries & Ssymank, 1994

Species and Habitats in Europe

Compared with other continents, Europe's natural biodiversity is relatively poor, mainly due to the after-effects of glaciation. Nevertheless, the percentage of species occurring only in Europe is quite high for several groups (Table 3.11.5). This gives the continent a special responsibility for their conservation. The Mediterranean area houses an especially large part of the species.

Table 3.11.5.
Europe's share of some of the world's species groups (known orestimated)

Species group	Known species in the world	Known species in Europe	Percentage of the world's species present in Europe	Number of species occurring only in Europe	Species occurring only in Europe as % of species in Europe
Reptiles	6 500	198	3%	90	45%
Amphibians	4 000	75	2%	56	75%
Mammals	4 300	270	6%	78	29%
Freshwater fish	8 400	334	4%	200	58%
Breeding birds	9 600	514	5%	30	6%
Butterflies	30 000	575	2%	189	33%
Vascular plants	260 000	12 500	5%	3 500	28%

Source: Council of Europe, 1997; Davis et al., 1994; van Swaay et al., 1997; Walter and Gillett, 1997

The distribution of vertebrates and of vascular plants species within the different European countries concerned with the present report is as shown in Figure 3.11.4.

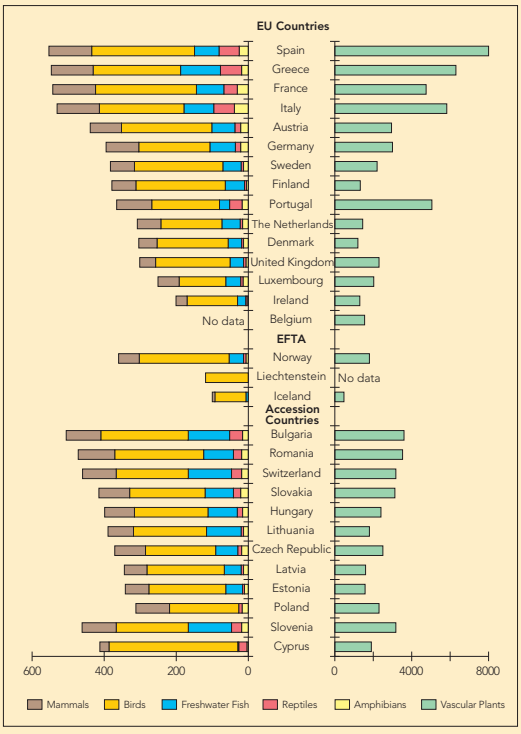


Figure 3.11.4

Number of vertebrates and vascular plants in some European countries

Source: For breeding birds: EIONET for AT, DK, FI, FR, DE, GR, LU, NL, NO, ES, SE. (Information received by ETC/NC in 1998). Other countries: European Bird Database (BirdLife International/European Bird Census Council), 1998. For other groups: EIONET information received by ETC/NC in 1997. Information on Cyprus: Cyprus Environment Service, 1998. Information on Ireland: Irish EPA, 1999

Climate, geomorphology, soil and history have resulted in variation among large biogeographic regions, recognised in the EU Habitats Directive and (for Europe as a whole) within the Bern Convention for the EMERALD Network since 1997 (Map 3.11.1).

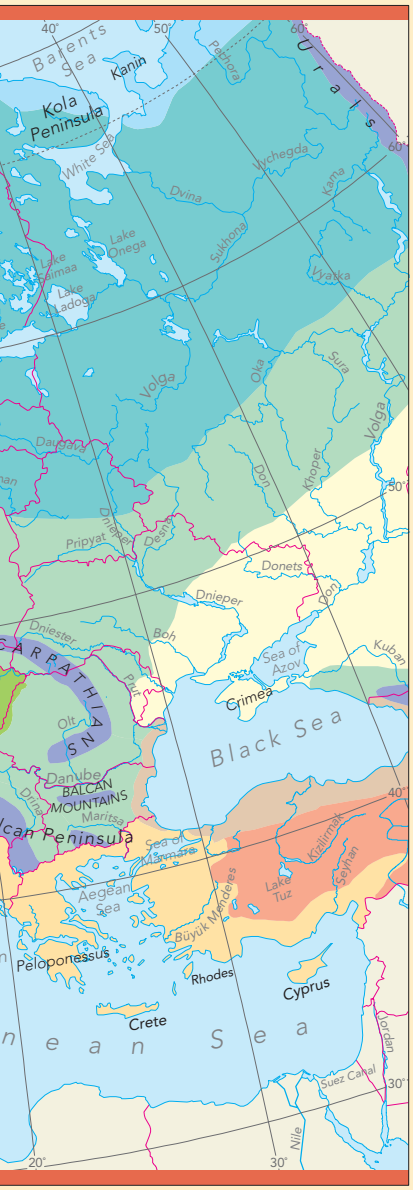
Box 3.11.4. Biodiversity: the main legal framework

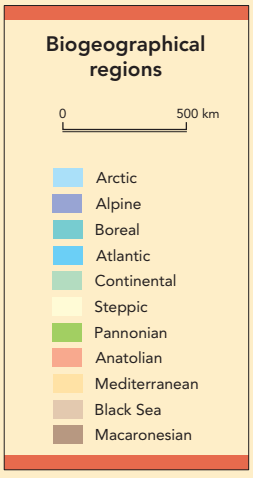
- The Convention on Biological Diversity (1992):
  - global
  - as a contracting party to the Convention, the EU has set up a European Community Biodiversity Strategy
- The Bern Convention (1979): Europe

As a contracting party to the Convention, the EU has set up:

- Directive 79/409/EEC on the conservation of wild birds (Birds Directive 1979)
- Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora (the Habitats Directive 1992).

Map 3.11.1
European biogeographic regions





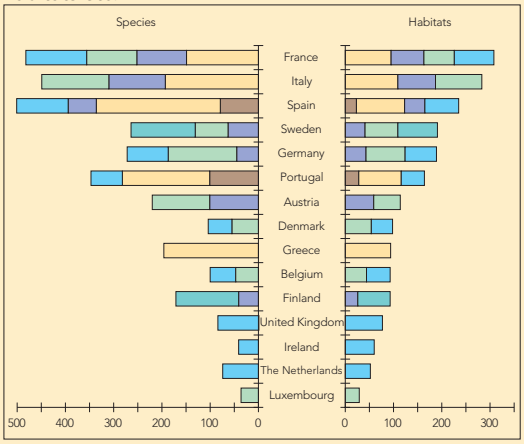
Source: European Commission DGXI; Council of Europe, 1997

Co-ordinated and harmonised information on selected species and habitats of European concern is collected at European level in relation to Community Directives (Birds and Habitats Directives for the NATURA 2000 process). Such information will soon be available also for non-EU countries, as a result of the preparation for accession and the implementation of international conventions such as the Bern Convention EMERALD Network (Resolution 4) (Kopaçi, 1998).

Distribution per biogeographic region of species and habitats listed under the Birds and Habitats Directives is shown in Figure 3.11.5; their distribution per country and per biogeographic region is shown in Figure 3.11.6. Figure 3.11.5 is not a direct indicator of each biogeographic region's richness in species and habitats, but underlines the share of European responsibility laid down in the Habitats Directive.

The full Mediterranean area – covering European, Asiatic and African coasts – is one of the most important centres of species richness in the world. More than 25 000 species, i.e. more than 10% of the world's flowering plants (phanerogams), occur in an area amounting to only 1.5 % of the earth's surface. About half of the species are endemic to the Mediterranean area. Around 200 phanerogams are in danger of extinction in the northern Mediterranean, and around 350 in the sourthern part. Animal diversity shows similar trends, though the species are less well known. The Mediterranean area is one of the worlds eight most important centres of origin for today's cultivated plants. The main pressures come from agriculture, such as severe overgrazing, and from fast-growing urbanisation and tourism. Coastal and marine habitats are especially threatened also due to water pollution, fisheries and species introduction. The impacts of climate change due to higher temperatures and less humidity may have grave effects. In half of the countries less than 2% of the Mediterranean systems are under nature protection, and for the whole region coastal protection is insignificant (Blue Plan, 1998).

In terms of number of habitats and species, three EU countries have a special responsibility: France and Spain, for four biogeographic regions, and Italy. Portugal shares with Spain an important responsibility for endemic species. The other biogeographic regions in the EU have other characteristic features of responsi- bility such as large areas for migrating and breeding birds, importance of forest or wetland habitats etc.



