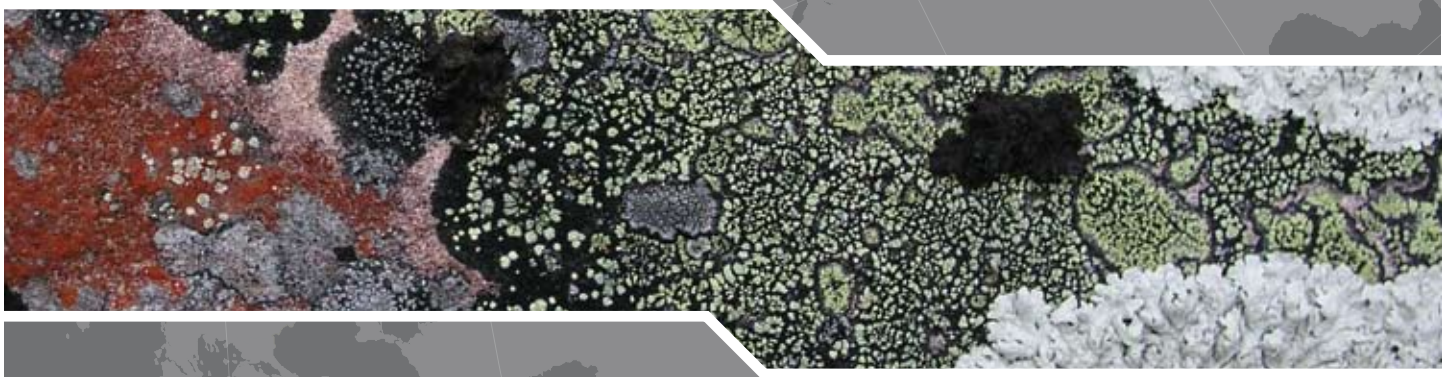
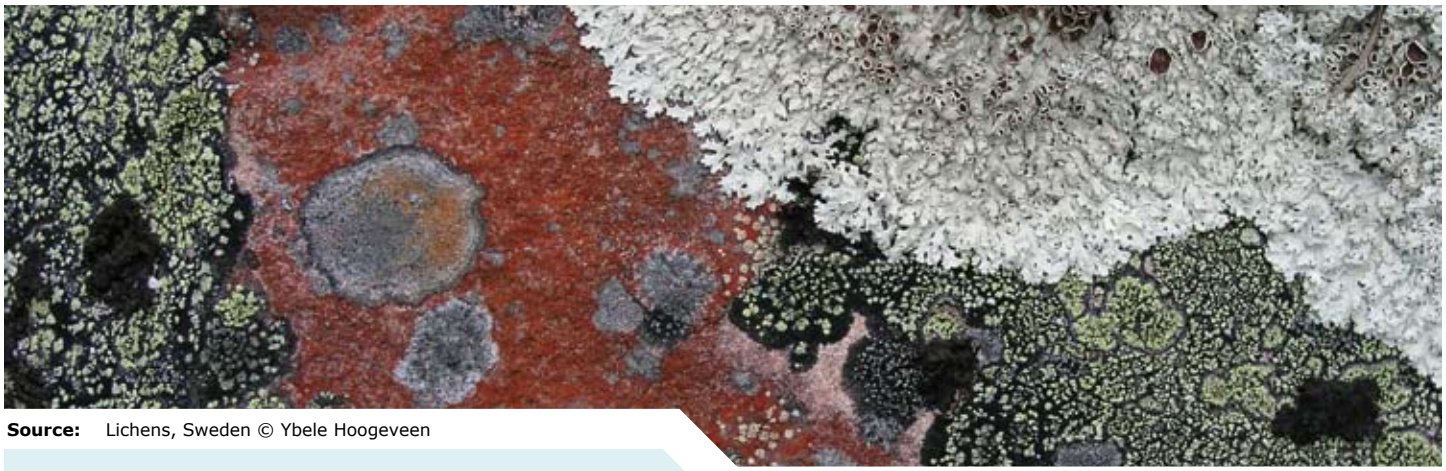
04

Biodiversity



4 Biodiversity



Source: Lichens, Sweden © Ybele Hoogeveen

Key messages

- Biodiversity decline and the loss of ecosystem services continue to be a major concern in the pan-European region. The target of halting biodiversity loss by 2010 will not be achieved without additional efforts.
- The main pressures on biodiversity continue to be urban sprawl, infrastructure development, acidification, eutrophication, desertification, overexploitation, and intensification of agriculture and land abandonment. Climate change is increasingly recognised as a serious threat, particularly to coastal, arctic and alpine habitats and species.
- More than 700 European species are currently under threat. 43 % of European bird species have an unfavourable conservation status.
- There has been significant progress in creating ecological networks, particularly with the Pan-European Ecological Network and the Natura 2000 network, which now covers about 17 % of the total EU-25 land area. However, there is little information on the conservation status of these networks.
- National forest plans that link sustainable forest management with an ecosystem approach are being implemented. The annual harvest of wood remains well below its annual increment, and primary forests (those hardly affected by human activity) make up about a quarter of the total forest area. However, illegal logging and human-induced forest fires are a growing problem, particularly in EECCA and SEE.
- The general biodiversity trend on agricultural land is negative despite agricultural policies being increasingly geared towards biodiversity conservation. The area of agricultural land in use has decreased and management of the remaining areas has intensified. Identification of high nature value farmland by 2006, a target of the Kiev Resolution, has not been fully completed. The proportion of these areas under favourable management cannot yet be assessed.
- The number of invasive alien species in the pan-European region continues to increase. Although the problem is recognised in most countries and strategic action is being taken, the efficiency of control measures needs to be increased by better monitoring and early warning systems.
- There are major data gaps on species, habitats and related landscape parameters. There has been progress in developing headline indicators for evaluating the 2010 target, but adequate funding for the long-term monitoring needed has not yet been forthcoming.
- Participation and awareness of biodiversity issues is growing and the Kiev Resolution target of implementing Communication, Education and Public Awareness (CEPA) programmes in half the pan-European countries by 2010 seems achievable.

4.1 The commitment: halting biodiversity loss by 2010

The loss of biological diversity and its components (genes ([1]), species, habitats and ecosystems) is an issue of global concern. It is inextricably linked to the degradation of ecosystem services, the natural production capacity and regulating processes that are essential for the sustainable use of the earth's resources and, ultimately, human well-being. Evidence is growing that these services are under great pressure due to human-induced climate change and the over exploitation of natural resources (Millennium Ecosystem Assessment, 2005).

The UN Convention on Biological Diversity (CBD), adopted in 1992, marked the political recognition of biodiversity loss as a serious problem, and the start of global action. Several thematic work programmes have been initiated under the CBD, focusing on the biodiversity of marine and coastal areas, agriculture, forests, inland waters, dry and sub-humid lands, and mountains. In addition, a number of cross-cutting issues, such as invasive alien species, awareness-raising, and indicator development, are being tackled. The target of halting the loss of biodiversity by 2010 was an EU initiative, first adopted in the 2001 EU Strategy for Sustainable Development and later incorporated into the EU's Sixth Environment Action Programme (2002). Subsequently, the CBD (2002) and the World Summit on Sustainable Development (2002) largely endorsed this at the global level, agreeing on a 'significant reduction' of the current rate of biodiversity loss by 2010.

At the pan-European level, the framework for action is the Kiev Resolution on Biodiversity, endorsed by the European environment ministers. In order to halt biodiversity decline by 2010, key targets have been adopted regarding a pan-European ecological network, agriculture and biodiversity, forests and biodiversity, invasive alien species, financing, monitoring and indicators, and public participation and awareness (see Box 4.1). For the EECCA countries, the implementation of the targets falls within the scope of the EECCA Environment Strategy. This is comparable to the Sixth Environment Action Programme and addresses a range of governance aspects, such as environmental impact assessment (EIA) procedures and compensatory mechanisms for biodiversity loss, as well as funding and the creation of ecological networks of protected areas (UNECE, 2003b).

An initiative, Streamlining European 2010 Biodiversity Indicators (SEBI), was taken in 2004 to develop biodiversity indicators for the pan-European region. Its aim is to provide proper feedback on policy achievements and on progress towards the 2010 target. SEBI is a cooperation between several international institutes, coordinated by the European Environment Agency. This chapter largely builds on the indicator framework developed by SEBI.

The next section provides an overview of the current status and trends of species, ecosystems and habitats and the main threats to biodiversity. The remaining sections examine progress on the main lines of policy action set out in the Kiev Resolution: spatial measures to create ecological networks; the integration of biodiversity concerns into agriculture and forestry; coordinated action against invasive alien species; biodiversity indicators and monitoring; and public awareness. The focus is mainly on terrestrial ecosystems, as the marine and coastal environment is dealt with in Chapter 5. Funding issues are not covered.

4.2 The case: Europe's threatened biodiversity

4.2.1 Biodiversity distribution and trends

Biodiversity assessments require an explicit geographical scale and reference situation as well as appropriate units of measurement (species, habitats, ecosystems). The relation between local species richness and biodiversity value is not straightforward. Habitats or ecosystems may be naturally species-poor, but nevertheless contribute substantially to overall biodiversity at a higher

([1]) Genetic diversity is not dealt with in this chapter.

Box 4.1 The Kiev Resolution on Biodiversity

Main aim: halt the loss of biological diversity at all levels by 2010, mainly through achieving the following key targets:

Pan-European Ecological Network

- By 2006, the Pan-European Ecological Network (core areas, restoration areas, corridors and buffer zones, as appropriate) in all states of the pan-European region will be identified and reflected on coherent indicative European maps, as a European contribution towards a global ecological network.
- By 2008, all core areas of the Pan-European Ecological Network will be adequately conserved and the Pan-European Ecological Network will give guidance to all major national, regional and international land use and planning policies as well as to the operations of relevant economic and financial sectors.

Agriculture and biodiversity

- By 2006, the identification, using agreed common criteria, of all high nature value areas in agricultural ecosystems in the pan-European region will be complete. By 2008, a substantial proportion of these areas will be under biodiversity-sensitive management by using appropriate mechanisms such as rural development instruments, agri-environmental programmes and organic agriculture, to *inter alia* support their economic and ecological viability.
- By 2008, financial subsidy and incentive schemes for agriculture in the pan-European region will take the conservation and sustainable use of biodiversity into consideration.

Forests and biodiversity

- By 2008, contribute to the implementation in the pan-European region of the Forest Biodiversity Expanded Programme of Work of the Convention on Biological Diversity through, *inter alia*:
  - implementation of the objectives and activities of the Framework for Co-operation between the Ministerial Conference on the Protection of Forests in Europe and the Environment for Europe/Pan-European Biological and Landscape Diversity Strategy;
  - national forest programmes according to the MCPFE Approach to National Forest Programmes in Europe (adopted at the Vienna Conference in April 2003);
  - application of the ecosystem approach.

Invasive alien species

- By 2008, the pan-European Strategy on Invasive Alien Species developed under the Bern Convention, fully compatible with the Guiding Principles of the Convention on Biological Diversity, will be implemented by at least half of the countries of the pan-European region through their respective biodiversity strategies and action plans.

Financing biodiversity*

- By 2008, there will be substantially increased public and private financial investments in integrated biodiversity activities in Europe, via partnerships with the finance and business sectors, that have resulted in new investment opportunities and facilities as outlined by the European Biodiversity Resourcing Initiative, taking into account the special needs of the countries of central and eastern Europe, the Caucasus and Central Asia.

Biodiversity monitoring and indicators

- By 2008, a coherent European programme on biodiversity monitoring and reporting, facilitated by the European Biodiversity Monitoring and Indicator Framework, will be operational in the pan-European region, in support of nature and biodiversity policies, including by 2006 an agreed core set of biodiversity indicators developed with the active participation of the relevant stakeholders.

Public participation and awareness

- By 2008, at least half of the countries in the pan-European region are implementing national 'communication, education and public awareness' action plans, in line with the CBD's Global Initiative on Communication, Education and Public Awareness, in order to communicate biodiversity and landscape policies and to increase multi-stakeholder participation, particularly indigenous and local communities, in their implementation.

Note: * = Not dealt with in this chapter.

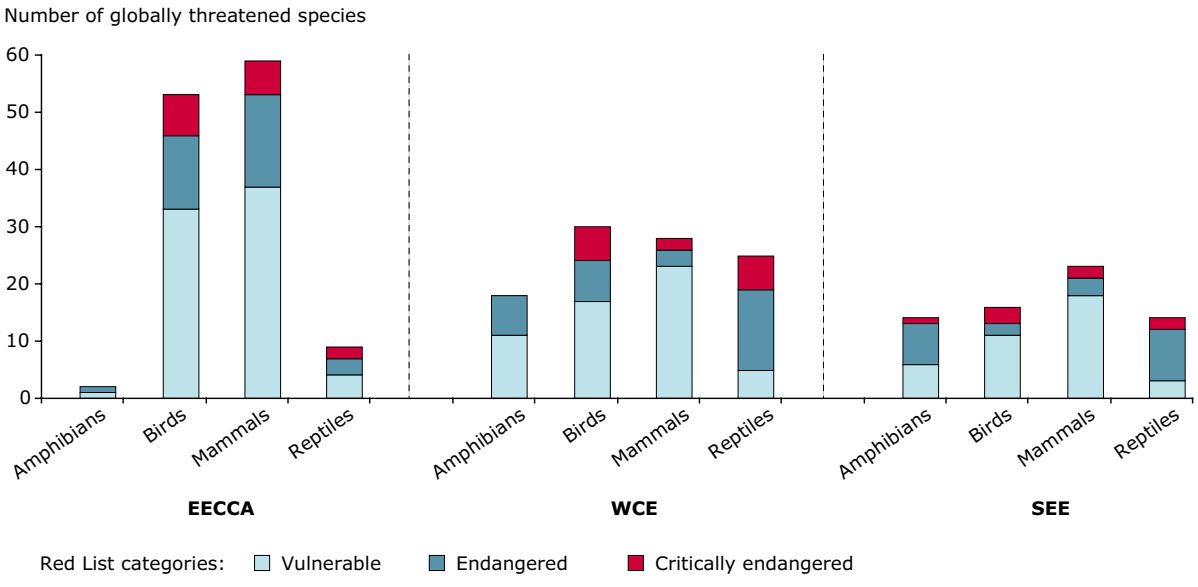
Source: UNECE, 2003a.

level (Hoogeveen *et al*., 2001). Several approaches to setting conservation priorities have been suggested (Brooks *et al*., 2006; Davis *et al*., 1994, 1997; Anderson, 2002; Anderson *et al*., 2005; Van Swaay and Warren, 2003; Heath *et al*., 2000). Particularly relevant for assessing Europe's contribution to global biodiversity are the biodiversity hot spots as identified by Conservation International (Mittermeier *et al*., 2005, see Box. 4.2) and the global species red lists (IUCN, 2006a). In the absence of quantitative data for habitats and ecosystems (particularly in the EECCA and SEE regions) this assessment builds mainly on species. Red lists of endangered species are a tool for assessing biodiversity trends (Butchart *et al*., 2004, 2005). Common species in the wider countryside, however, are also covered to obtain a general indication of the sustainability of land use. Case studies are used to highlight particular issues, especially in biodiversity hot spots.

According to the IUCN Red List of Threatened Species (IUCN, 2006a), 16 119 plant and animal species are threatened at the global level, 729 of them occurring in Europe. Mammals and birds account for the highest numbers of vulnerable and endangered species (see Figure 4.1). Critically endangered mammals are the Iberian lynx and the Mediterranean monk seal, which are on the brink of extinction as the result of habitat destruction, degradation and fragmentation as well as disturbance (Palomo and Gisbert, 2002; Ward, 2005; MOm/Hellenic Society for the Study and Protection of the Monk Seal, 2006; UNEP/MAP, RAC/SPA, 2003). Of European bird species, 43 % have an unfavourable conservation status (Birdlife International, 2004). Subsequent red lists reveal that the overall status of European and Central Asian birds deteriorated between 1994 and 2004 (see Figure 4.2). Only the Caucasus shows a (minor) increase. The situation for freshwater fish is even more critical (Map 4.1). In the Mediterranean region 56 % of the 252 endemic freshwater fish are threatened with extinction and seven species are now extinct. Pollution, water extraction and droughts are considered to be the main threats. Other major threats are posed by invasive species and the construction of dams (Smith and Darwall, 2005).

Figure 4.3 shows that, of the more common bird species, forest and particularly farmland birds have declined. The initial steep decline of farmland birds is associated with increasing agricultural specialisation and intensity in some areas, and large-scale marginalisation and land abandonment in others. The falling trend has levelled off since

Figure 4.1 Globally threatened terrestrial vertebrates in the pan-European region



Source: IUCN, 2006a.

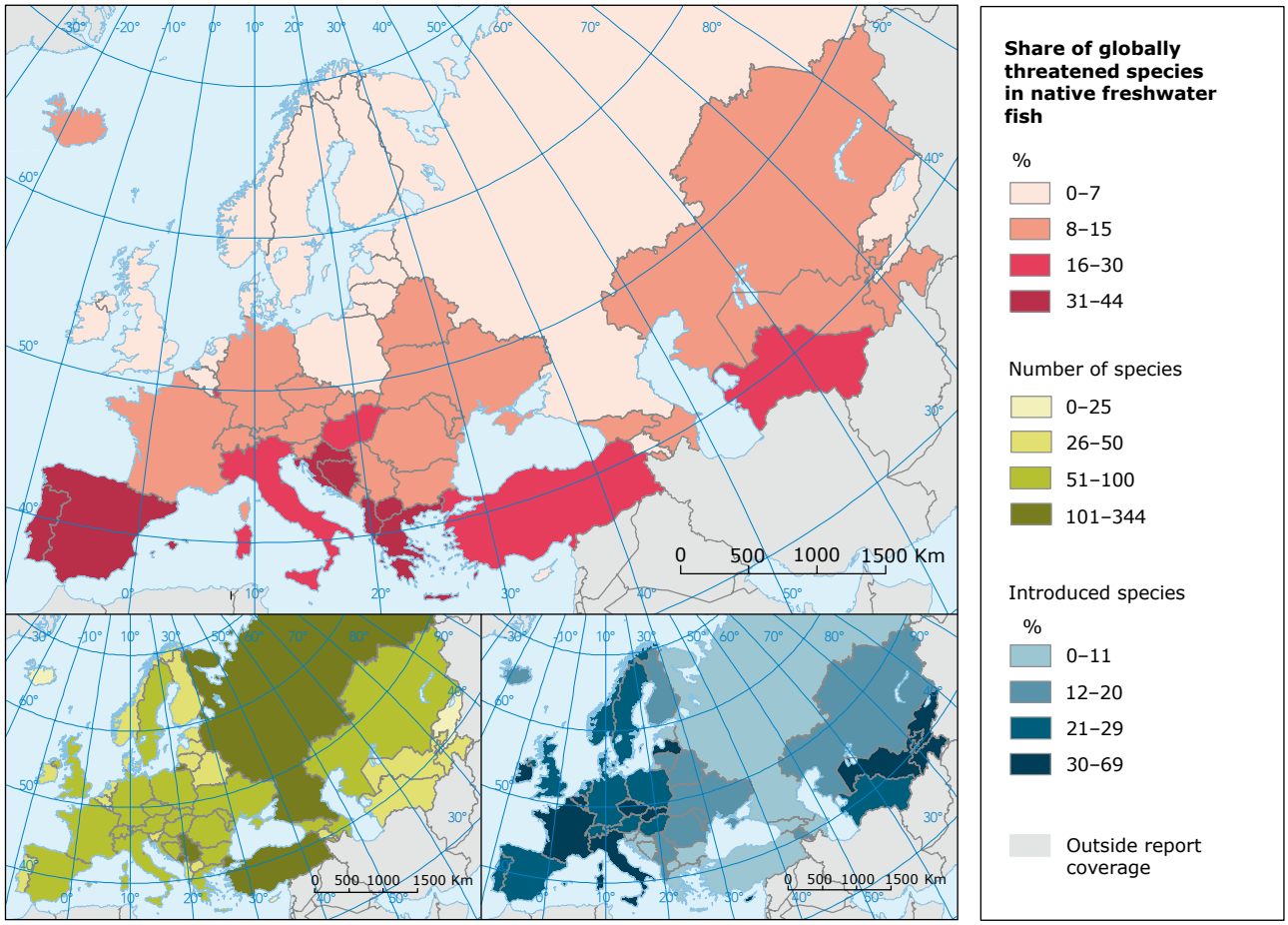
the late 1980s, partly because of stabilising inputs of nutrient and pesticides in the EU-15 and partly because of drastically lower inputs in EU-10 as a result of political reforms and the resulting economic crisis in the agricultural sector. Renewed agricultural intensification in the eastern regions, combined with further land abandonment throughout Europe, is expected to lead to further decline.

4.2.2 Land-cover change

One of the general factors underlying the above trends is land-cover change, the dynamics of which vary greatly across Europe. WCE has experienced rapid urbanisation, infrastructure development and the modernisation of its agriculture with resulting large-scale habitat loss and degradation. At the other extreme, huge undisturbed areas remain in what is known as the 'Great Euro-Asian Nature Backbone', ranging from the vast forests in Russia and Siberia in the north to the mountains, steppes and deserts of Central Asia in the southeast.

Figure 4.4 shows changes in land cover that have occurred in WCE between 1990 and 2000. A large part of this region has effectively become urban in character, with massive sprawl around the existing urban centres in much of lowland Europe, and along the coasts. In many places agriculture has been marginalised as an economic activity, often with resulting land abandonment. Elsewhere new areas may be taken into production, but on average

Map 4.1 Distribution of freshwater fish in the pan-European region



Source: EEA-ETC/BD, 2006.

Box 4.2 'Biodiversity hot spots' in the pan-European region

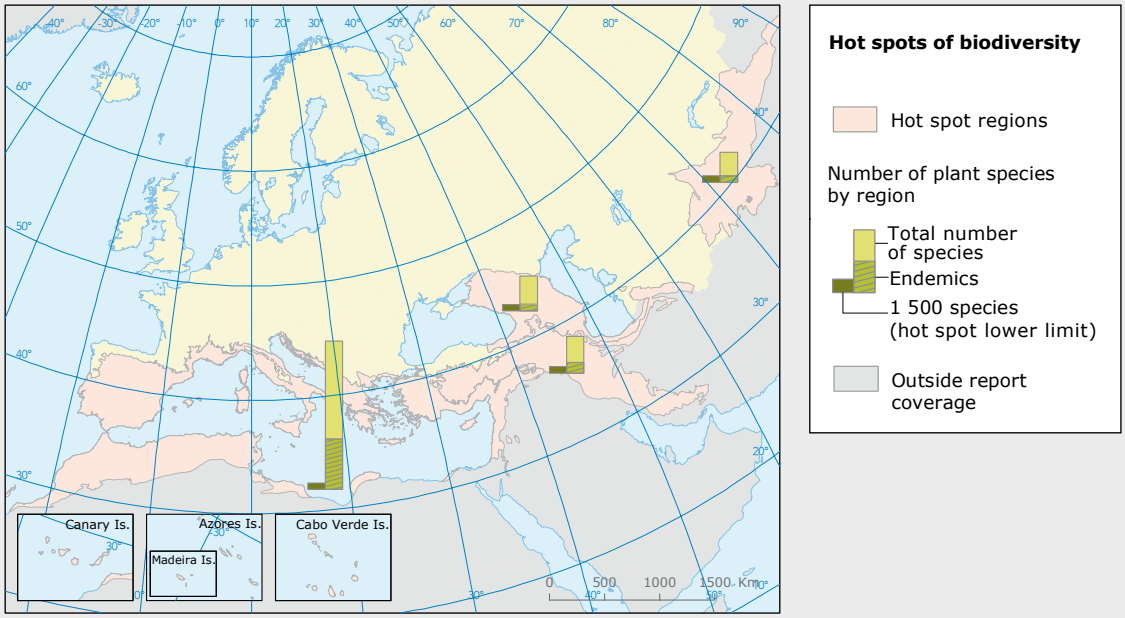
'Biodiversity hot spots' as identified by Conservation International are regions with more than 1 500 endemic species and more than 70 % habitat loss in historic times (the baseline varies between regions, but typically lies several centuries back). The identified biodiversity hot spots in the pan-European region are listed below.

The Mediterranean basin: This region has more than four times as many vascular plant species than the rest of Europe. It is also the home of the critically endangered Iberian lynx and Mediterranean monk seal. Main threats are: urbanisation and tourism, in particular on the coasts, forest fire, land abandonment, intensification of agriculture and forestry, water abstraction and pollution, and, increasingly, desertification.

The Caucasus: Its deserts, savannas, arid woodlands and forests contain about 6 400 vascular plant species, a quarter of which are endemic. Illegal logging, overgrazing, poaching, overfishing, infrastructure development; and pollution of rivers and wetlands are reported as the main threats to biodiversity in this region. The majority of remaining intact habitats are in the higher mountain regions.

Mountains of Central Asia: Ecosystems range from glaciers to desert, and contain ancestors of domestic fruit varieties. The region is also home to a rich variety of ungulates, including the threatened argali wild sheep. Main threats to biodiversity reported in the region are expansion of settlements and infrastructure development as well as mining, overgrazing, poaching, water abstraction and drainage.

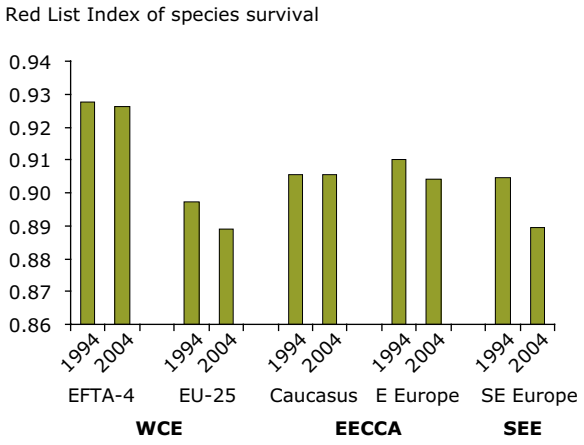
Irano-Anatolian region: This region forms a natural barrier between the Mediterranean basin and the dry plateaus of western Asia. It is a centre of wild relatives of crops such as wheat, rye, oats, seed and forage legumes and fruits. The main threats are development of irrigation schemes for agriculture and associated infrastructure such as dams, overgrazing, overharvesting of woody plants for fuelwood, and mining. The region boasts four endemic and threatened viper species.



Taxonomic group	Number of species (% endemics in brackets)			
	Mediterranean basin	Caucasus	Mountains of Central Asia	Irano-Anatolian region
Plants	22 500 (52)	6 400 (25)	5 500 (28)	6 000 (42)
Mammals	226 (11)	131 (14)	143 (4)	142 (7)
Birds	489 (5)	378 (0.3)	489 (0)	362 (0)
Reptiles	230 (34)	86 (23)	59 (2)	116 (10)
Amphibians	79 (34)	17 (18)	7 (57)	18 (11)
Freshwater fish	216 (29)	127 (9)	27 (19)	90 (33)

Sources: Mittermeier *et al*., 2005; Médail and Quézel, 1997; WWF Caucasus, 2004; Blondel and Aronson, 1999; Troumbis *et al*., 2000.

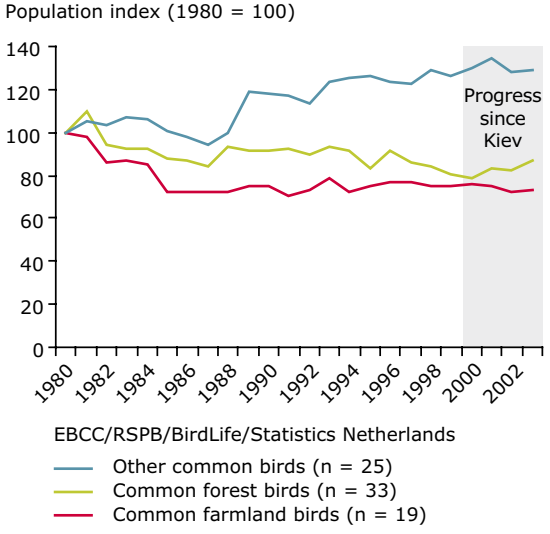
Figure 4.2 Red List Index for birds



Note: The RLI for European birds based on pan-European extinction risk uses information from the Birds in Europe database (Tucker and Heath 1994; BirdLife International, 2004) to measure the projected overall regional extinction risk of sets of species, and to track changes in this risk. It is based on the proportion of species in each category on the regional Red List, and changes in this proportion over time resulting from genuine improvement or deterioration in the status of individual species. An RLI value of 1 (one) equates to all species being categorised as Least Concern at the European level, while an RLI value of 0 (zero) indicates that all species are extinct in Europe.

Sources: BirdLife International/IUCN (unpublished data, 2006). Sample sizes: EU-25 (460), EFTA4 (317), EECCA (427), E Europe (397), the Caucasus (313), SEE (390). No data for Andorra, Monaco and San Marino.

Figure 4.3 Trends in common birds (selected countries)



Note: Based on data from: Austria, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Spain, Sweden, United Kingdom, Estonia, Latvia, Poland, Czech Republic, Hungary, Norway and Switzerland.

Source: EBCC, 2005.

the loss caused by land abandonment outweighs this. The utilised agricultural area in WCE decreased by 2.5 % between 1990 and 2000 (EEA, 2006a). No comparable land accounts are available for EECCA and SEE.

Another prominent phenomenon (see Figure 4.5) is the increase in forest cover of about 8 000–9 000 km^2 per year since 1990. This expansion has primarily happened in the EU and EFTA, mainly due to decreasing grazing pressure and spontaneous re-growth, and afforestation on abandoned agricultural land. The largest increase in forest area within the past five years is reported for southern European countries (Spain, Italy, France, Portugal, Greece and Bulgaria) (UNECE/FAO, 2005a). In the Mediterranean region and parts of the steppic biogeographic region, afforestation programmes are being used as one of the tools to combat land degradation, combined with the prevention of, *inter alia*, forest fires (EEA, 2005).

4.2.3 Specific threats

Urbanisation and infrastructure

In WCE the pressure of urbanisation and transport on biodiversity is highest in the densely populated lowland areas and coastal zones (EEA, 2006b,c). Gas and oil pipeline construction is causing habitat fragmentation and degradation in the Caucasus (GRID Tbilisi, 2002). In Central Asia urbanisation has led to loss and fragmentation of the fragile sand-desert ecosystems in Turkmenistan (Chemonics International Inc., 2000). The impact of urbanisation and infrastructure in SEE is biggest in Romania, Bulgaria and Turkey, where grasslands and steppes are affected. The steppe ecosystems in Turkey are particularly threatened by road and dam construction (CBD, 1999) (see also Chapter 5, Marine and coastal environment).