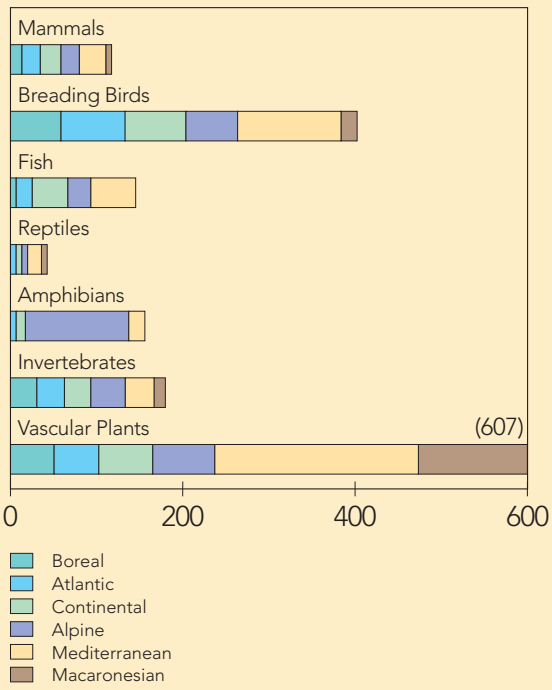


Figure 3.11.5
Number of Species and Habitats of the Birds and Habitats Directives, per biographic Region

Source: European Commission, DGXI; id, 1997; EBCC date: 1998

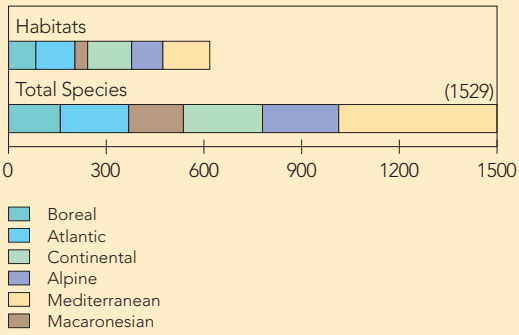


Figure 3.11.6
Share of responsibility for Annex I habitat-types and Annex II species conservation, per country for each biogeographic region

Source: ETC/NC

Box 3.11.5. Indications of forest changes in Europe

Apart from changes induced by management and silviculture, many types of changes are observed such as :

- The growing season of some tree species – i.e. the period within a year in which they grow – has slightly increased within a 30 years observation period (ETC/NC-EFI, 1998).
- Increasing growth trends (biomass production) in European forests, with possibly more vulnerability to drought, frost, diseases (ETC/NC-EFI, 1998).
- Shifts in natural forest species composition observed in two directions, towards oligotrophic acid or towards eutrophic conditions, leading to development towards other habitat-types.
- Nitrophilous plants are spreading, a favourite food of roe deer – maybe one reason for the increase in populations in large parts of northern and central Europe in the last decades (Wittig, 1992).

The condition of forests remains critical (Federal Research Centre for Forestry and Forest Products, 1998) and decline continues in large parts of Europe; minor improvements have been noted in possible response to favourable weather conditions or reduced acid deposition. In general, forest damages result from a multiple cause-effect complexity. Worsening areas are largely observed in the Atlantic (south), parts of the Mountainous (south) and in the Sub-Atlantic regions; also in the southern part of the Boreal region (regions as defined within the ICP programme – International Cooperation Programme on Assessment and Monitoring of Air Pollution Effects on Forests). Areas of improvement include parts of the Sub-Atlantic region, and most recently in eastern and central Europe. However, the trends vary considerably among species as well as locally.

110 natural ecosystem types, containing a total of nearly 73 000 animal and plant species, are restricted to 3-5% of Germany's land area. It is considered that of the 15% habitats threatened with complete destruction, 60% cannot or only can be partially restored.

4.3. What may happen to European Ecosystems in the future?

4.3.1. General assessment

As regards future pressures and impacts on biodiversity likely to occur towards the year 2010, the main assumptions are as follows:

- pressures are not uniform across regions and will continue to develop in different directions;
- over the coming decades, the global effects of land use on ecosystems and their underlying biodiversity are likely to be as or more significant as those associated with climate changes;
- influences from fragmentation are foreseen to increase;
- changes within the next decade may be less perceptible in regions which have been subject to under continuous heavy pressure and where biodiversity has already been severely altered, than in more pristine areas;
- eutrophication will continue to be an important pressure, although there may be localised reductions in nutrient levels;
- acidification of forests is likely to continue in areas already affected (central Europe and the northern Atlantic region), although some decrease is expected in the most seriously affected areas;
- intensification of agriculture can be expected to continue on a large scale in plains, notably in the Atlantic plains, and to occur locally in several regions;
- in northern countries intensification of forestry and afforestation will continue;
- land abandonment, mainly affecting grassland ecosystems, is likely to affect largely southern regions, with a consequent erosion of soil and an increase in fire risks. Land abandonment and marginalisation also concern continental and sub-continental middle mountains;
- introduction of species will continue, and use of GMOs will increase.

Pressures from land-use and pollution have different significance for habitat-types in the different regions of Europe. The maps (Box 3.11.7) based on the MIRABEL model show the predominant composite pressures on three widely distributed habitat-types: coniferous forests, dry grasslands and wet

Box 3.11.6. CAUTION:

Due to the huge complexity of processes involved and our limited understanding of how the system works, it is a big challenge to try to assess ecosystem biodiversity trends through modelling. Any attempt at quantifying trends should therefore be treated with great caution.

Environmental consequences of pressures related to land-use changes, pollution and climate changes have been assessed tentatively for this report mainly through the development of a conceptual framework, called MIRABEL (Models for Integrated Review and Assessment of Biodiversity in European Landscapes, developed in UK) (Petit et al., 1998). Based on literature references, expert opinion and, where possible, on semi-quantitative modelling, MIRABEL documents and suggests foreseen changes in the status of habitat/ecosystem-types of forests, grasslands, heathlands, arable lands, etc. Examples and analyses from other sources and models are included in this chapter.

Box 3.11.7. Regional predominant pressures on coniferous forests, dry grasslands and wet grasslands

Pressures from land-use and pollution have different significance for habitat-types in the different regions of Europe. The maps based on the MIRABEL model show the predominant composite pressures on three widely distributed habitat-types: coniferous forests, dry grasslands and wet grasslands. The arrows indicate the regions where the pressure occurs. The length of the arrows has no relation to intensity.

Regional predominant pressures

0 1000 km

- Natura 2000 key conservation sites
- CORINE key conservation sites

Map 3.11.2.

Source: doc MIRABEL pp 84-85 (Petit et al., 1998)

The site information used as background for the analysis was extracted from 1997 information on pSCIs (proposed Sites of Community Interest) and CORINE Biotopes.

Note: Data from NATURA database (blue) and CORINE-Biotopes database (red)

grasslands . The arrows indicate the regions, where the pressure occurs. The length of the arrows has no relation to intensity.

4.3.2. Fragmentation

The increasing demand for space (for uses such as agriculture, forestry, recreation, tourism, transport, housing, industry) leads to a human-induced fragmentation of habitats, and to increased influences from adjacent intensively used areas on smaller and smaller semi-natural and natural areas (see Chapter 2.3). Even measures to create protected areas or to promote environmentally friendly agricultural production cannot prevent influences and impacts if the areas of land involved are small. The effects on biodiversity are: reduced habitat size and

Box 3.11.8. Sustainable species populations in fragmented landscapes: the LARCH model

Fig. 3.11.7.

Marshland species on sites in fragmented landscapes – potential for maintaining sustainable populations of indicator species of birds and mammals

Source: Larch. R. Foppen & P. Chardon, Institute for Forestry and Nature Research (IBN-DLO), NL

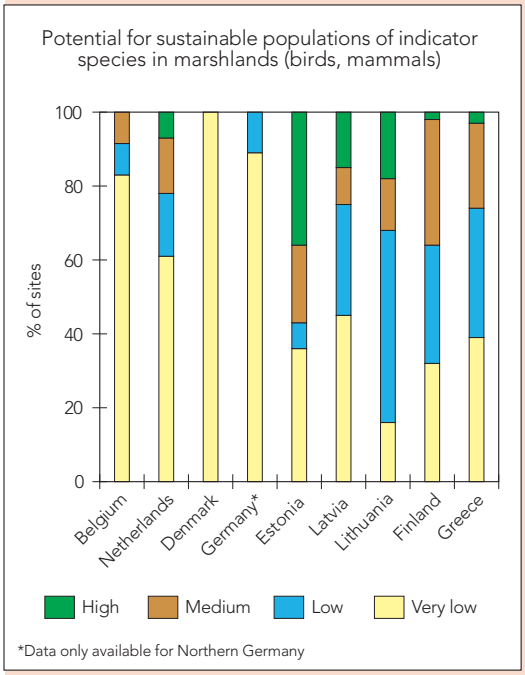
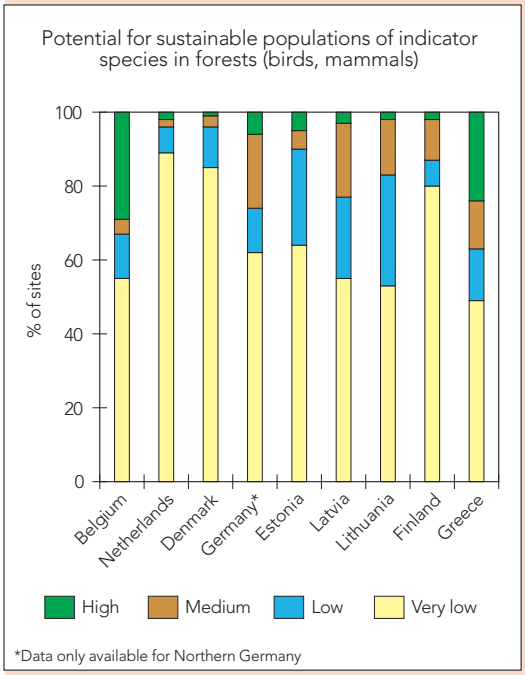


Fig. 3.11.8.