Agricultural intensification and land abandonment

The agricultural pressures on biodiversity are diverse and differ markedly between regions. Intensification in terms of fertiliser inputs, specialisation, and scale enlargement generally decreases biodiversity (Donald *et al.*, 2001). The most intensive farm systems in WCE have thus

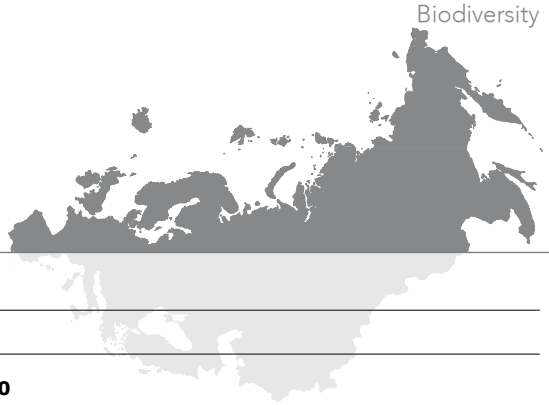
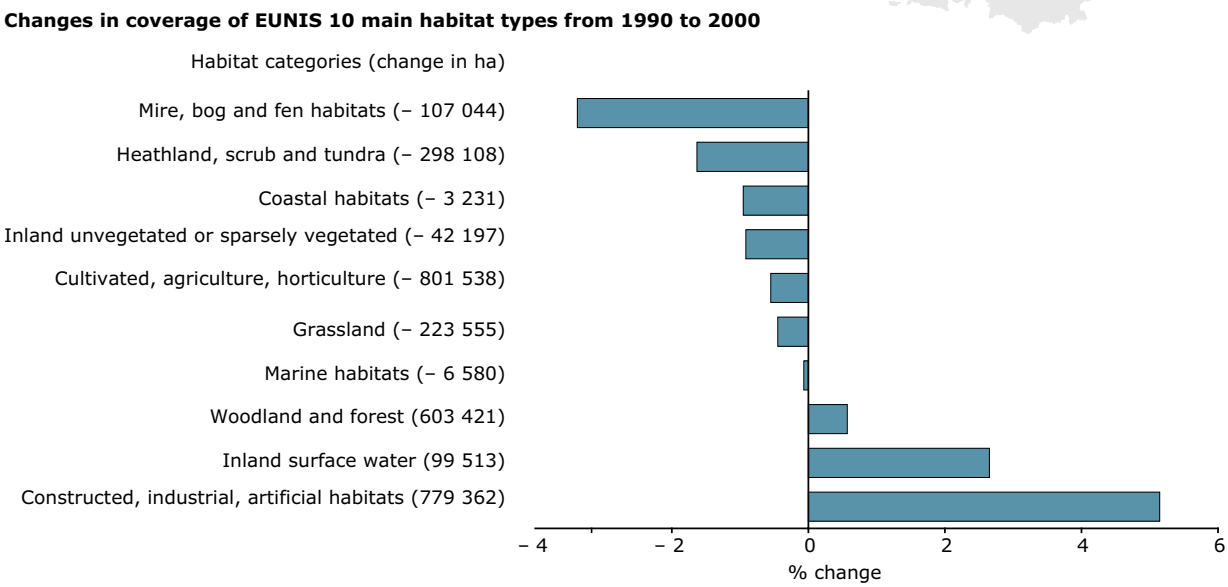


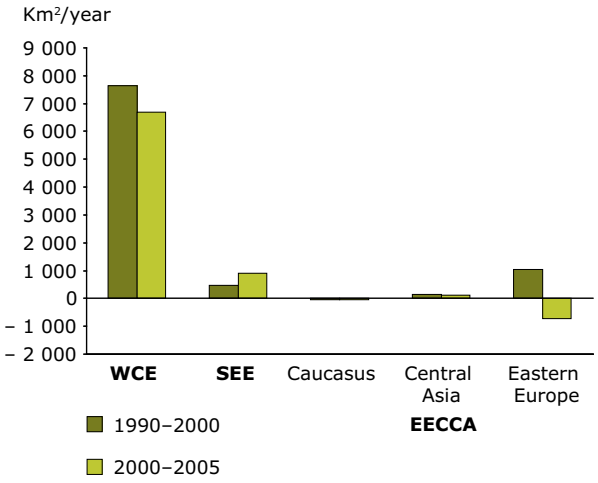
Figure 4.4 Main land-cover changes from 1990–2000



Note: Coverage: EU-25 excluding Finland, Sweden, Cyprus, Malta.

Sources: EEA, 2005; EUNIS database.

Figure 4.5 Change in annual forest area between 1990 and 2005



Source: UNECE/FAO, 2005a.

resulted in highly productive monocultures with very low biodiversity. At the other end of the scale are the species rich traditional farming systems, predominantly found in peripheral (southern and eastern) regions. They have low stocking densities, little or no chemical inputs, and labour intensive management, such as shepherding. In socio-economic terms these extensive farming systems are under pressure and subject to both land abandonment and intensification (EEA, 2004b; Baldock *et al.*, 1995). More details on the agriculture-related pressures on biodiversity are given in Section 4.4.

Desertification

Desertification is the process of land degradation in arid, semi-arid and dry semi-humid areas, resulting from unsustainable land use in combination with climatic factors. Drainage, overgrazing and irrigation may all lead to soil erosion, salinisation, lowered productivity and vegetation loss. It is a serious problem in the Caucasian states and Central Asia, for example in the Shiraki, Eldari, Iori, Taribani and Natbeuri valleys in Georgia (IUCN, 2006b). In Armenia a 1.9 % increase in eroded area was observed between 1980 and 2000, and in Azerbaijan 3.6 million ha are currently subject to erosion (GRID Tblisi, 2002; Azerbaijan National Academy of Sciences, 2004).

Natural expansion of deserts is observed in several areas in Tajikistan, but in the mountains this could be seen as desertification as it is mainly due to the intensive use of natural resources resulting in degradation of the environment (Novikov and Safarov, 2003). Two thirds of Kazakhstan's territory is affected by different degrees of desertification

(UNCCD, 2002). In eastern and south-eastern Europe, desertification is mainly restricted to Bulgaria, Turkey and especially Romania (Ministry of Environment and Water Management of Romania, 2005) (see Section 2.4, Soil).

Acidification and eutrophication

Nitrogen and sulphur emissions, either to the air or directly to soil and water bodies, can cause acidification and eutrophication of ecosystems. In 2004 more than 23 % of trees assessed in 31 countries were classified as damaged as a result of acidification, although defoliation varies greatly between species and regions. While defoliation of several main species has increased since 1990, defoliation of Scots pine is now clearly lower than in the mid 1990s (UNECE, 2005). In the vicinity of the copper nickel complexes in Norilsk (Taimyr Peninsula) and Monchegorsk (Kola Peninsula), acidification has destroyed vegetation over hundreds of square kilometres (State Committee of Russian Federation for Environment Protection, 1997; Ministry of Natural Resources of Russian Federation, 2002).

Serious pressures on forest and freshwater ecosystems are also reported from Ukraine (UNECE, 2001b), Croatia (Ministry of Environmental Protection and Physical Planning of Croatia, 2000) and Albania. In Bulgaria soils representing 56 % of the territory of the country have been acidified as a result of excessive fertiliser use (Ministry of Environment and Water of Bulgaria, 2001). Ecosystems in more than 70 % (in area) of WCE are affected by eutrophication. This damage level is expected to decline only slightly by 2020 (EEA, 2005). In the other regions the problem is less prominent, but eutrophication of aquatic ecosystems and associated algal blooms are also reported in SEE (Vardaka *et al.*, 2005; Ministry of Environment and Physical Planning of the Republic of Macedonia, 2003; Ministry of Environment and Water Management of Romania, 2005). During recent years the environmental conditions in the Black Sea have improved slightly (UNECE, 2001b) (see Chapter 5, Marine and coastal environment).

Radioactive contamination

Twenty years after the Chernobyl disaster, about 6 million ha of forests in the north of Ukraine and southern Belarus still have higher levels of radioactivity than before the accident — particularly high ^{137}Cs concentrations are found in mushrooms, berries and game. These high levels are expected to continue for several decades due to the persistent recycling of radiocaesium in forest ecosystems (IAEA, 2006).

Forest fires

Apart from immediate damage to people, wildlife and habitats, forest fires can result in erosion and insect outbreaks, water and air transfer of combustion products and a release of the carbon stored by trees to the atmosphere (Riera and Mogas, 2004). Very large fires, as reported from Russia, can transform the forest environment for centuries (FAO/ECE/ILO, 2004). The magnitude and geographical distribution of human-induced forest fires will be dealt with in Section 4.4.

Illegal logging/wildlife trade

Many species are illegally hunted and traded. Quantitative data is limited, but the problem appears to be most prominent in the southern and eastern regions (see Box 4.3). Illegal logging accounts for more than 50 % of the wood harvested in the far-eastern parts of the Russian Federation and in the Caucasus. The occurrence and impact of illegal logging will be dealt with in Section 4.4.

Invasive alien species

In the course of time, many species have been introduced into Europe, either on purpose or accidentally. Many of them have become invasive, successfully outcompeting native species and affecting habitats. This is increasingly regarded as a major threat to biodiversity. For the pan-European region, 121 species are now listed as 'worst invasives'. Their impact and the policy responses will be dealt with in Section 4.5 (see also Chapter 5, Marine and coastal environment).

Climate change

Climate change is an overarching pressure that may aggravate many of the threats discussed above. It is expected to become the main driver of biodiversity loss in the future, affecting physiology (e.g. primary production), phenology (i.e. the growth cycle of plants and animals) and species distribution (Ciais *et al*., 2005; Thomas *et al*., 2004). In the past four decades the start of the growing

Box 4.3 Endangered species: the saiga antelope and the snow leopard

The saiga antelope (*Saiga tatarica*) occurs in steppic grasslands and semi-arid deserts in Central Asia and is classified as 'critically endangered' at global level. Mainly due to poaching, its numbers have declined from over one million in 1993 to less than 200 000 in 2000. In Turkmenistan only 2 000 animals remain of a population of 15 000 to 20 000 in the 1970s–1980s. However, substantial conservation efforts, including hunting bans and penalties for illegal trade, have been taken by Central Asian countries. In Kazakhstan the saiga antelope has again increased by 10–15 % per year to a current level of 45 000 to 50 000. The Russian population, estimated at 5 000 to 25 000, appears stable.

The snow leopard (*Uncia uncia*), occurring in the mountains of Central Asia, has declined throughout its range and is globally classified as 'endangered'. The population in Kyrgyzstan, once the second largest in the world, has declined by 50–80 %. Illegal trade in fur and bones is an incentive for poaching and snow leopards are also occasionally killed by owners of livestock. However, the main cause of decline of the snow leopard is the depletion of its prey through illegal hunting.

Sources: IUCN 2001, 2006a; CITES Secreteriat, 2006; CMS Secretariat, 2006; Dexel, 2002.

season in Europe, as observed in herbs, shrubs, trees, birds, butterflies and amphibians, has advanced by an average of 10 days (Menzel *et al.*, 2006; Parmesan and Yohe, 2003; Both *et al.*, 2004). The longer growing season also affects the annual carbon uptake of plants and thereby the net carbon exchange of the biosphere (Churkina *et al.*, 2005).

The observed northward latitude and upward altitude shift in the distribution ranges of various species is attributed to climate change (e.g. Walther *et al.*, 2002; Parmesan and Yohe, 2003). Plant species richness in north-western Europe has increased over the past 30 years, warmth-tolerant and generalist species becoming more frequent (Tamis *et al.*, 2005; Preston *et al.*, 2002; Often and Stabbeorp, 2003). In many mountainous regions, tree-lines have moved up, pushing alpine species further upwards (Inter-agency Commission of the Russian Federation on Climate Change, 2002; Grabherr *et al.*, 2002; Grace *et al.*, 2002; Dullinger *et al.*, 2004). Likewise, endemic species in the arctic, such as lichens and mosses, have been replaced by

Box 4.4 The impacts of climate change on the alpine ecosystems of Armenia

Mountain ecosystems are vulnerable to climate change. Historical, archeological, paleobotanic and palynologic data show that significant changes in the ecosystems of Armenia have occurred in the last three millennia, related to global warming and a drier climate. During this period the forest areas have shrunk significantly, the semi-desert and steppe vegetation belts have expanded, and the Alpine vegetation belt has shrunk.

Estimates of future vulnerability are based on the IPCC scenario of an increase of the air temperature by 2 °C and a reduction of atmospheric precipitation by 10 % for the republic as a whole. Specially developed computer models are used to analyse the vulnerability of natural ecosystems in Armenia.

The present area of alpine vegetation is about 2 200 km, located between 2 800 and 4 095 m above sea level. In the above climate change scenario the reduction of the alpine belt area is projected to be about 22 %. Alpine meadows and carpets in particular will be reduced, but alpine vegetation will be relatively well preserved in rocky areas, stone screes and placers on the highest mountain ridges and peaks. Endemic and rare plant species growing on lower mountain ridges (Komarov's caraway, Pallace's immortelle, Caucasian rododendron, *Physoptichis caspica*, etc.) are more vulnerable.

Source: Ministry of Nature Protection of the Republic of Armenia, 1998; First national communication of the Republic of Armenia under the UNFCC. http://unfccc.int/resource/docs/natc/armnc1e.pdf.

invading generalist species (Molau and Alatalo, 1998; ACIA, 2004).

Modelling studies show the potential for significant disruption of terrestrial and freshwater ecosystems by climate change (IPCC, 2001). The impacts will to a large extent depend on the migration capacity of species in relation to landscape structure as well as their ability to cope with increasing climate extremes. All available scenarios highlight the vulnerability of arctic, mountain and Mediterranean ecosystems (Brooker and Young, 2005; Schröter *et al*., 2005; EEA, 2005; see also Box 4.4). In Scotland and Wales, for example, a 1 °C annual temperature increase is expected to reduce the distribution of arctic alpine ecosystems by 90 % (Ellis and Good, 2005). By 2100, more than 35 % of plant species in northern countries may be invasive, and 25 % of the plant species in Romania, Bulgaria, Iberian countries and some other Mediterranean countries may have disappeared (Bakkeness *et al*., 2006).

Climate change will also aggravate the problem of human-induced forest fires (see section below). Projections show a considerable increase in the extent and frequency of fires, for example, in the Iberian peninsula and Russia (ACIA, 2004), affecting ecosystem composition in favour of fast-growing species.

The main threats to biodiversity in Europe are summarised in Table 4.1.

4.3 Providing a backbone: ecological networks

4.3.1 Pan-European Ecological Network

The Pan-European Ecological Network (PEEN) is a non-binding conceptual framework which aims to enhance ecological connectivity across Europe by promoting synergies between nature policies, land-use planning and rural and urban development

Table 4.1 Summary of main threats to biodiversity

Threat	WCE	EECCA			SEE
		Caucasus	Central Asia	Eastern Europe	
Climate change	**	***	***	**	**
Urbanisation/ infrastructure	***	*	*	**	**
Agricultural intensification	**	*	**	**	**
Land abandonment	**		*	**	***
Desertification	*	**	***	*	**
Acidification	*			***	*
Eutrophication	***	*	*	**	**
Radioactive contamination				**	
Forest fires	*			**	**
Illegal logging		**	*	**	***
Illegal hunting/ wildlife trade		***	***	*	
Invasive alien species	**	*	*	**	**

Note: The number of stars indicates the importance.

at all scales (Council of Europe, 2003a). In the Kiev Resolution on Biodiversity the European environment ministers committed to identifying the core areas, corridors and buffer zones of the PEEN by 2006 and bringing the core areas under favourable management by 2008 (see also Section 4.1).