Forest Species on sites in fragmented landscapes – Potential for maintaining sustainable populations of indicator species of birds and mammals

Source: Larch. R. Foppen & P. Chardon, Institute for Forestry and Nature Research (IBN-DLO), NL



The LARCH model was developed in the Netherlands to evaluate sustainability of species populations in landscapes. It has been tentatively extended to a European scale (Foppen and Chardon, 1998). This type of support system could be applicable to the future NATURA 2000 Network. The results of a test on a selection of representative nature areas, using CORINE Biotopes data, are shown here.

The LARCH model depends on species characteristics and on landscape features: landscapes with a low spatial coherence (thus with a high degree of fragmentation) need larger key populations than landscapes with a high spatial coherence.

According to LARCH, the potentials for a high biodiversity in western Europe are low. The situation in some countries in eastern and southern Europe seems better, but is also critical (Figures 3.11.7. & 3.11.8.).

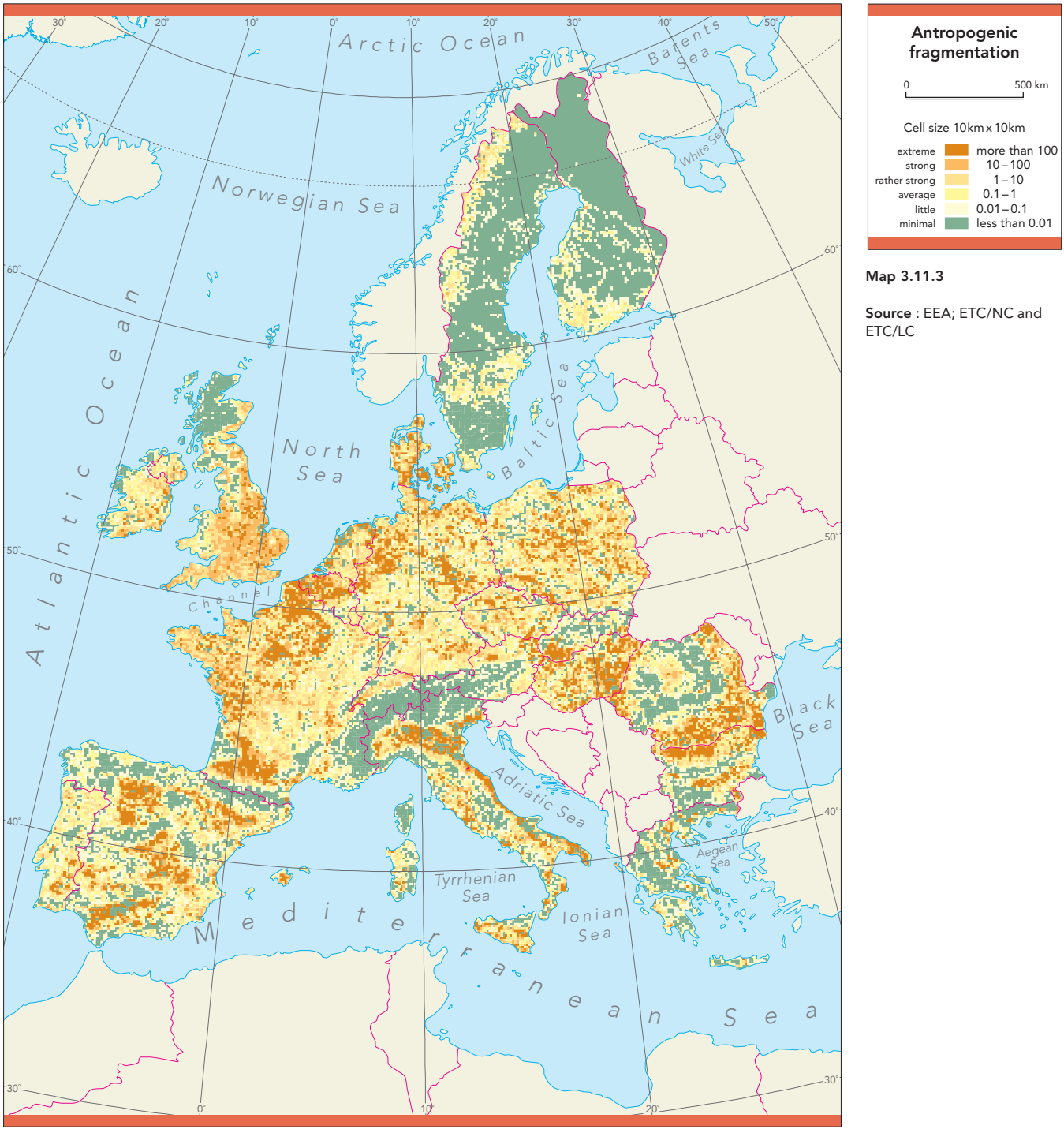
To increase the potential for sustainable populations both habitat quality and the degree of spatial coherence have to increase. To safeguard major parts of our biodiversity, it is important to ensure large nature reserves (>10 000 ha) linked in functional ecological networks.

The figures show the percentage of CORINE biotope sites with respectively very low, low, medium and high potentials for sustainable (viable) populations of indicator species in marshlands and in forests for different countries in Europe (Germany only for the Northern part):

- high potential: on the sites analysed more than ¾ of the indicator species may have sustainable populations (birds, mammals)
- medium potential: on the sites analysed ½ - ¾ of indicator species with sustainable populations;
- low potential: on the sites analysed ¼ - ½ of indicator species with sustainable populations;
- very low potential: on the sites analysed less than ¼ of indicator species with sustainable populations;

increased distance between suitable habitats for some species (barrier-effect), with detrimental consequences on the sustainability of core characteristic species and of species requiring large areas to survive (Box 3.11.8); and an increase in the perimeter/area ratio which facilitates the settlement of edge species. Opening up areas facilitates invasion of species. Chemical conditions (fertiliser, pesticides, salt, oil) and local climate conditions are influenced by adjacent areas, often up to several hundred meters. Disturbance and noise is also increasing steeply with fragmentation.

Thus multifactorial influences from fragmentation constitute a major combined pressure. Several types of fragmentation maps are being produced in Europe by different projects, showing somewhat different perspectives. The map presented here (Map 3.11.3) relates to pressures considered in detail in the chapters dealing with urban areas, coastal areas and mountain areas



Map 3.11.3

Source : EEA; ETC/NC and ETC/LC

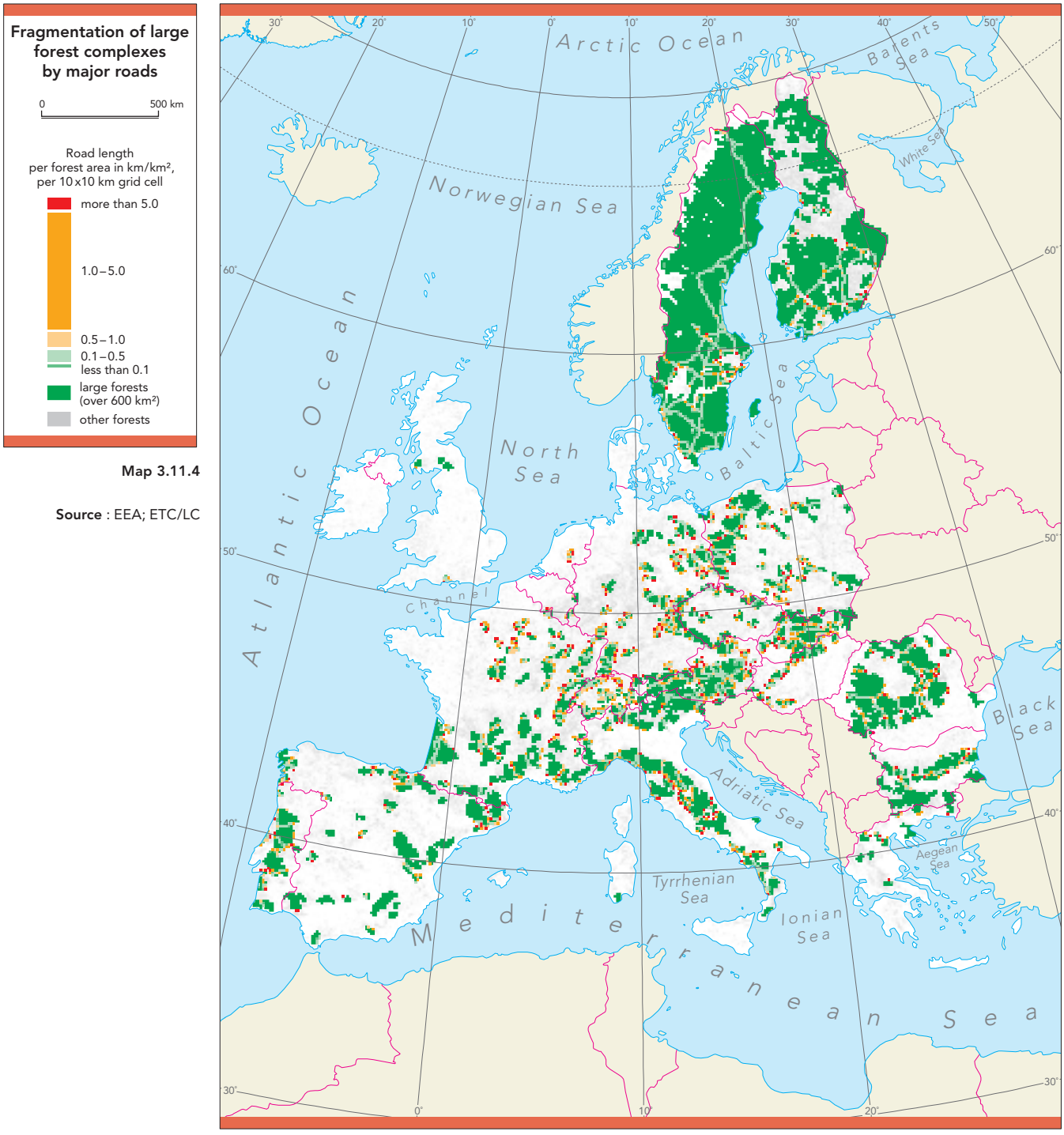
(Chapters 3.13, 3.14, 3.15).

The extent of urban areas is likely to increase by 5-8% between 1990 and 2010, while new transportation infrastructure is expected to claim 8 500 to 12 500 km² from other uses during the same period. This is likely to have a major effect. The existing fragmentation of large forest complexes in Europe is shown in Map 3.11.4.

4.3.3. Towards intensification or abandonment of agriculture: effects on grasslands – an example

The effects of intensification are normally radical, but vary greatly according to the type of agricultural area converted:

- from complex agricultural systems, often containing trees and many small extensively used habitats to arable monocrops;
- from permanent meadows and pastures to 'improved grasslands' with a high fertiliser input and in-sowing of grasses, favouring a small number of common



Map 3.11.4

Source : EEA; ETC/LC

grasses;
- from grasslands to cultivated fields, often accompanied by a changed water regime (drainage or irrigation);
- overgrazing and impoverishment of pastures, accompanied by soil erosion and compaction;
- loss of small biotopes (strips of meadows, hedges, tree stands along rivers and lakes, small ponds) related to increasing size of holdings or cultivation plot size.

The effects of marginalisation and abandonment can also vary greatly. When occurring in a previously intensive agricultural environment, abandonment can mitigate former fragmentation by creating corridors and providing new food and shelter. When occurring in extensively managed areas, abandonment can lead to development of

Box 3.11.9. Forecasted changes in pressure on grasslands from intensification or abandonment of agriculture

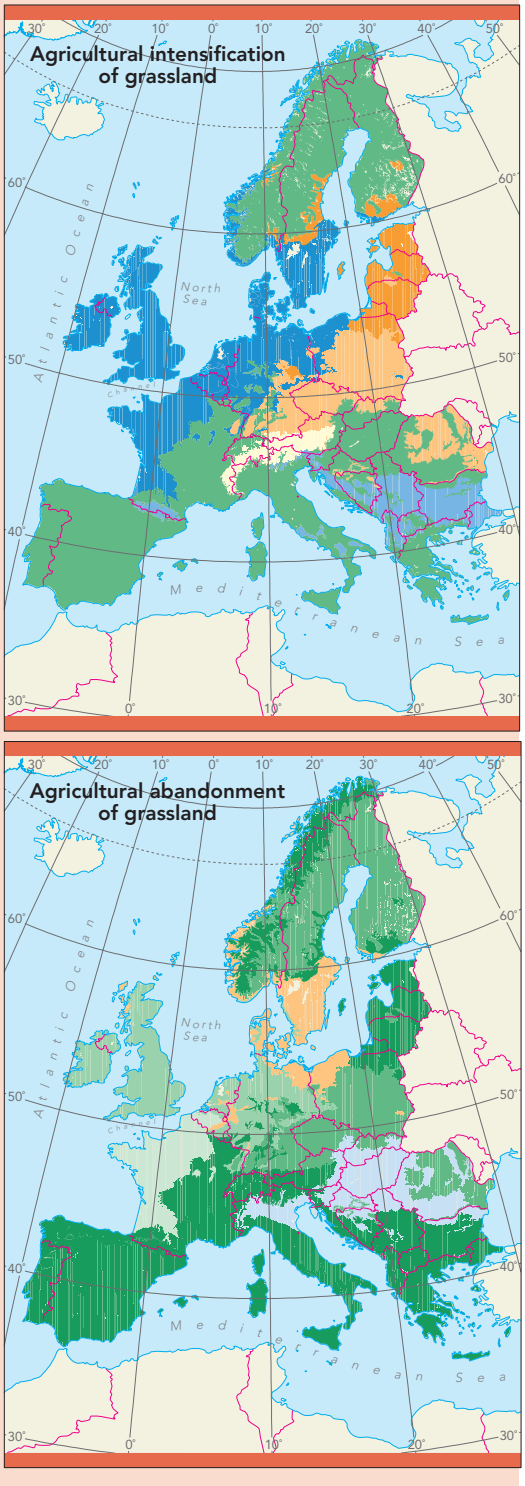
Maps 3.11.5. and 3.11.6. show forecast changes on pressures due to intensification and to land-abandonment on grasslands depending on 'ecological regions' as defined in MIRABEL.

The predictions were based on the following assumed rates of agricultural intensification and extensification:

- until 2005, CAP would follow the policies adopted under the 1992 reforms and developed in Agenda 2000;
- after 2005, EU would progressively liberalise its agricultural policy (Stolwijk, 1996);
- by 2005-6, the Central European countries would have joined the EU.

The intensification of agriculture is expected to have an increasingly detrimental effect on grassland habitats in eastern Europe. In regions in western Europe where grasslands have already been greatly changed in the past, the forecast changes are consequently expected to become less important. In the other regions, it is expected that the current level of ecological impacts will continue. Land abandonment occurs all over Europe albeit with significant differences in intensity and geographical distribution. In most regions, the recent trends are expected to remain the same as at present. In the Mediterranean region, as well as in continental middle mountains, land abandonment from agriculture will continue to be an important though local pressure. However, this assessment does not take into consideration the possible evolution of abandoned grasslands towards urbanisation.

Processes of intensification, extensification, marginalisation and consequent impacts on ecosystems, will be determined by local environmental and economic conditions. Experience shows however that earlier predictions of widespread abandonment in some regions seem not to have been fulfilled for example in Denmark (Bethe and Bolsius, 1995) and in France (Bontron, 1990).



Map. 3.11.5.

Source: MIRABEL (Petit *et al.*, 1998)

Map 3.11.6.

Source: MIRABEL (Petit *et al.*, 1998)

common highly dynamic habitat-types at the expense of specialist habitat-types often with long continuity.

Grasslands are likely to be heavily affected towards 2010 and onwards (box 3.11.9) by a combination of several pressures as a continuation of ongoing processes. Changes in the CAP set-aside rules and subsidies will be decisive in many areas.

Examples of effects of marginalisation, including consequences for species composition are shown in Table 3.11.6.

4.3.4. Climate Change

The way various pressures due to climate change combine and how they will counteract each other's impact in the future still remains very uncertain (Table 3.11.7).