So far only the core areas of the PEEN have been formally designated as protected areas, for example Ramsar sites, World Heritage sites, Biosphere reserves, Biogenetic reserves, and Natura 2000 sites. The designation of Emerald sites is in a pilot phase (see also the following sections). Large sites protected under national regulations for nature protection can also be considered as core areas of the PEEN. The effective implementation of corridors and buffer zones will require a combination of nature conservation policies, sustainable forestry and agriculture, as well as restoration measures, within a transboundary approach (Brunner, 2002; Bennett, 2004; Kuijken, 2003; Council of Europe, 2003b).

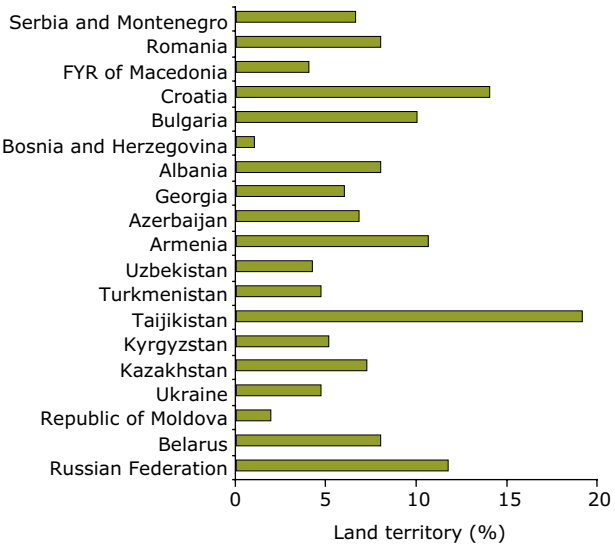
Based on guidelines set up by the Committee of Experts for the PEEN (Council of Europe, 2000) indicative maps of the PEEN have been drawn up by NGOs and research institutes for south-eastern Europe (Biró *et al*., 2006) and central and eastern Europe (Bouwma, *et al*., 2002) (see Map 4.2). A map is currently being developed for western Europe. The establishment of the PEEN is supported by legal provisions and instruments under various conventions and international agreements (Bennett, 2002; Bonnin, 2004), including the Ramsar Convention, the Bonn Convention, the Man and the Biosphere (MAB) Biosphere Reserves Programme, the Bern Convention, the Alpine Convention and especially the Carpathian Convention, which explicitly refers to the need for a Carpathian ecological network as a integral part of the PEEN. At the national level, European and Central Asian countries contribute to the PEEN through their own system of protected areas. The share of protected areas in the EECCA and SEE countries is shown in Figure 4.6.

In addition to their policy on protected areas, a growing number of countries are considering the need to ensure connectivity between core areas. Some countries and regions have chosen to integrate ecological networks into nature policy law (Hungary, Czech Republic, Slovakia, Germany, the Russian Federation, the Flemish region of Belgium), while others have integrated these concepts into spatial planning legislation (Switzerland, Lithuania, Estonia, France). In other countries, the national ecological network is supported by a non-binding governmental strategy (the Netherlands, Luxembourg, Kyrgyzstan) (Bonnin, 2004).

Regional transboundary initiatives such as the Alpine Network of Protected Areas (Réseau Alpin, 2004), the Lower Danube Green Corridor (WWF, 2003), the European Green Belt (IUCN, 2006c), Econet for Central Asia (GEF/UNEP/WWF, 2006) and the initiative for Central Asia (see Box 4.5) are also major contributions to the PEEN.

As part of the Ecoregional Conservation Plan for the Caucasus, endorsed during the Caucasian countries' Ministerial Conference in March 2006, a map of priority conservation areas (PCA) and corridors in the Caucasus ecoregion has been prepared by

Figure 4.6 Area coverage of nationally protected areas in EECCA and SEE countries, 2005



Sources: CDDA, 2006 (Serbia and Montenegro, Romania, Former Yugoslav Republic of Macedonia, Croatia, Bulgaria, Bosnia and Herzgovina, Albania); GEF/UNEP/WWF, 2006 (Uzbekistan, Turkmenistan, Taijikistan, Kyrgyzstan, Kazakhstan); WWF, 2006 (Georgia, Azerbaijan, Armenia). Russian Ministry of Natural Resources, 2006 (Russia); Ministry of Natural Resources and protection of the Environment of Belarus, 2006 (Belarus).

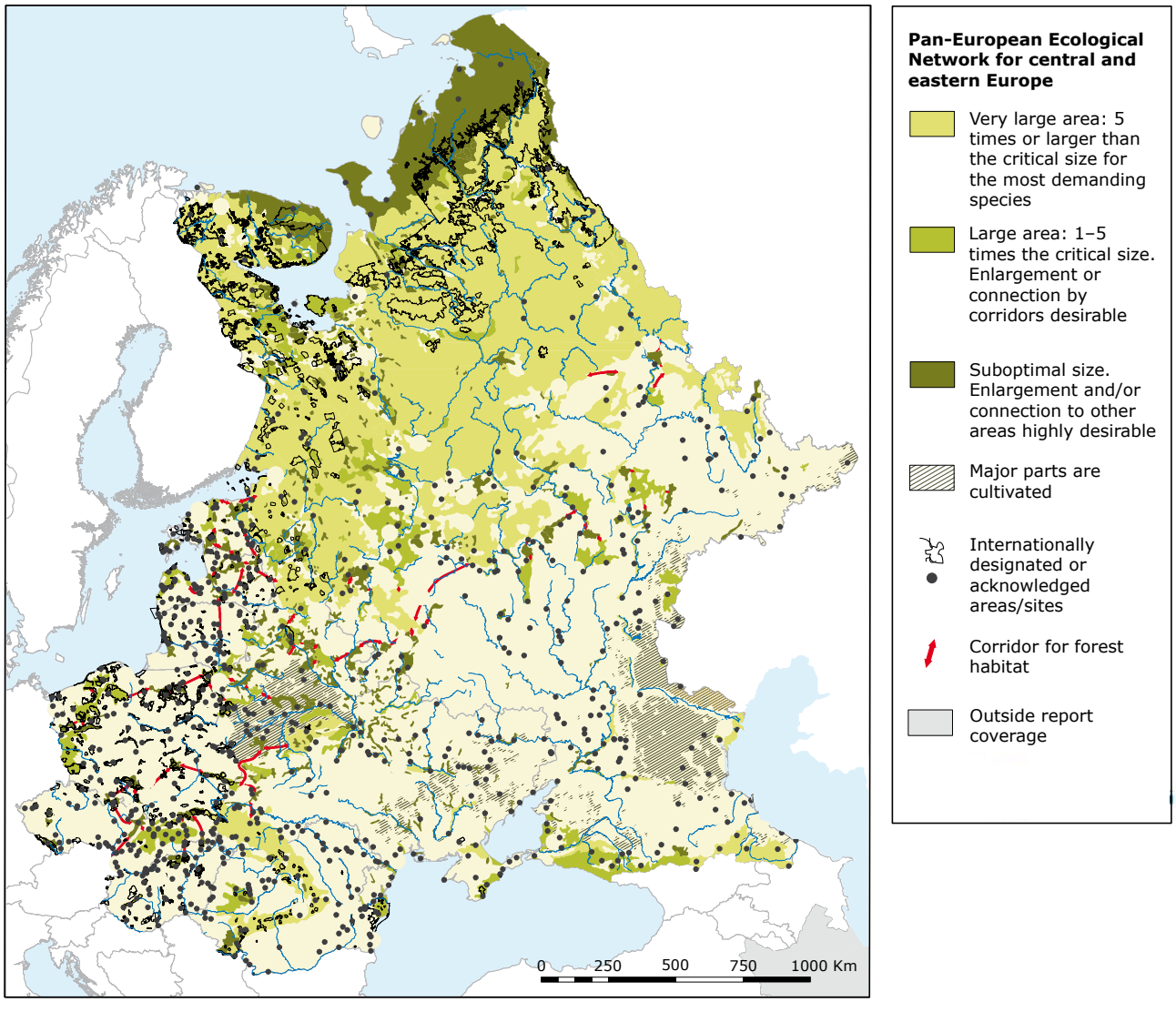
WWF, as a guideline for future action towards an ecological network in this region. The Natura 2000 network will be the EU's main contribution to the PEEN (see section below).

4.3.2 Natura 2000

The Natura 2000 Network comprises Special Protection Areas (SPAs) under the Birds Directive and Special Areas of Conservation (SACs) under the Habitats Directive (European Commission 1996–2006, 2005). In December 2006, the Natura 2000 network comprised 20 862 sites under the Habitats Directive, including 1 248 marine sites (12.2 % of the land area of the EU is covered) and 4 617 sites under the Birds Directive, including 484 marine sites (9.9 % of the land area of the EU is covered, see Map 4.3). Combined, the Habitats Directive and Birds Directive sites cover about 17 % of the total EU land area. Article 10 of the Habitats Directive also refers to ecological coherence, although it does not mention corridors specifically or make them mandatory.

The European Commission Communication *Halting the Loss of Biodiversity by 2010 and beyond —*

Map 4.2 Indicative map of the Pan-European Ecological Network for central and eastern Europe

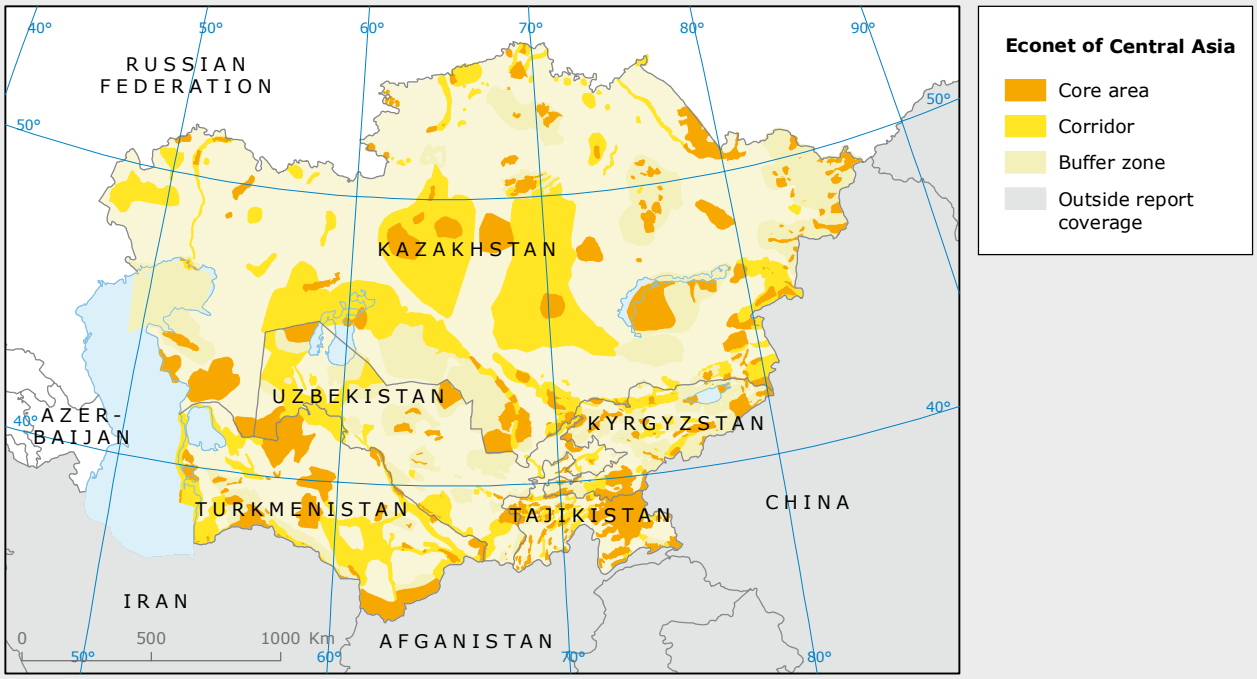


Source: Alterra, Wageningen UR (unpublished).

Box 4.5 Transboundary initiatives on protected areas in Central Asia

Initiated by WWF-Central Asia, a framework for the creation of a coherent ecological network in Central Asia was approved in 2006 by the Central Asian Intergovernmental Sustainable Development Commission. The initiative has stimulated the establishment of new protected areas over the past three years: 600 000 ha in Kazakhstan and 200 000 ha in Kyrgyzstan.

Source: GEF/UNEP/WWF, 2006.



Sustaining Ecosystem Services for Human Well-Being (European Commission, 2006) calls for Member States to reinforce the coherence and connectivity of the Natura 2000 network. It also highlights the need to restore biodiversity and ecosystem services in non-protected rural areas of the EU. Compliance with these objectives is the key to the implementation of the PEEN within the EU.

In terms of percentage of their territory covered, Slovakia, Slovenia and Spain make the highest contribution under the Birds Directive — 18–25 % of the land territory — closely followed by Hungary, Cyprus, Estonia and the Netherlands. Germany, Denmark, Poland, Estonia, Finland and the Netherlands make a significant contribution to the marine part (Figure 4.7a). Slovenia and Spain make the highest contribution under the Habitats Directive with 32 % and 23 %, respectively, of their land territory, followed by Portugal, Greece, Estonia, Hungary, and Luxembourg, ranging from 10 % to 17 % of their territories. As for the marine environment, Germany makes by far the largest contribution (Figure 4.7b).

The degree to which countries are considered to have fulfilled their obligations with regard to site proposals under the Habitats Directive is assessed through the Sufficiency Index (SI). Among the EU-15, Denmark, the Netherlands and Belgium have completely fulfilled their obligations (SI 100 %), followed closely by Germany, Greece and Italy, while Finland is still 32 % off target. Among the EU-10, Malta fulfilled 92 % of its obligation; followed by Latvia, 90 %; Hungary, 87 %; and Estonia, 85 % (see Figure 4.8).