The projections in the IS92 emissions scenario of IPCC – The Intergovernmental Panel on Climate Change (see Chapter 3.1) – of importance for biodiversity are:

- an increasing concentration of CO_2 from 350 ppmv presently to 500 ppmv in the year 2050;
- a rise in the global average temperature of the earth by about 1.5°C;
- a rise in sea level by about 30 cm.

Regional projections of climate are however less certain. Several models predict a roughly 2°C increase in temperature across Europe by 2050 but differ widely in their projections of precipitation change. Projections from the models should therefore be considered with extreme caution (Alcamo *et al.*, 1998; Viner

Table 3.11.6. **Selection of known examples of grasslands-types harbouring species of conservation interest and suffering effects of marginalisation**

Grassland-type and location	Type of marginalisation	Nature conservation implications	Other comparable situations
Flood meadows of Saône valley (FR)	Combination of intensification and abandonment	Threat to rare flora and birds (Crex crex, Numenius arquata)	Shannon river flood plain, Ireland
Upland grasslands of Jura (FR)	Decline in grazing of more remote pastures. Afforestation	Threat to flora	Upland pastures in several intermediate and marginal regions
Heather moorland, uplands (UK)	Abandonment of traditional management. Overgrazing	Changes to flora and vegetation	
Calcareous grassland, Nord-Pas de Calais (FR)	Localised abandonments of escarpments	Threat to flora and butterflies	Chalk grassland in south-east England
Steppes of Almeria (ES	Traditional dryland cultivation has been abandoned and converted mainly to irrigation and almond plantations	Local extinction of bird species: black-bellied sandgrouse (Pterocles orientalis) and little bustard (Tetrax tetrax)	Other steppe areas in Iberia threatened with irrigation and/or afforestation
Sub-alpine grasslands in Valle d'Aosta (IT))	Abandonment of grazing	Decline in populations of mole rat and Ursini's viper as well as some birds: chough (Pyrrhocorax pyrrhocorax), rock partridge (Alectoris graeca),	High mountain pastures in Pyrénées and Haut-Jura
Upland meadows Iberian mountains (ES)	Abandonment of transhumance and seasonal grazing	Threat to flora and endangered butterflies	Meadows in other mountain systems, e.g. Portugal, Cantabria
Lowland grasslands of Doñana National Park (ES)	Decline in grazing, partly due to restrictions imposed by Park	Threat to feeding grounds of Lynx pardina	Exclusion of grazing from afforested areas, e.g. Sierra de Gata
Olive grove pastures, Serra d'Aire e Candeiros (PT)	Abandonment of grazing	Threat to chough	Permanent pastures in many upland and coastal conditions

Source: amended from Baldock *et al.*, 1996; other sources: Broyer in Bignal, McCracken and Curtis (eds.), 1994; Bruneel in McCracken and Bignal, 1995; Barret *et al.*, undated; Manrique and De Juana in Goriup *et al.*, 1991; Viejo in McCracken and Bignal, 1995.

Predicted impacts of climate changes on various habitat/ecosystem-types depending on regions defined in the MIRABEL study

Table 3.11.7.

Source: Petit *et al.*, 1998

Habitat-type	Foreseen impact of climate change by 2050
Intertidal habitats, saltmarshes	Where coastal defences are few, will move inland.
	Possible extension of saltmarshes in areas where increase of rainfall only in summer will favour salt accumulation.
Coastal dunes	More rapid succession because of increased vigour of vascular plants (continental Hemi-Boreal).
Running waters	Increased winter flow and small spring flows will change sedimentation patterns (Boreal regions).
	40% loss of summer rainfall expected in Atlantic plains, with widespread drying-up of surface waters in summer.
	Loss of running water is expected to be widespread in southern Spain.
Bogs	Possibilities of methane release and faster ecosystem processes due to increased temperature in Boreal regions.
	Raised bogs should become less vigorous and bcome more vulnerable to other pressures. Will cease to grow at the edge of their range (sub-continental middlemountains).
	In central Europe rainfall does not rise, bogs will stop growing. According to the UK scenario, summer rainfall will increase by 30%, but due to increase in temperature, bogs may be invaded by trees.
	In the Alps, summer rainfall increasing by 41% could rejuvenate raised bogs.
Marshes and fens	Trends similar to those in running waters.
Dry grasslands	In general will be favoured, provided that grazing is maintained, except in regions where rainfall is expected to increase: central Europe, Alps, Pannonian and South European plains, Mediterranean and Thermo-Nemoral mountains. In these regions mesic grasslands will be favoured.
Alpine and sub-alpine grasslands	Will be liable to invasion by trees, but this is a slow process when grazing pressure is maintained.
Moss and lichen dominated habitats	Due to decrease of snow cover period, rapid invasion by grasses and other vascular plants.
	In high mountains can retreat to higher altitudes.
Dwarf-shrub communities	In several regions, increasingly invaded by scrubs and trees.
	In thermo-atlantic regions, sclerophyllous scrub will expand at expense of woodlands and temperate heaths.
	For arctic-alpine communities, only those in high mountain regions can retreat in higher altitudes
Broad-leaved woodlands	In all regions deciduous woodlands may expand to higher altitudes. In Boreal regions, the zone may slowly move northwards.
	In many regions, broadleaved deciduous woodlands will get more vigorous and more competitive in relation to Conifers in northern and central Europe.
	In Atlantic regions, dry summers to favour broadleaved evergreen species; viz Rhododendron ponticum on acid soils.
	In Southern Spain, it is expected to be too dry for trees to grow except in valley bottoms.
Coniferous woodlands	In all regions coniferous woodlands may expand to higher altitudes. In Boreal regions, will become more vigorous, with a higher upper limit in mountains. The process could be rapid. The Norway spruce may be damaged by excessive transpiration.
	Conifers, though growing rapidly will be in competition with broad-leaved trees but the process will be slow.
	In sub-continental middle mountains, the increase of average winter temperature will be unfavourable to more continental conifers such as Pinus nigra which may become more vulnerable to defoliation due to insects.
	In the Alps, increased rainfall should favour higher forest productivity and denser canopies.
	In general increased risk of insect attacks may occur especially in border zone of ecological range of tree species.

and Hulme, 1997).

Apart from an increase in temperature and possible changes in growing seasons, the main features foreseen are a continuous decrease of rainfall in southern Europe, and a significant increase of summer rainfall in the Alps, which represent the water reservoir of Europe, with likely important consequences on water regimes of rivers (see Chapter 3.15).

The ecological consequences will be felt through a gradual adaptation to the new conditions. Species with limited climatic adaptability and distribution as well as low dispersion capacity are likely to be severely threatened, while a large number of species may adapt through migration and selection (Box 3.11.10).

5. From policy to action

Box 3.11.10. Biodiversity change – model results for species and climate (see Chapter 3.1)

The EUROMOVE model estimates 'Biodiversity loss' based on assessment of potential changes in distribution of a selection of plant species (information on 1 492 species based on Atlas Flora Europaea) in relation to climate variables. The main trends expected are:

- Climate change will not have a dramatic effect on Europe before 2010: in most parts of northern and western Europe, the percentage of species with a stable distribution is between 80 and 100%, indicating stability. In parts of the Iberian Peninsula, France and eastern Europe, the percentage of stable species is less than 80%, which may indicate a potential significant change in biodiversity.
- Between 2010 and 2050 very pronounced changes in biodiversity can be expected. In large parts of Europe, less than 80% of the species will remain at the same locations. The southwestern part and the most eastern part (Russia) of Europe may suffer the highest changes in biodiversity; the loss of species might exceed 50%. The biodiversity in the northern part of Europe, the eastern part of middle Europe and Ireland and Scotland remains more or less stable during that period. The percentage of stable species in western Europe is between 65 and 80%.

Change in species distribution is an indicator for some biodiversity trends, but it cannot express the whole complexity of processes involved. In the case of climate change, some species are likely to disappear from specific regions, while others will find appropriate ecological conditions in the newly created environment. A critical issue is the time scale in which changes will occur.

Source : European Commission, 1999; EUROMOVE model (Alkemade *et al.*, in prep.)

A considerable number of activities for research, inventories and monitoring of biodiversity are organised at national, international and EU level, in order to improve knowledge of biodiversity. However, no general monitoring of changes in biodiversity in the EU exists at present (see Chapter 4.2), and aggregating and analysing the widespread information presents many difficulties. Among biodiversity-related policies, the following are of particular relevance for the European Union.

5.1. Birds and Habitats Directives

As stated above, a major contribution to the conservation of biodiversity at EU level is through the implementation of the Birds Directive and the Habitats Directive, setting up a coherent and representative ecological network of designated sites: the NATURA 2000 Network (European Commission DGXI, undated), including Special Protection Areas (SPAs), under the Birds Directive, and Special Areas of Conservation (SACs) under the Habitats Directive. Both Directives also regulate hunting, collection, transport and trade of some species, the latter in application of the CITES Convention. The two directives are seen as the main direct nature conservation related Community contribution to the Global Convention for Biological Diversity.

The Habitats Directive has brought new key concepts for conservation and has asserted others:

- importance of habitats;
- assessment of sites on the basis of biogeographic regions;
- the need for core area protection and for buffer zones and the importance of connectivity between core areas to ensure a real network function;
- the importance of maintaining or promoting specific human activities within the SACs in order to ensure the 'favourable conservation status' of species and habitats.

While SPAs are directly incorporated into the NATURA 2000 Network, as soon as designated by Member States, the network from SAC sites, under the Habitats Directive, is achieved through three distinct stages:

1. national inventories of sites including Annex I habitat-types and Annex II species by Member States and provision to the European Commission-DGXI of their list of potential Sites of Community Interest (pSCI);
2. assessments at European level of national pSCIs, in a biogeographic approach, and consultation between Member States and the Commision to establish the list of Sites of Community Interest (SCI);
3. once the SCI list is agreed, Member States have six years to designate the sites as SACs and to set up the corresponding conservation plans.

The emerging better co-ordination between Community or national measures from other sectors is very important, mostly in agriculture and infrastructure (Birdlife International, 1995) as well as pollution abatement (agriculture, transport, energy). As stressed in the Progress Review of the 5EAP (1996), until now, at EU level, the link between 'Nature' legislation (the Birds and Habitats Directives) and Common Agricultural Policy (CAP) has remained inadequate. Steady progress is beginning to show with the freezing of infrastructure co-financing by the EU, in case of obvious adverse effects on NATURA 2000 sites (e.g. Tagus Bridge in Portugal, estuary of the Seine River in France).

Various incentive measures which, in the future, could provide the best opportunities for implementing coherent actions in relation to NATURA 2000 (Sunyer and Manteiga, 1998) are those which, in the past years, were given the lowest funds, compared with high level funding for production, as in the case of Spain (Table 3.11.8). For afforestation programmes, their added-value to NATURA 2000 will only be effective if, contrary to the past, strict conditions of species used and location of plantations are respected.

The future progress and success of NATURA 2000 Network will depend closely on its adequate integration within Agenda 2000, including the extension of agri-environmental measures, support payments under the Less Favoured Areas Directive and the reorientation of Structural Funds (Goss *et al.*, 1998; WWF Europe, 1997). Also, since some Annex I habitat-types are forest habitat-types, sustainable forestry should be applied in a co-ordinated way.

People's involvement and partnership with land-managers and users remains a key issue as stressed during the Bath Conference on NATURA 2000 and People – a partnership conference held in June 1998 in Bath in the U.K.

Opportunities for Natura 2000: available Community budgets in Spain for rural development, agricultural production and conservation — Table 3.11.8.

Community Intruments	Average annual amount between 1995-1997 (in 1 000 euro)	Opportunities for Natura 2000
Crops production premiums	2 024 380	*
Livestock production premiums	868 764	*
FEOGA Orientation for structural measures in rural area	808 356	**
Afforestation measures (2080/92)	107 718 (in 1996)	**
Agri-environmental measures (2078/92)	125 250	***
LEADER: local projects for rural development	81 264	***
Measures for Less Favoured Areas	66 492 (in 1994)	***
LIFE-Nature	6 600	****

* very little opportunity, even conflicting effect; ** some opportunity, if well targeted; *** important opportunities, if well targeted; **** very suitable opportunities

Source: amended from WWF/Adena, 1998

5.2. LIFE-Nature

LIFE-II-Nature is the current EU financial instrument for direct nature conservation in a series starting in 1984 (ACE-biotopes), followed by ACNAT (from 1991), and LIFE-I-Nature (1992 to 1995). LIFE-II has run 1996-1999; negotiations for LIFE-III starting in 2000 were ongoing.

The amount available in 1997 was limited to 42 430 693 euros for new projects in 1997 and to 48 000 000 in 1998. Funding is given only to projects able to contribute to the implementation of NATURA 2000. The projects may also focus on the conservation of species listed in the annexes of the two Directives to carry out essential species-conservation actions which are complementary to the designation of the sites, as reflected in the two following examples:

- A co-ordinated approach to the conservation of the Brown Bear, a priority species (European Commission, 1997a) (see Chapter 3.15). Eight projects have been financed in five European countries where the bear appears in threatened populations (France, Spain, Greece, Italy and Austria).
- Action plans for Europe's globally threatened bird species prepared by BirdLife International, in partnership with Wetlands International: plans concern 23 of Europe's most endangered bird species.

LIFE-Nature supports incentive and demonstration projects and intervenes only for 50% or exceptionally 75% of the total cost of the project. Three main areas of action are concerned: to provide essential initial capital for investment works, non-recurring actions or recurring management practice, to stimulate demonstration projects, to prime larger-scale funding for long-term manage-

Progress in the implementation of the Birds and Habitats Directives

It is expected, that around 10% of the EU land area will be designated under the future NATURA 2000 Network. In addition, significant marine areas will also be designated. This will exert great influence on land development and spatial management policies not only in core areas, but also in the surroundings of the sites, to avoid the damaging effects of pressures on the site.

Thus Article 6 of the Habitats Directive provides an innovative mechanism for management of change and a framework for the balance between ecological and socio-economic interests, i.e combining conservation and sustainable use of resources.

Considering the formal entry of Accession Countries to the EU, two directives are therefore already of great interest in the enlargement process. The annexes of species and habitats to be considered in the enlargement have to be adapted to the context of the extension. Countries in accession are already preparing themselves for setting up national lists of pSCIs, such as building on the EMERALD Network initiative under the Bern Convention (The Council of Europe) as a parallel to the NATURA 2000 Network for non-EU countries. An important source of data for these countries is CORINE Biotopes data.

The designation of Special Protection Areas (SPAs) relates to 182 bird species and sub-species listed in Annex I of the Birds Directive, as well as migratory species, while the designation of Special Areas of Conservation (SACs) relates to 230 other animal species, 483 plants species (listed in Annex II) and 198 habitat-types (listed in Annex I) of the Habitats Directive.

The implementation process has proved difficult and has suffered many delays, particularly for the Habitats Directive, due to complex discussions and negotiations at national and local level between national authorities and landowners, farmers, foresters, hunters, etc.

Designation of Special Protection Areas (SPAs) under the Birds Directive

The Birds Directive has had positive impacts on restoring several bird populations by means of hunting bans (in the case of the Cormorant, *Phalacrocorax carbo*, the increase of the population is now so strong that is causes problems in several areas) and trade bans (the Mediterranean population of the Goldfinch, *Carduelis carduelis*, a popular cage-bird, is increasing in line with the steady transposition into national laws of regulations on the capture of birds and trade bans).

Assessment of the state and trends of Annex I bird populations within sites designated as SPAs is difficult because not all Member States have reported information about sites at the same level of detail. In several cases, sites are designated without information on the presence of Annex I birds and even less on bird populations.

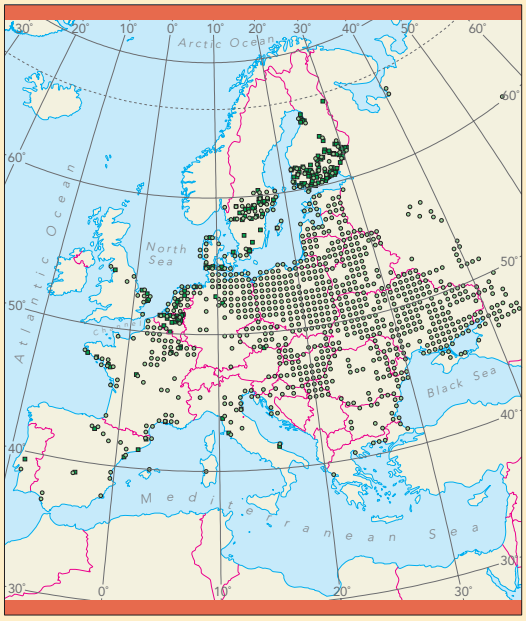
By 26 January 1999, 2 406 sites were designated as SPAs at various rates and covering different proportions of Member States' territories (Figures 3.11.9 & 3.11.10).

According to available 1997 data reported from Member States, several bird species populations are well protected within the total area of designated SPAs, others not as adequately. For instance, the only existing EU population of Zino's Petrel *Pterodroma madeira* is appropriately protected by just one SPA (in Madeira); on the contrary, 114 designated SPAs protect only 5% of the total EU population of the White Stork, *Ciconia ciconia*, which occurs in 11 of the 15 Member States with major populations in Spain, Greece, southern Portugal and eastern Germany. For four Annex I bird species (the Corsican and Sardinian Goshawk, *Accipiter gentilis arrigonii*, the Sardinian Rock Partridge *Alectoris graeca whitakeri*, the Blue Chaffin *Fringilla teydea* from the Canary Islands and the Gyrfalcon *Falco rusticola* in Sweden and Finland) no SPAs have been designated yet.