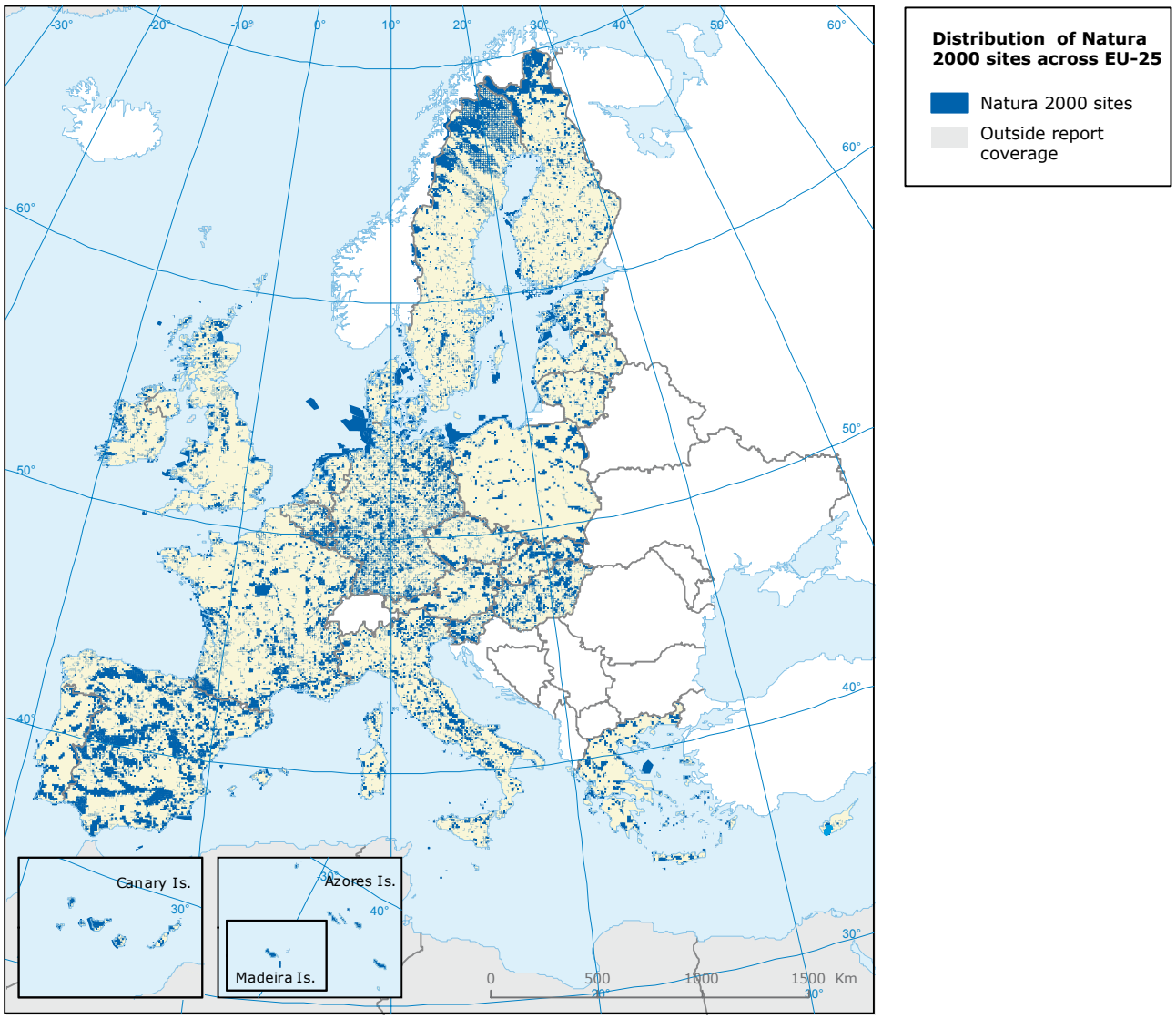
A consistent scheme for monitoring the conservation status of Natura 2000 sites is being

developed (see also Section 4.6). A preliminary survey of 20 species and eight habitats under the Birds and Habitats Directives revealed a 'favourable' conservation status in only 6 % of the sample. Loggerhead turtles in the Mediterranean, brown bears in Austria and the Eurasian lynx in the Alps (European Habitats Forum, 2006) were considered among the 12 species with a 'bad' conservation status.This small and non-representative sample does not allow any extrapolation, and unfortunately general assessment of the conservation status of the almost 900 species and 220 habitats covered by the Birds and Habitats Directives is not yet possible.

4.3.3 Emerald network

The Emerald network, initiated under the Bern Convention on the Conservation of European Wildlife and Natural Habitats, aims to extend a common approach to the designation and management of protected areas, equivalent to Natura 2000, to non-EU countries in Europe and

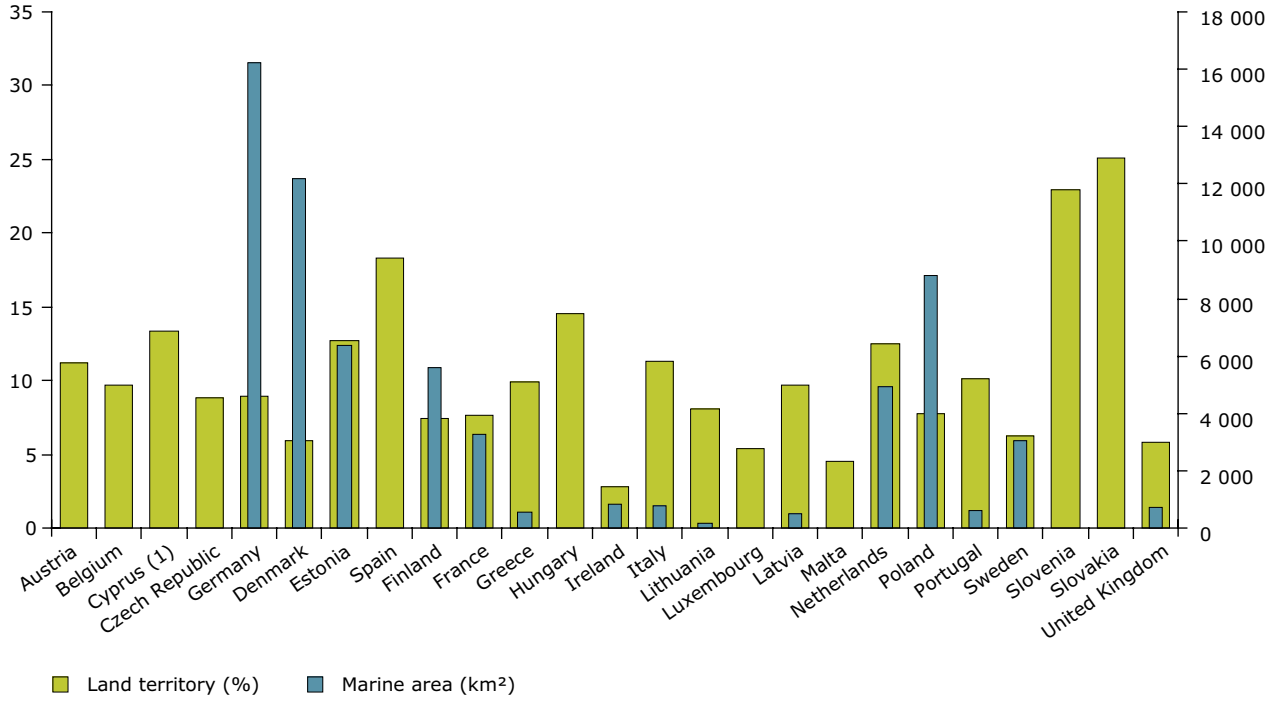
Map 4.3 Distribution of Natura 2000 sites across EU Member States



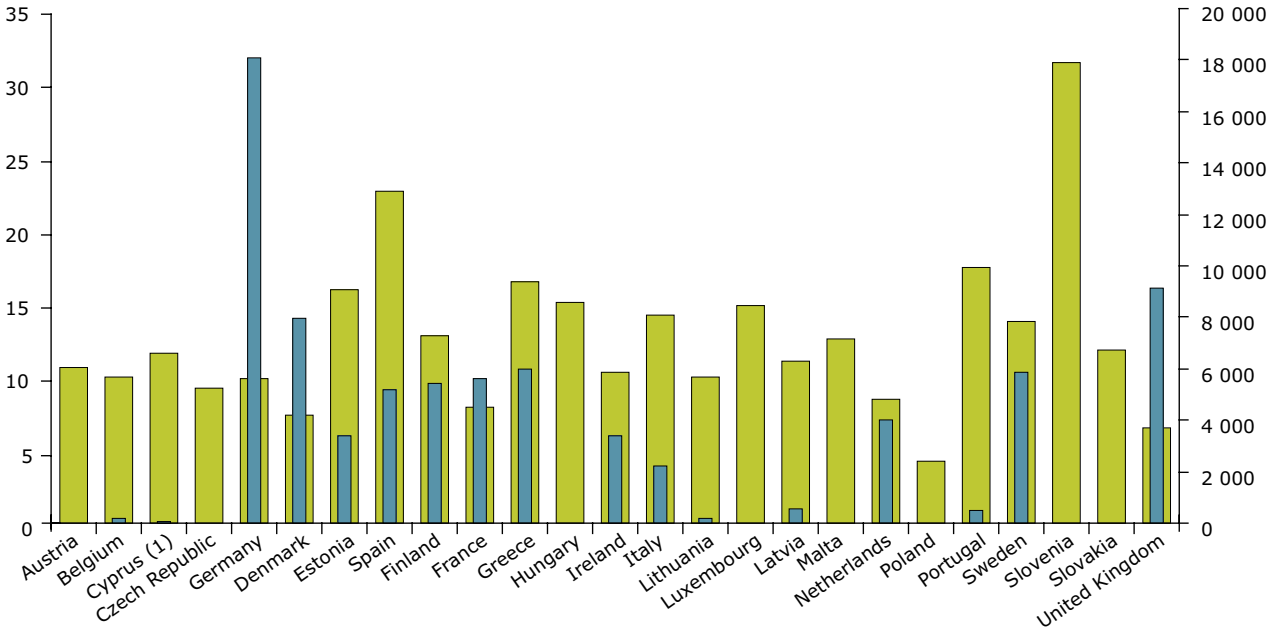
Source: EEA-ETC/BD, December 2006.

Figure 4.7 Proportion of national land territory and marine surface area protected under the Birds and Habitats Directives

a: Designated as Special Protection Areas (SPAs) under the Birds Directive



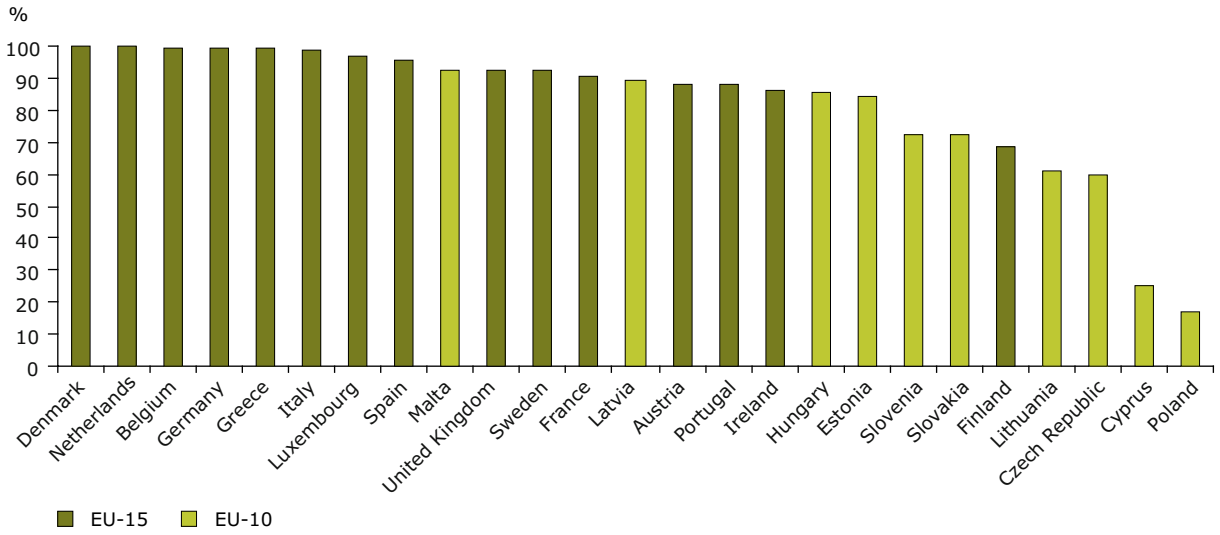
b: Proposed as Sites of Community Interest (SCIs) under the Habitats Directive



Note: (1) = The area of the Member State and the % corresponds to the area of Cyprus where the Community acquis applies at present, according to Protocol 10 of the Accession Treaty of Cyprus.

Source: EEA-ETC/BD, December 2006.

Figure 4.8 Sufficiency of Member State proposals for designating sites under the Habitats Directive



Source: EEA-ETC/BD, January 2007.

northern Africa (Council of Europe, 1999). Pilot projects have been implemented in the 12 new EU Member States before they joined the EU, Norway, Switzerland, Iceland, western Balkans, Turkey, the Republic of Moldova, the Russian Federation, Ukraine, Armenia, Georgia and Azerbaijan and two African countries (Burkina Faso and Senegal). The purpose of these pilot projects is to identify, for further protection, Areas of Special Conservation Interest (ASCIs), containing the species and habitats listed in Resolutions No. 4 and 6 of the Standing Committee to the Bern Convention and Annexes I and II of the Habitats Directive.

As a continuation of the initial pilot projects, important further work has been carried out in six south eastern European countries under a Community Assistance for Reconstruction, Development and Stabilisation (CARDS) regional programme, resulting in more than 80 % of ASCIs being identified in each country (Map 4.4).

The Emerald initiative has been very useful for the EU-12 countries in preparing their contribution to the Natura 2000 network before accession. From a pan-European perspective, the initiative should help stimulate the completion of national networks of protected areas in other European countries.

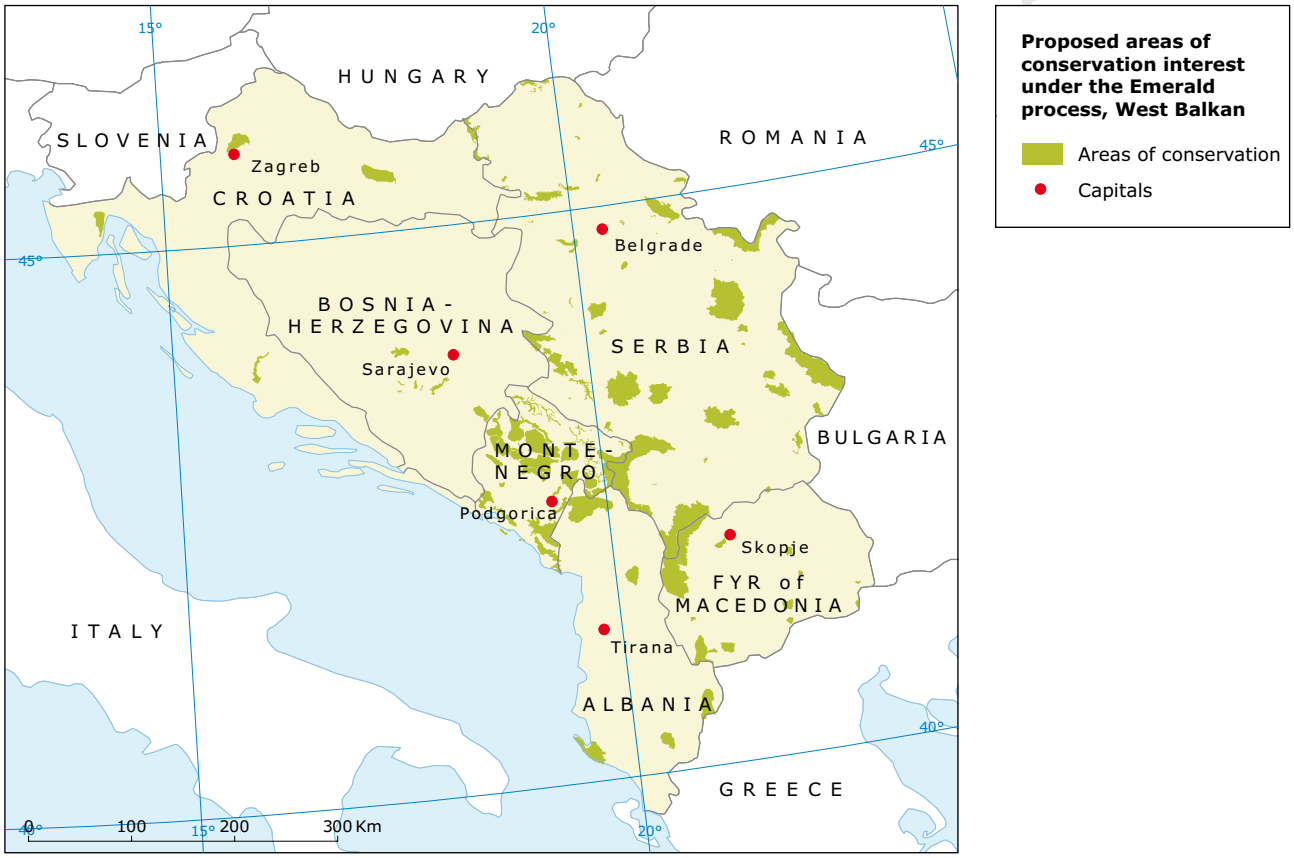
4.4 Achieving sustainable use: forestry and agriculture

4.4.1 Ecosystem services

The stability of ecosystems and the services they provide depend to a large extent on their biodiversity and the complex interactions between species and their environment. Human-induced disturbances may affect the dynamics within ecosystems and lead to irreversible damage. The majority of the ecosystem services that support life on Earth are being degraded or used unsustainably (Millennium Ecosystem Assessment (MA), 2005). In its analysis, the MA distinguishes between provisioning services (food, freshwater, roundwood, fuelwood etc.), regulating services (climate, disease and water regulation) and cultural services (non-material benefits).