Map 3.11.7 shows, as an example, that the present designation of SPAs in EU does not satisfactorily cover the distribution range of the Bittern *Botaurus stellatus*, a threatened heron.

Proposals for Sites of Community Interest (pSCIs)

Assessment of Sites of Community Interest (SCIs) is done by biogeographic regions (see Map 3.11.1). By January 1999, 8 814 proposed (pSCI) sites were put forward for inclusion in the Community List of sites, representing about 8.5% of the EU land area (Figure 3.11.11). However, only 7 540 are so far documented with information permitting recording and assessment (EEA/ETC-NC, 1998; EEA/ETC-NC, in press).



Map 3.11.7
Botarus: Present EU designation of sites (Birds Directive SPAs) for the threatened bird Bittern in relation to its Western and Central European distribution (January 1999)

Source: ETC/NC

Final establishment of the Community list of SCIs is at present only met in the smallest of the six biogeographic regions, the Macaronesian, which covers just two countries: Spain and Portugal; pSCIs represent 36% of the area of the region.

The surface area of sites proposed by Member States differs widely. This can be due to large differences in the habitat-types, such as coastal and mountain areas, to the existence of still large remote areas in the country, and the political interest of Member States to designate in future large surfaces as SACs, including buffer zones (Figure 3.11.12).

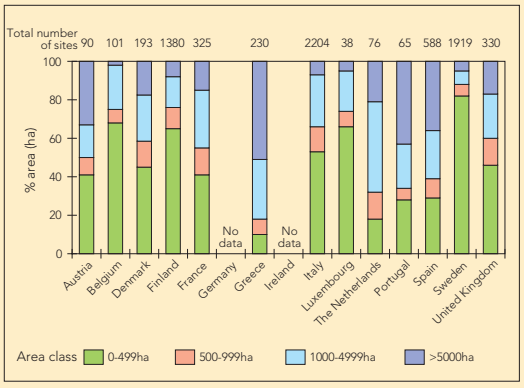


Figure 3.11.12
Number and percentage of pSCIs in Member States, shown in four categories of surface area. January 1999.

Source: ETC/NC

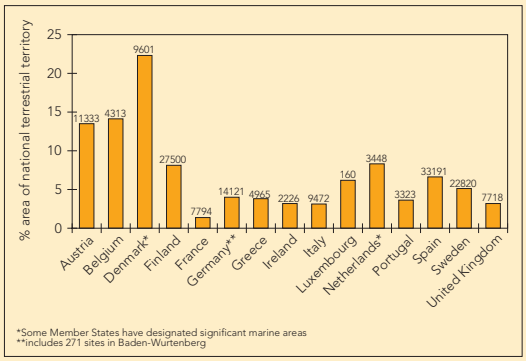


Figure 3.11.10
Proposed total area of Special Protection Areas (SPAs, including marine areas) as % of national terrestrial territory

Notes: 1. Some Member States, especially Denmark and the Netherlands, have designated significant marine areas. 2. The number of SPAs for Germany includes 271 sites (covering 86 km²) in Baden-Wurtenberg, that have been designated for nature conservation values other than the importance for birds.

Source: European Commission - DGXI, 1999

Region (area in 1000 km2) / Country	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	The Netherlands	Portugal	Spain	Sweden	United Kingdom
Boreal (total area 655.5)															
%pSCI area/biogeographic regions in country				13										3	
Number of pSCIs				1368										1563	
Atlantic (total area 780.5)															
%pSCI area/biogeographic regions in country		4	7		1	0		0			6	19	12		5
Number of pSCIs		47	48		118	0		0			76	4	70		330
Continental (total area 659.6)															
%pSCI area/biogeographic regions in country	9	8	6		1	0			8	13				9	
Number of pSCIs	46	54	146		145	0			519	38				248	
Alpine (total area 258.5)															
%pSCI area/biogeographic regions in country	12			90	7	18			21				36	36	
Number of pSCIs	42			19	74	7			518				27	109	
Mediterranean (total area 885.5)															
%pSCI area/biogeographic regions in country					3		17		13			12	13		
Number of pSCIs					77		230		1167			28	378		
Macaronesian (total area 10.5)															
%pSCI area/biogeographic regions in country												19	42		
Number of pSCIs												4	122		

Figure 3.11.11
Areas and numbers of sites of community interest proposed by Member States (pSCIs) by January 1999. Distribution in biogeographic regions.

Source: ETC/NC

NATURA BAROMETER
(As of 26/199)

Member State	Birds directive SPA classification					Habitats directive Proposed SCIs (stage 1)				
	No. of SPA's	Total area (km²)	Area maps	Inform -ation	Progress	Number of sites proposed	Total area (km²)	Site maps	Natura 2000 forms	National list
Belgium	36	4,313				102	913			
Denmark	111	9,601				194	10,259			
Germany	551	14,121				602	8,704			⊃
Greece	52	4,965				230	25,745			
Spain	170	33,191				588	70,250			
France	112	7,794				652	15,200 [1]			⊃
Ireland	109	2,226				48	542			
Italy	202	9,472			⊃	2,480	49,304			
Luxembourg	13	160			⊃	38	352		0	⊃
The Netherlands	28	3,448				76	7,330			
Austria	58	11,333				90	9,215			
Portugal	36	3,323				65	12,150			
Finland	439	27,500			⊃	1,380 [2]	47,500 [2]			⊃
Sweden	302	22,820		0	⊃	1,923	45,642			⊃
United Kingdom	187	7,718				333	16,885			
EU 15	2,406	161,985				8,801 [2]	319,991 [2]			

(1) Data for some sites is missing
(2) This figure is an estimate

Notes: Some member states have designated significant parts of their coastal waters (i.e. non land area). Certain sites have been, totally or partially proposed under both Directives. Only sites that have been formally and definitely proposed are taken into account in the Natura barometer. Some Member States have however also transmitted provisional lists: these are given in brackets.

Keys:

0 No, or insignificant classification
Classification notably insufficient
Classification incomplete
Classification complete
⊃ Significant progress since last Natura barometer

0 List insignificant or not transmitted
Partial but insufficient national list
Substantial national list but information still incomplete
Complete national list according to Member State, information transmitted is coherent

0 No transmission
Incomplete information or partial transmission
Complete for transmitted sites
Computerised and coherent or transmitted sites

NATURA BAROMETER
(Situation as of 1/4/96 on the basis of information transmitted officially by the Member States)

Member State	Birds directive SPA classification			Habitats directive SAC designation (stage 1)				
	Number of SPA's	Total area (km²)	Progress	National list	Number of sites	Total area (km²)	Site maps	Natura 2000 forms
Belgium	36	4,313		0	–	–	–	–
Denmark	111	9,601			175	± 9,000		–
Germany	494	8,537		0	–	–	–	–
Greece	26	1,916		0	–	–	–	–
Spain	149	25,338		0	–	–	–	–
France	99	7,069		0	–	–	–	–
Ireland	75	1,579		0	–	–	–	–
Italy	80	3,164			± 2,800	?	–	–
Luxembourg	6	14		0	–	–	–	–
The Netherlands	23	3,276		0	–	–	–	–
Austria	n/a	n/a			94	± 3,620		
Portugal	36	3,323			30 (Madeira + Azores only)	414		
Finland	15	n/a			370	24,726		–
Sweden	75	1,460			563	40,498		
United Kingdom	126	4,396			211	7,429		–

Note on SPA's
some member states, especially Denmark and The Netherlands, have designated significant parts of their coastal waters (i.e. non land area). Certain SPA's in Germany have been classified for nature conservation values other than their importance for birds.

Figure 3.11.9
Examples of the NATURA Barometer showing the pro- gress in Member States from 1996 until beginning 1999.

Source: European Commission, 1996 to 1998, Natura 2000. DGXI Newsletter NATURA Nos 1:1996 and 8:1999

ment of particular habitats and species through other financial mechanisms, i.e. the Agri-Environment Regulation, the Structural Funds and Cohesion Fund.

Some 335 PROJECTS have been financed under LIFE-II-Nature (1996 - 1999), largely on practical site-related actions. In 1998, 85 new projects were funded, most of them involving site related actions (75% relates to pSCIs, 22% to SPAs); to a lesser extent projects were directed towards priority species (3%).

The socio-economic environment in which projects operate is of paramount importance. Experience shows that dialogue and consultation with local communities provide more chance for conservation of biodiversity in the long run. In that sense, LIFE has an irreplaceable value for raising public awareness and encouraging innovative actions.