One aspect of sustainable use is the exploitation of local resources and their (global) significance. Food production, for example, seems warranted at the European scale, but is in fact vulnerable and associated with major impacts on the environment. Worldwide, only 14 animal species and four plant species (wheat, maize, rice and potato) account for 90 % of our food (EEA, 2006a). In large parts of Europe, increasingly intensive food production and

Map 4.4 Proposed ASCIs under the Emerald process, in the western Balkans area (Albania, Bosnia and Herzegovina, Croatia, FYR of Macedonia, Serbia and Montenegro)



Source: EEA-ETC/BD, December 2006, unpublished.

the resulting large scale monocultures have had a significant impact on biodiversity and its associated regulating and cultural services. In addition, care has to be taken that the original gene pool from which the cultivated species originate is maintained (see Box 4.6).

Consumption in Europe can also have significant impacts on ecosystems elsewhere. This 'ecological footprint' is difficult to measure, but current estimates suggest that the area needed to provide essential ecosystem services to the European population exceeds Europe's surface by a factor of two (EEA, 2006a).

The following sections explore sustainability issues in more detail for two sectors that depend heavily on and affect biodiversity in Europe: forestry and agriculture.

4.4.2 Forestry

Trends and pressures on biodiversity

The forest area of Europe amounts to 10.3 million km^2 (79 % of which is located in the Russian Federation). About one quarter is considered as primary forest; that is, without clearly visible indications of human activities. Another 50 % is modified natural forests, with little human influence, and the rest heavily modified. In many parts of WCE the majority of forest consists of plantations. The low degree of naturalness of these forests is reflected by their low share of deadwood, an important indicator of forest biodiversity. Rough estimates based on total biomass content suggest that deadwood quantities in the Russian Federation are three times higher than in north-western Europe (UNECE/FAO, 2005a). More comprehensive data will be available in the near future from country

Box 4.6 Global centres of crop origin

Our major food crops have come mainly from high mountain valleys, isolated from each other to a large extent and with a very great habitat range. Europe and Central Asia contain three such centres:

Central Asia (Tadjikistan, Uzbekistan, etc.) is a centre of the wild relatives of crops such as wheats, rye and many herbaceous legumes, as well as seed-sown root crops and fruits, some 42 species.

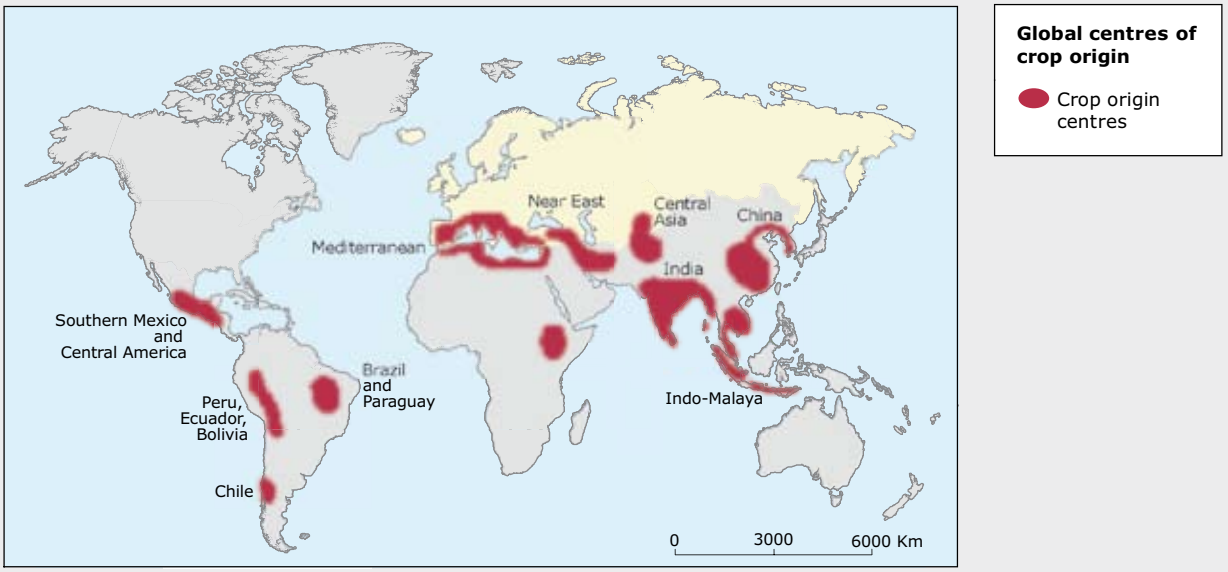
The Mediterranean basin is a centre of the wild relatives of crops such as wheats, barleys, forage plants, vegetables and fruits, especially spices and ethereal oil plants, some 84 species.

Near East (including Transcaucasia, Iran and Turkmenistan) is a centre of the wild relatives of crops such as wheats, rye, oats, seed and forage legumes and fruits, some 83 species.

It was Nikolai Vavilov (1887–1943) who pioneered the study of the systematics of cultivated plants and the centres of origin of the world's crops. In Transcaucasia and several countries then within the Soviet Union, he discovered a wealth of strains of cereals, forage grasses, root crops and vegetables, as well as an extraordinary richness of local fruit tree varieties 'surpassing many other countries in the world'. By the 1930s, the Soviet Union had built up an exceptionally complete collection of strains of the world's most important crops.

The challenge of safeguarding these reservoirs of genes to ensure resistance to disease and pests, and many other qualities, is today more important than ever.

Sources: Bioversity Intenational; Vavilov, N. I., 1992.



Source: N. Vavilov, 1949, Chronica Botanica Vol 13. Waltham, Massachusetts, adapted by Reid, Walter and Kenton Miller, 1989.

reporting to the Ministerial Conference on the Protection of Forests in Europe (MCPFE).

The total growing stock in Europe is around 109 billion m^3, of which 80 billion m^3 are in the Russian Federation, about 19 billion m^3 in WCE and about 4.5 billion m^3 in SEE (UNECE/FAO, 2005a). The total net annual increment (NAI) in Europe is 1.8 billion m^3, more than half of which is in the Russian Federation. About 180 million m^3 of wood were harvested in the Russian Federation during 2005, which is less than 20 % of its NAI. In comparison, WCE harvests about 60 % of its NAI, the SEE region and eastern Europe about one third, the Central Asian region about one fifth, and the Caucasus about one eighth (UNECE/FAO, 2000).

Industrial roundwood is the most important forest product. The amount harvested each year has increased since 1990 in WCE, the Caucasus and Central Asia, whereas it has declined by 50 % in eastern Europe due to the crisis in the Russian forestry industry. Over the same period, the harvesting of industrial roundwood has been quite stable in the SEE (UNECE/FAO, 2005a). In all UNECE scenarios, roundwood harvesting in WCE and eastern Europe appears to be sustainable, at least for the next 15 years. UNECE does, however, identify a number of problems related to economic viability, institutional weakness in eastern Europe, shortcomings in governance and skills, and forest fires (UNECE/FAO, 2005b).

In some regions fuelwood and non-wood forest products (such as animal fodder, berries, mushrooms, nuts, seeds, cork, meat and skins) remain important for the rural population, especially in the Caucasus, Central Asia, the Balkans, and Turkey (UNECE/FAO, 2005a). Poverty may lead to over-exploitation and impact on forest biodiversity, especially around human settlements (CAREC, 2005).

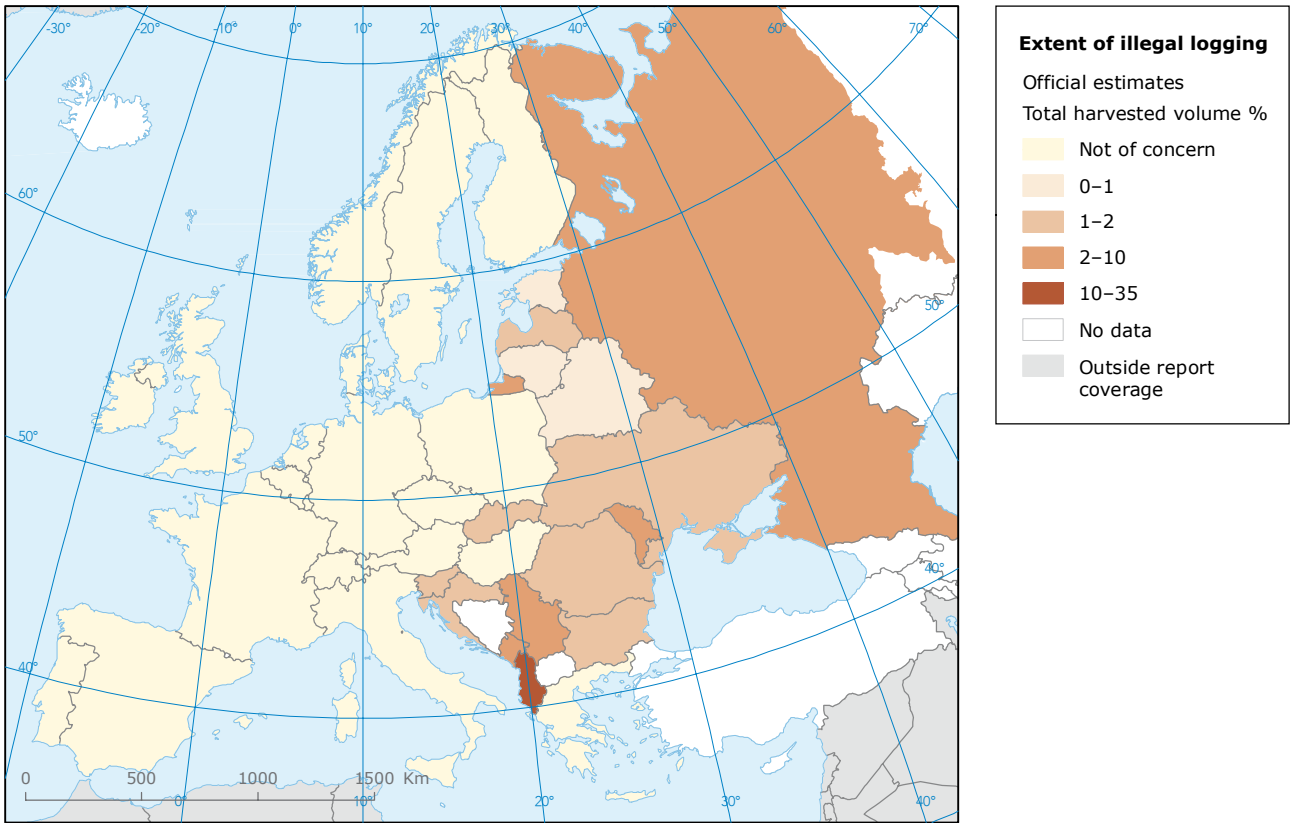
A special threat to forest biodiversity is illegal logging, often rooted in poverty, but also stimulated by commercial incentives, and enhanced by flaws in forest legislation and its enforcement. Illegal logging tends to be more frequent in private than in public forests, and may also occur in protected forests and forest reserves (Bouriaud and Niskanen, 2003; Ottitsch *et al*., 2005). In some cases it is a side effect of cross border conflicts. Illegal logging is most frequent in the Balkan region, the Baltic countries, the Russian Federation, the Caucasus, Central Asia and in some central and eastern European countries (see Map 4.5). Definitions of illegal logging vary between organisations and the estimates of environmental NGOs tend to be higher than governmental and industry estimates (Ottitsch *et al*., 2005; CEPF, 2003/2004; Gunes and Elvan, 2005; UN-ECE/FAO, 2004; WWF, 2004, 2005a, 2005b; IUCN and CCI RF, 2005; Illegal logging Info, 2006).

Changes in traditional land use and climate have increased the number, magnitude and frequency of forest fires in the Mediterranean and SEE regions, the Russian Federation, Central Asia and the Caucasus (FAO/ECE/ILO, 2003; FAO/ECE/ILO, 2004), and reductions in forest fire service capacities in EECCA countries have added to the problem (Dimitrakopoulus and Mitsopoulus, 2006; Goldammer, 2003; Goldammer, 2006). The summer of 2003 was one of the most severe fire seasons in southern Europe, particularly Portugal and France, in recent decades (European Commission, 2004a). In the Balkan region, Croatia, Turkey, the Former Yugoslav Republic of Macedonia, and Bulgaria were most exposed to forest fires during the period 1988–2004, with a strong peak in 2000 (Nikolov, 2006). Large forest areas in Kazakhstan were also affected (Goldammer, 2006), while official Russian Federation statistics report between 20 000 and 40 000 fires annually. Fires in Belarus and Ukraine are more small-scale (Goldammer, 2006). The number of fires and the annual burnt area in northern and central Europe and in the Baltic countries has been rather stable during the past decade.

Policy responses

Most countries in Europe have prepared or are in the process of preparing national forest programmes according to the MCPFE guidelines (MCPFE Vienna Resolution V1). Linkages between an ecosystem approach and sustainable forest management have been successfully established and integrated into forest policy frameworks. The total area of forest formally designated for production and extraction of forest goods has decreased over the past 15 years (most significantly in Sweden, Finland, Ukraine, Romania and Belarus). National policies are increasingly geared towards the development of services such as nature conservation and recreation. The area of forest designated for the conservation of biodiversity has increased considerably in Spain, Italy, Kazakhstan and Croatia. There has been a slight overall decrease of forest with protective functions (soil, water) since 2000, with, nonetheless, strong increases in Albania, Estonia, Iceland, Lithuania and the United Kingdom. The Caucasus shows a negative trend for both protective and production functions (UNECE/FAO, 2005a). Implementation of the Natura 2000 and Emerald networks, inside and outside the EU respectively has provided an important impetus for protecting the biodiversity of Europe's forests.

Map 4.5 Extent of illegal logging in selected countries



Note: Illegal logging takes place when timber is harvested in violation of national laws (European Commission, COM(2003)251 final).

Sources: UNECE/FAO, 2004; Bouriaud, 2005; Ottitsch *et al*., 2005, WWF, 2004; WWF, 2005a; WWF, 2005b.