5.3. Agri-environmental measures

The agreement reached in March 1999 among EU ministers for agriculture on a reform of CAP targets farmers, consumers, the agri-industry, the environment and the EU economy in general (see below and Chapter 3.13) (Fischler, 1999). The reform builds upon the experiences gained by the Commission and Member States on earlier CAP and agri-environmental measures. Agri-environment measures and schemes were introduced in several EU Member States from the mid 1980s onwards. The establishment of national agri-environment programmes became obligatory for all Member States with the introduction of Regulation 2078/92/ECC as part of the CAP reform in 1992. They included such measures as reducing use of pesticides and chemical fertilisers, organic farming, protection of biotopes, maintenance of existing sustainable and extensive farming systems, protection of endangered farmed animals and plant varieties, and upkeep of landscapes (see Chapter 3.13).

There were considerable differences in the design of the 127 agri-environment programmes approved by the EU by June 1997 (European Commission, 1997b). Depending on the country, they have been prepared at either national or regional and local level, or various combinations of the two. The 2 200 different measures of the 1996 programmes fell in three broad categories, as shown in Figure 3.11.13, which gives the percentage of agriculture area in each country which was dedicated to these measures; this must be seen in relation to the total agricultural surface area of the Member States.

While the Netherlands dedicated up to two-thirds of its corresponding budget for training and demonstration projects, Finland, France, Portugal, Luxembourg, Sweden and some German Länder mostly invested in maintenance of extensive practices with significant impacts for preventing intensification, under-use or abandonment. Another interesting case is the variation in the budget dedicated to organic farming (see chapter 3.13).

Agri-cultural schemes, though important for the conservation of farmed environments of high nature value, for improved genetic diversity and for protection of agro-ecosystems, present a number of weaknesses (Petersen, 1998):

- competition with mainstream production support payments (such as the maize premium);
- insufficient administrative capacity and experience in many regions to handle this new policy;
- budget limitations (in 1997 only 3.7% of the total CAP budget, or 5% if Member State contributions were included; in some countries, a national co-financing contribution of 25% has proven difficult);
- the Regulation 2078/92 schemes remain viable only through additional measures for farmers (for example LEADER programmes; see Chapter 3.13);
- payments were not guaranteed to continue in the future;
- there was no comprehensive evaluation or monitoring of results.

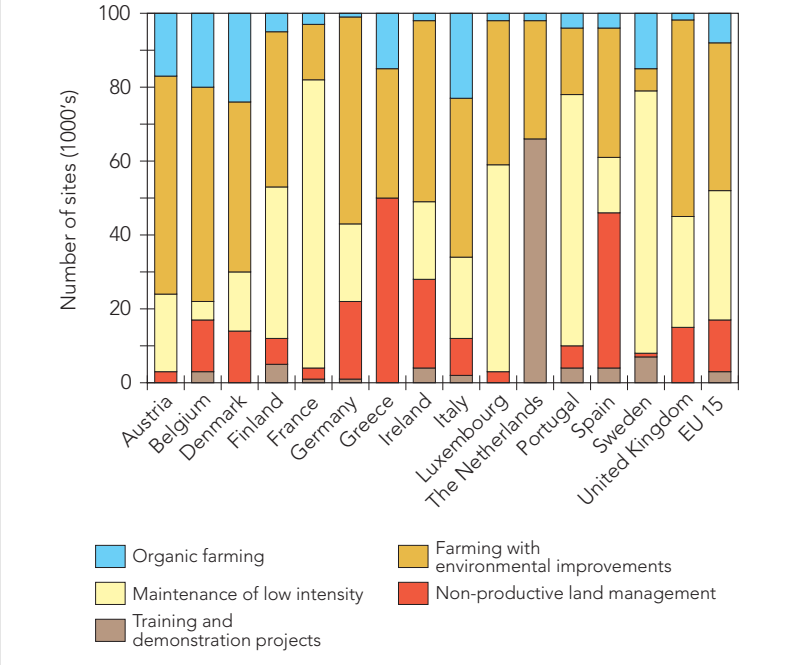
A more recent assessment (European Commission, 1998d) has however indicated growing positive results, especially in organic farming, nature-protection measures and maintenance of landscapes. By 1998 an average of 13.4% of EU farmers were involved with the programmes and 20 % of the total agricultural area in EU was covered.

Results of the 1999 CAP Reform are expected have both positive and negative impacts on biodiversity, but the full implications cannot yet be foreseen. An important concern for biodiversity is how Member States will comply with the terms attaching environmental conditions to direct payments to farmers. At present 42% of the Usable Agricultural Area in EU (UAA) is used to

produce arable crops of the types: cereals, oilseed and protein crops (COPs). With evolving pricing systems this area may change. The compulsory set-aside will be set at 10% only until 2002, after which it will be 0%. This may mean a re-establishment of the area of high-intensity agriculture in many regions. But voluntary set-aside will be maintained in particular to take account of environmental considerations. Grass for silage will be eligible for arable crops. The effect of the changed support to beef and milk cattle on maintenance of pasture grazing and on production of organic manure is unknown. Finally the extension of the traditional compensatory allowances to farmers in less favoured areas to areas where farming is restricted by the existence of specific environmental constraints represents an important challenge.

Estimated proportion of budgeted spending in each EU Member State (1996 programmes) by category of measure

Figure 3.11.13



Source: European Commission, 1997b

5.4. Towards sustainable forestry in Europe

With the anticipated enlargement of the EU, the importance of forest issues will be enhanced, with additional biological and cultural dimensions but also with new types of environmental problems.

The European Community at present has a number of specifically targeted regulations concerning forests (see Table 3.11.1). Following a 1997 European Parliament Resolution, the European Commission set out proposals for an EU forestry strategy, based on a recognition of the diversity of Europe's forests, their multifunctional role and the need for ecological, economic and social sustainability (European Commission, 1998). This strategy is in line with recommendations developed under the Kyoto Protocol on Climate Change, as well as with the pan-European Ministerial Conference on the Protection of Forests (Lisbon 1998) which adopted a work programme on the conservation and enhancement of biological and landscape diversity in forest ecosystems for the period 1997-2000 (PEBLDS, 1997) based on four main objectives:

- conservation and appropriate enhancement of biodiversity in sustainable forest management, including:
- adequate conservation of all types of forests in Europe;
- recognition of the role of forest ecosystems in enhancing landscape diversity;
- clarification of impact of activities from other sectors on forest biological diversity.

There is a growing interest among producers in obtaining certification of forests (in accordance with national development under the basic principles of the Forest Stewardship Council) and among consumers for information on products from certified forests presents another important path towards forest sustainability (FSC, 1999). A pan-European Forest Certification (PEFC) is foreseen to be operational in 2000.

5.5. Implementation of the global Convention on Biological Diversity by the European Community

All countries concerned with the present report have ratified the Convention on Biological Diversity (CBD) and many have consequently prepared national biodiversity strategies, to be followed up with action plans (Art. 6 of the CBD) related to specific themes. As such the Convention represents a major framework for developing integrative approaches of biodiversity into sectors. An important aspect developed within the Convention is the ecosystem approach (Lilongwe, Malawi workshop, 26-28 January 1998; UNEP, 1998) including 12 basic principles as a conceptual background for land-management planning, taking into account the importance of biodiversity for ecosystems functionality.

As a contracting party to the Convention, the EU developed a European Community

Biodiversity Strategy in February 1998 (European Commission, 1998b), which was adopted by the European Parliament in October 1998. Major themes for action are: conservation of biodiversity, sustainable use of biodiversity, sharing benefits of the use of genetic resources, research, monitoring and exchange of information, education, training and awareness. Eight 'sectors' or policy areas of relevance to biodiversity are highlighted: conservation of natural resources, agriculture, forestry, fisheries, regional policies and spatial planning, transport and energy, tourism, development and economic co-operation.

The strategy is foreseen to be implemented through Action Plans and other measures to be presented by the relevant services of the Commission (DG VI, DG XVI, etc.) by February 2000. The process will be overseen from a number of 'focal points' that will be established within the Commission.

By reinforcing some aspects of the 5EAP, the Strategy constitutes a new, major consistent approach to the integration of biodiversity concerns into other policy areas and provides a methodology for achieving environmental objectives.

The identification of practical biodiversity indicators, to monitor the effects of policies on biodiversity under the CBD, is an important part of the process. The indicators are discussed within the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention (SBSTTA, 1997). The choice and development of biodiversity indicators need careful co-ordination, since several other indicator initiatives for biodiversity are ongoing at international and Community level as well as in most Member States. Lack of co-ordination may lead to confusion in data collection and reporting. At European level, the European Environment Agency, EUROSTAT and OECD are involved with Member States in developing indicators suitable for the environmental reporting process.

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