4.4.3 Agriculture

Trends and pressures on biodiversity

Agricultural land covers about 50 % of Europe's total land surface with the share varying considerably between countries (FAOSTAT, 2001). Agriculture-related biodiversity is highest in traditional extensive farming systems, often dominated by semi-natural grasslands, but these are suffering from continuing land abandonment and intensification (EEA, 2004b).

In western Europe (EU-15), agriculture has intensified continuously over recent decades, reflected by a steady increase in fertiliser inputs and milk and cereal yields: the wheat yield, for example, has roughly trebled since the early 1960s (FAOSTAT, 2003). In central and eastern Europe investments in the agricultural sector dropped substantially during the time of political and economic change in the 1990s, reflected by a sudden drop of about 50 % in the use of nitrogenous fertiliser in countries such as Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia. Compared with the EU-15, current input rates in these countries are low, but the new agro-economic framework after accession is expected to lead to some intensification (EEA, 2004a).

After the political changes in the Russian Federation, 3.8 million ha of pasture were abandoned and turned into shrubland between 1990 and 1994 (National Report to CBD Russia, 1998) and around 20 million ha of arable land is currently abandoned (Ioffe and Al, 2004). Overgrazing is frequent in Romania, the Caucasus and Central Asia, with, for example, up to 25 % of pastures in Kyrgyzstan severely degraded through overgrazing (National Report to CBD for Armenia, 2006; National Biodiversity Action Plan Tajikistan, 2003; National Biodiversity Action Plan Kyrgyzstan, 1998; National Biodiversity Action Plan Romania, 1996).

Irrigation, salinisation and overgrazing are major threats to desert, steppe, pasture and, to a lesser extent, mountain ecosystems in Uzbekistan, Kazakhstan and Azerbaijan (National Report to CBD Uzbekistan, 1998; National Biodiversity Action Plan Kazakhstan, 1999; National Report to CBD Azerbaijan, 2004). Erosion and desertification have affected more than 120 million ha in Kazakhstan (National Biodiversity Action Plan Kazakhstan, 1999). In Azerbaijan, uncontrolled imports and excessive use of pesticides and agrochemicals further add to the pressures on biodiversity (National Report to CBD Azerbaijan, 2004) (see also Section 2.3, Inland waters).

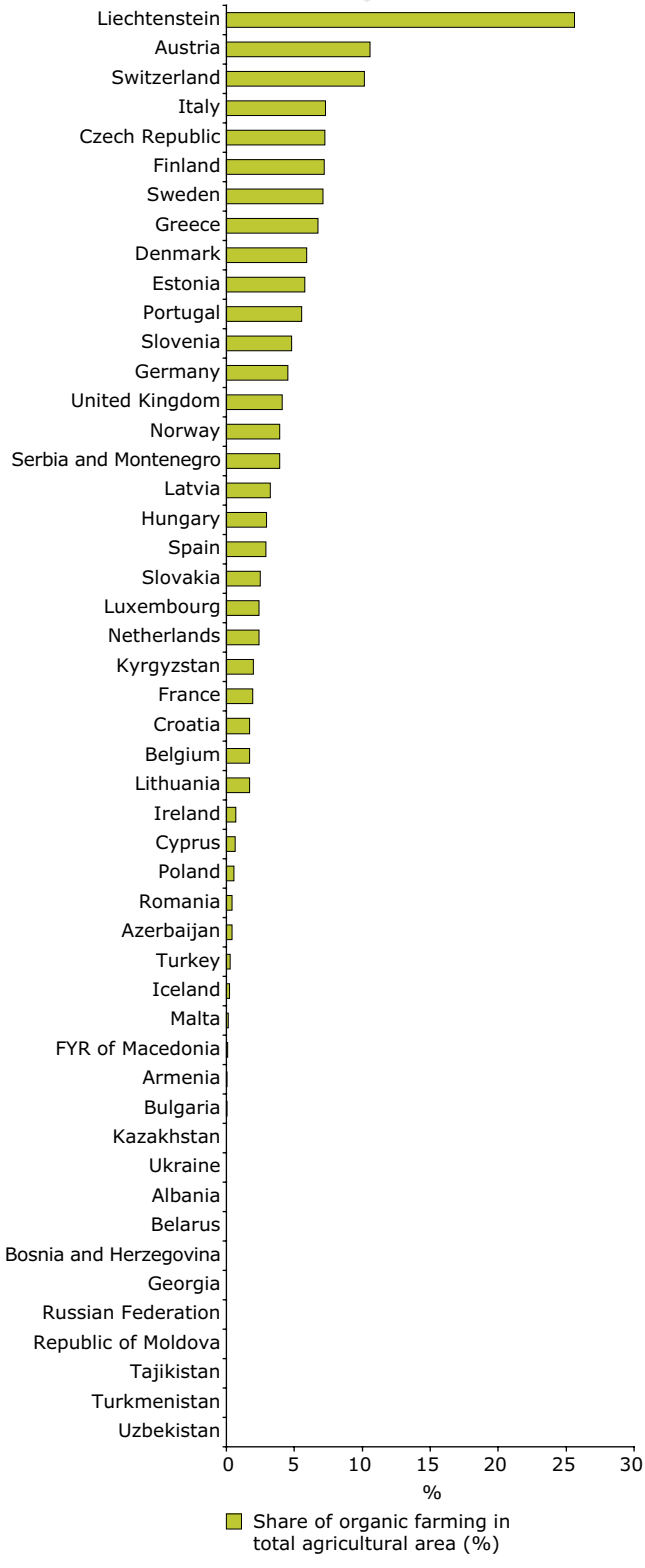
Policy responses

The pressures exerted by agriculture on the environment, including those on biodiversity, have led to policy responses, for example within the framework of the EU common agricultural policy (CAP). In subsequent reforms (1992, 1999, 2003) the CAP has been geared increasingly to non trade concerns, for example through financial support for specific measures beneficial to the environment and the decoupling of subsidies from production.

Agri-environment schemes are the most relevant policy tool for biodiversity conservation on farmland, although they are not necessarily aimed at biodiversity goals. In the EU, the share of agricultural land under these schemes varies from less than 5 % in the Netherlands and Greece to more than 80 % in Austria, Sweden, Finland and Luxembourg (EEA, 2006b). Agri-environmental approaches in the EECCA and SEE regions are very varied and usually geared towards general sustainability issues (see Box 4.7).

Organic farming has developed rapidly since the beginning of the 1990s, with, by 2004, 6.5 million ha in Europe managed organically by around 167 000 farms. Of these, more than 5.8 million ha were in the EU — 3.4 % of the utilised agricultural area — where there are almost 140 000 organic farms. In the EECCA and SEE regions organic farming covers less than 0.5 % of the agricultural land (see Figure 4.9). In most countries organic farming is supported by legislation and direct payments. In the EU, the European Organic Action Plan is being implemented (Willer and Yussefi,

Figure 4.9 Share of organic farming per country in the pan-European region, 2004



Sources: Organic Centre of Wales, 2006; IFOAM 2006.

2006). Two-thirds of the EECCA and SEE countries have introduced incentives, such as organic farming schemes and accreditation, but public awareness is still very limited.

The identification and conservation of high nature value (HNV) farmland was given high priority in the Kiev Resolution on Biodiversity (UNECE, 2003a). It was agreed to identify all high nature value areas in the pan-European region by 2006, and that a substantial proportion of these areas would be brought under biodiversity sensitive management by 2008.

Three main categories of high nature value farmland are (adapted after Andersen *et al.*, 2003):

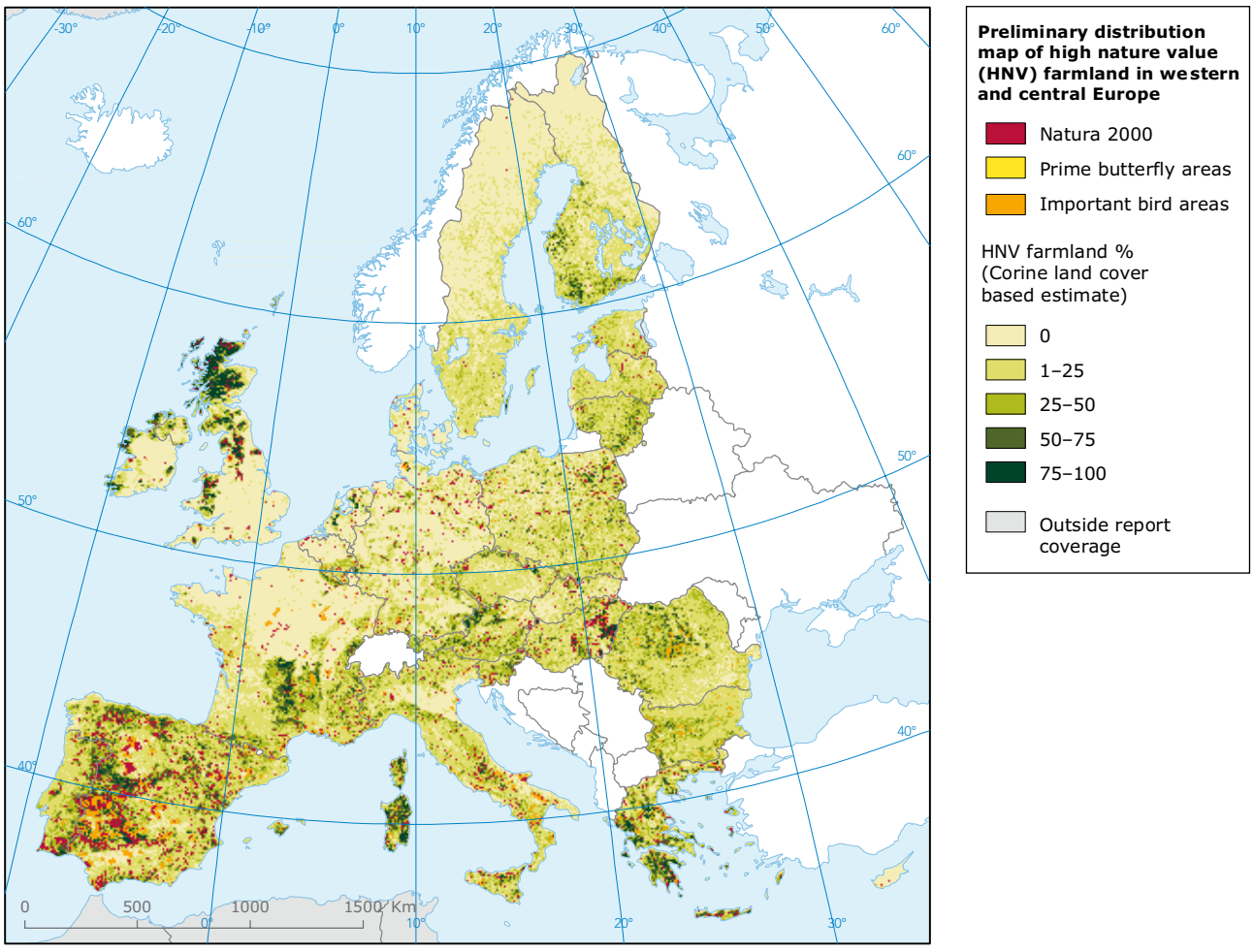
Type 1: farmland with a high proportion of semi-natural vegetation;

Type 2: farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stonewalls, patches of woodland or scrub, and small rivers;

Type 3: farmland supporting rare species or a high proportion of European or world populations.

A map of HNV farmland prepared for the European Environment Agency (Andersen *et al.*, 2003; EEA, 2004b) is currently being updated, using the latest Corine land cover data (2000), supplemented by data on Natura 2000 sites, Important Bird Areas

Map 4.6 Preliminary distribution map of high nature value farmland in the WCE countries



Note: This map is subject to further improvement. Important bird areas will be reselected on the basis of an updated list of HNV farmland birds. In addition, refinements on the basis of national datasets may be carried out.

Source: Preliminary data EEA/DG JRC.

Box 4.7 Pasture rehabilitation in Armenia

In Armenia the extensive development of land and overgrazing have led to the serious degradation of high nature value agricultural lands. In 2005, the government's Decree No. 800 began the implementation of such measures as the evaluation and improvement of natural pastures. The evaluation was carried out under the natural resources management and poverty reduction project and the 'Food safety policy of Armenia' (2004) on 9 500 ha of pastures in 59 communities.

The 'Strategy on Development of Agriculture in Armenia' pinpoints the need for natural rehabilitation of pastures and grasslands to mitigate pressures on them near settlements and make better use of the most remote ones. Several measures have been taken including the restoration and construction of about 200 cattle watering facilities in 45 communities, and the application of improved fertilising methods to 1 770 ha of pastures and grasslands. One of the most important projects is a joint pasture reconstruction programme carried out by the government and the International Centre for Agricultural Research in Dry Areas (ICARDA). Within this, experts have developed surface improvement technology to raise the quality of pastures and teach farmers sustainable management methods — as a result 3 300 ha of pastures and grasslands will be improved.

Source: Third National Report to the CBD, 2006.

(Heath and Evans, 2000), Prime Butterfly Areas (van Swaay and Warren, 2003) and national data sets. A preliminary updated map ([2]) of HNV farmland is shown in Map 4.6. SEE and EECCA are not covered in the data sets and, hence, are not represented. The share of HNV farmland in these regions is most probably higher than in WCE, but the currently available data do not allow a precise estimate. The Kiev target of identifying high nature value farmland in the pan-European region by 2006 has thus only partly been met.

As a consequence, achievement of Kiev's second target — favourable management in place by 2008 — is also in doubt. The preliminary data for EU-25 show that agri-environment support is not correlated with the share of HNV farmland per country (EEA, 2004b). A limited proportion of HNV farmland is designated as protected sites. Regions with a high proportion of such protected farmland habitats do not appear to be particularly targeted by agri-environment schemes, nor do they have a high share of organic farming (EEA, 2006a). For the SEE and EECCA regions, lack of data prevents a quantitative assessment.

To judge the effectiveness and future prospects of policy interventions, it is crucial not only to obtain ecological data, but also to gain detailed insight into the socio-economic mechanisms underlying HNV farming systems. Regional case studies are necessary to analyse the links between biodiversity, agricultural practices, and policy support.

4.5 Controlling invasive alien species

Trends and pressures on biodiversity

Invasive alien species are species whose introduction and/or spread outside their natural distribution range threaten biological diversity (CBD, 2007). This threat is considered one of the major global pressures on biodiversity (Millennium Ecosystem Assessment — MA, 2005). Globalisation processes have created new pathways for the introduction of alien species to Europe and elsewhere. Most recent introductions have happened unintentionally, through trade, transport — for example in ship ballast water — and through tourism. In the past, alien species were often deliberately introduced for hunting purposes and as resources for agriculture, aquaculture, gardening, pest control, erosion control, etc. Some of them have become invasive, out-competing native species and taking over their niches.

Figure 4.10 shows the recorded establishment of alien species in terrestrial and freshwater

([2]) The data on HNV farmland presented here aim at showing the distribution of HNV farmland areas in Europe based on a consistent methodology for all countries. Work is also ongoing for defining an indicator on 'high nature value farmland and forestry' in the context of evaluating EU rural development programmes. This rural development indicator will integrate not only the 'state' of HNV areas (as presented in Map 4.6) but also 'driving forces' (e.g. management systems) supporting and maintaining HNV farmland and forestry.

environments in parts of Europe (see Chapter 5 for coverage of invasive alien species in the marine environment). The rising trend indicates that the situation is far from under control, with impacts on biodiversity expected to increase because of the growing number of species involved, and the increasing vulnerability of ecosystems to such invasions, which results from fragmentation and climate change.

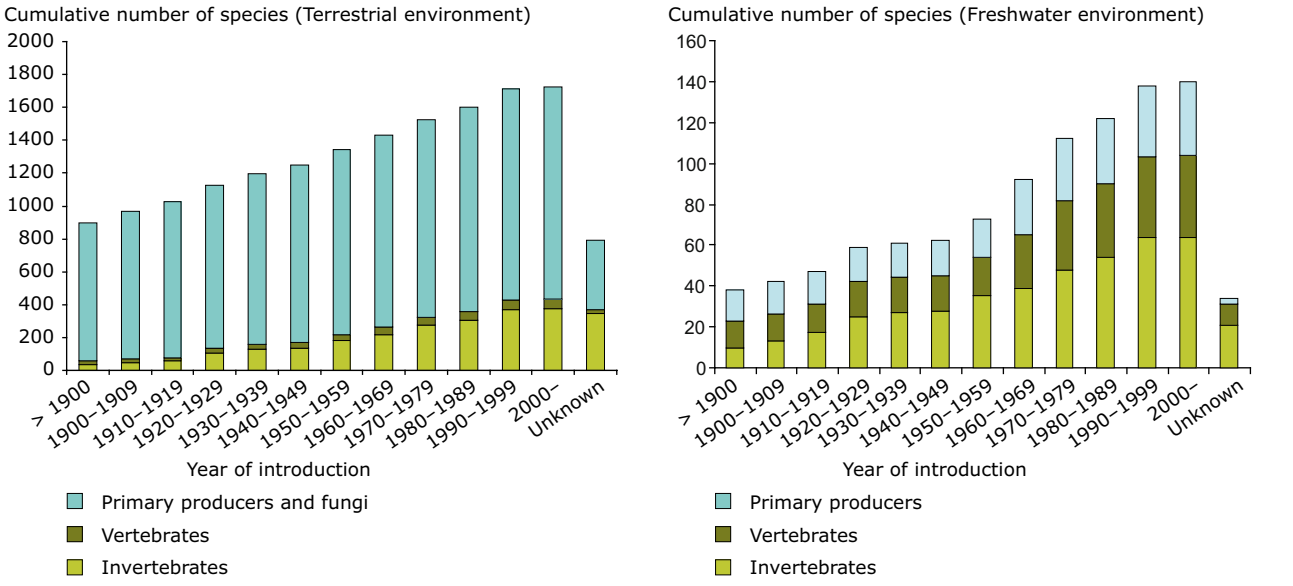
Not all invasives are equally harmful to native biodiversity. The 'worst invasive alien species' in Europe have therefore been identified as a first step in developing the Convention on Biological Diversity indicator 'Trends in invasive alien species' (EEA/SEBI 2010, 2006). The 163 species on the list, of which vascular plants are the biggest taxonomic group with 39 species, have a significant impact on native biodiversity at the genetic, species or ecosystem levels, and may also affect human health, society or the economy. The list includes 53 species in the marine environment, 18 in brackish waters, 50 in freshwaters and wetlands and 75 in terrestrial ecosystems; a number of species occur in more than one ecosystem. Figure 4.11 shows that since 1950, on average more than one of the listed species establishes itself each year, and there is no clear sign that the situation is improving.

The geographical distribution of the 121 terrestrial and freshwater species on the list of worst invasive species is shown in Map 4.7. The distribution appears rather even but with proportionally low numbers in the large northern and eastern countries. These country figures are only very rough indications of the actual impact, which may differ markedly between species and regions.

Policy responses

The Kiev Resolution on Biodiversity (UNECE, 2003a) urges the European countries to implement the European Strategy on Invasive Alien Species as established under the Bern Convention (Council of Europe, 2003) and in accordance with the Guiding Principles for Invasive Alien Species under the Convention on Biological Diversity (CBD, 2002b) ([3]).

Figure 4.10 Cumulative number of alien species established in 11 Nordic and Baltic countries* since 1900



Note: * = Iceland, Norway, Sweden, Denmark, Finland, Estonia, Lithuania, Latvia, Poland, Germany and the Russian Federation (west of Ural).

Sources: EEA/SEBI 2010, 2007; NOBANIS, 2007.

([3]) Additional examples of international agreements are e.g. the FAO Codes of Conduct for Responsible Fisheries (FAO, 1995), the International Plant Protection Convention and the International Convention for the Control and Management of Ships Ballast Water and Sediments established by the International Maritime Organization under the United Nations.

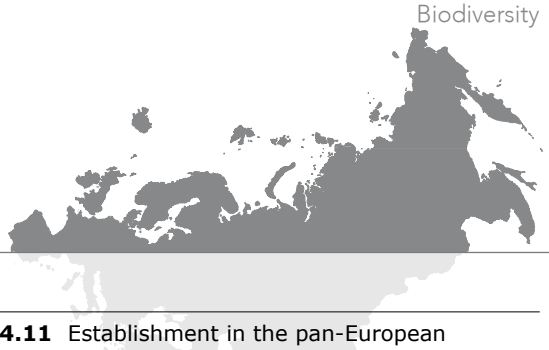
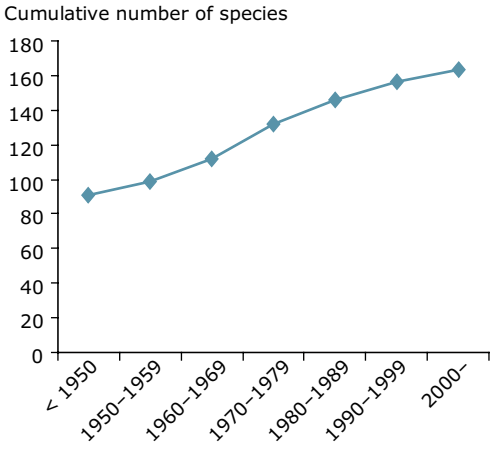


Figure 4.12 shows the response by the countries so far.

The target of half of the countries in the pan-European region meeting the obligations of the Bern Convention and the CBD on invasive alien species through national strategies and planning by 2008 seems achievable; indeed, the majority of the countries have paid explicit attention to invasive alien species in their biodiversity strategies as reported to CBD. Dedicated National Strategies on Invasive Alien Species have been established, for example, in Austria, Norway and the United Kingdom and are in preparation in a number of other WCE countries. A few countries, such as the Netherlands, have taken action to control invasives, but are yet to formalise this in a national strategy or report it to CBD. Policy responses in EECCA are lagging somewhat behind and may need to be supported through capacity building. A more in-depth analysis of how the countries are turning the national strategies into actions should be carried out.

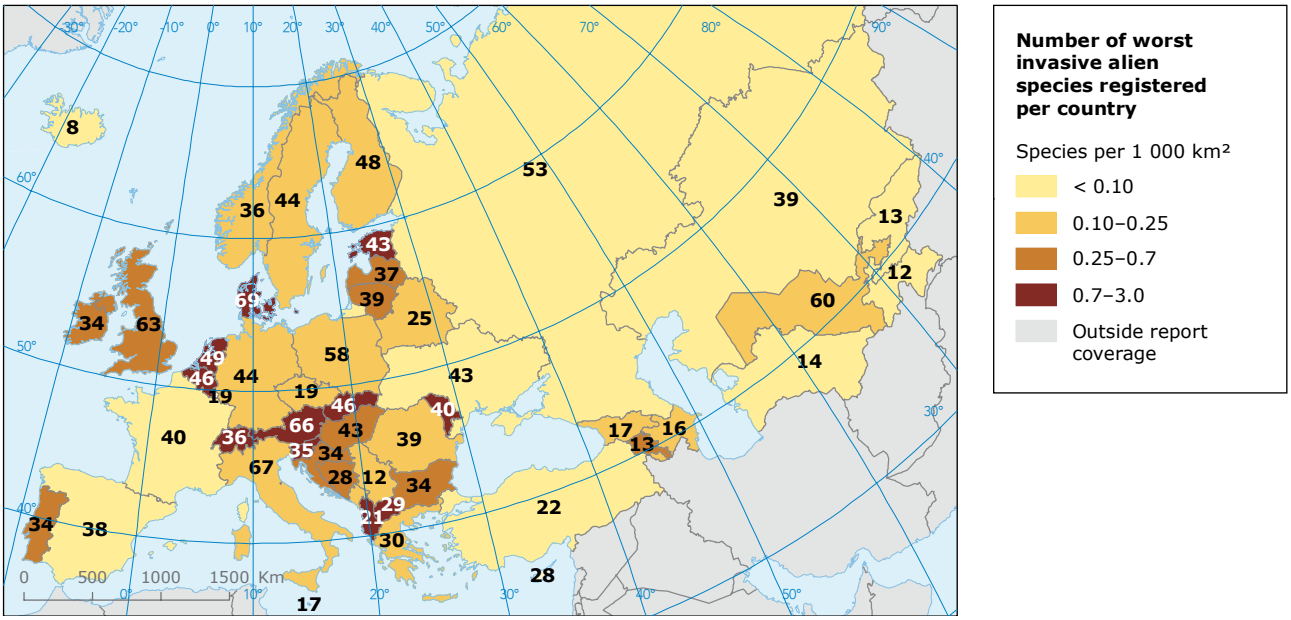
Actions necessary to counter invasive alien species include measures for management and restoration which are usually both difficult and costly (see Boxes 4.8 and 4.9). Within the EU, the LIFE programme finances management actions to control invasive alien species. During the period 1992–2002 in total approximately EUR 28 million

Figure 4.11 Establishment in the pan-European region of the worst invasive alien species threatening biodiversity (all ecosystems)



Source: EEA/SEBI 2010, 2007 Expert Group on trends in invasive alien species.

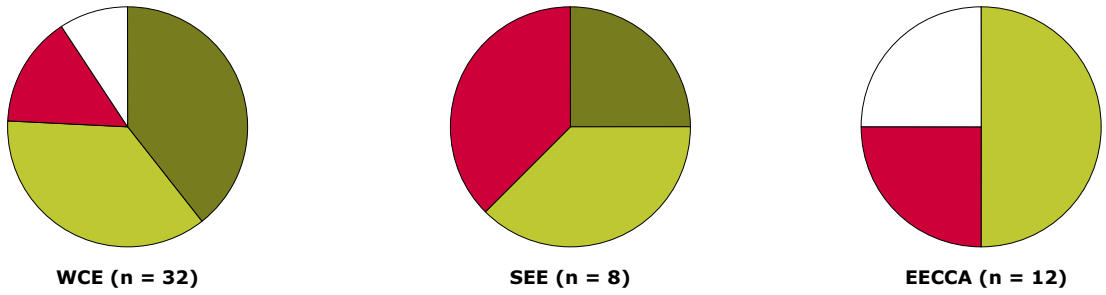
Map 4.7 Number of species in the pan-European region listed as 'worst invasive alien species threatening biodiversity in Europe' occurring in terrestrial and freshwater ecosystems



Note: Species native to a country are not included in figures for this country.

Source: EEA/SEBI 2010, 2006 Expert Group on trends in invasive alien species.

Figure 4.12 Progress in developing national strategies for invasive alien species



Note: A country is assigned to one category only, a specific national strategy for invasive alien species is given priority over general national biodiversity strategies/action plans. Information is lacking from the following countries: WCE: Monaco, San Marino and Andorra; EECCA: Turkmenistan, Uzbekistan and Belarus.

Sources: Council of Europe, 2004; EEA/SEBI 2010 Expert Group on trends in invasive alien species.

was spent in LIFE actions to manage invasive alien species (European Commission, 2004b). The list of worst invasive species that threaten biodiversity in Europe can serve as a tool to prioritise management actions, in establishing monitoring of invasive alien species and 'early warning' systems.

4.6 Getting the message across: monitoring and public awareness

Biodiversity indicators and monitoring

Due to its broad scope and complexity, biodiversity has long suffered from uncoordinated and scattered monitoring across Europe. Recent surveys have shown that most programmes work in isolation and only cover parts of biodiversity or focus on specific targets, often not aimed at policy-makers (Nieto and Delbaere, 2005). Over recent years the interest in monitoring has increased, politically as well as in science and society. At the EU level, legal instruments such as the Birds and Habitats Directives and, to a lesser extent, the Water Framework Directive provide a framework for structured and focused monitoring of specific elements of biodiversity across the EU (Romao, 2004). When fully implemented, monitoring under the Birds and the Habitats Directives, which is compulsory, will provide a regular and updated assessment of the status of biodiversity components of Community interest (see also Section 4.3).

The 2010 target to halt biodiversity loss has initiated development of headline indicators and reporting processes at global level (Convention on Biological Diversity), at pan-European level (Kiev Resolution on Biodiversity), and at EU level (the Malahide Declaration, endorsed by the Environment Council (European Commission, 2004c)). The Kiev Resolution states that *by 2008, a coherent European programme on biodiversity monitoring and reporting, facilitated by the European Biodiversity Monitoring and Indicator Framework, will be operational in the region, in support of nature and biodiversity policies, including, by 2006, an agreed core set of biodiversity indicators, developed with the active participation of the relevant stakeholders*.

In 2004 the European Environment Agency, European Centre for Nature Conservation and UNEP World Conservation Monitoring Centre initiated the SEBI 2010 ([4]) process to support this (Nieto, 2005; McInnes, 2005, 2006a, 2006b). The

([4]) Streamlining European 2010 Biodiversity Indicators. This project integrates the previous activities under the 'European Biodiversity Monitoring and Indicator Framework' as referred to in the Kiev Resolution on Biodiversity.

Box 4.8 Worst invasives — the iceplant

The iceplant, *Carpobrotus edulis*, native of the Cape Region of South Africa, was intentionally introduced into Europe as an ornamental plant, and for erosion prevention, for example on roadsides. Today it is a major problem in southern Europe and in the British Isles. It grows abundantly on coastal dunes, shrub areas and cliffs and in salt marshes, rapidly forming large mono-specific stands, and creating extensive, impenetrable and species-poor mats up to 50 cm thick that displace native vegetation. The species also alters the ecosystem by increasing the level of organic carbon, acidifying the soils, and producing considerable amounts of litter.

There is an urgent need for control and management of the iceplant in Europe, and a number of actions have been carried out at a high cost. A 2002–2005 LIFE Nature project (LIFE2000NAT/E/7355) for the conservation of the endangered flora in Menorca, Spain, focused on its control and eradication from about 68.7 affected ha. Eradication, which could only be carried out by hand, took more than 250 days and involved moving some 2 500 m^3 of plant material, at a cost exceeding EUR 120 000.

As a result of opposition from two landowners, the iceplant still remains in natural habitats in two places on Menorca. The results of the eradication were positive, but, as the plant has a high capacity to regrow, mainly through the soil seed bank, all the cleared areas are visited about every six months, to remove seedlings and vegetative regeneration.

Photo: The iceplant, *Carpobrotus edulis,* Cyprus
© Tor-Björn Larsson

Photo: *Carpobrotus* control campaign in Menorca, Spain
© Pere Fraga i Arguimbau

Distribution of the iceplant in Menorca before eradication
Iceplant area
Roads

Sources: EEA/SEBI 2010, 2006; Vila *et al.*, 2006; Consell Insular de Menorca, 2001.

SEBI headline biodiversity indicators are clustered in focal areas defined by CBD ([5]). Beyond the production of indicators, the SEBI 2010 process should lead to harmonised long term monitoring across Europe and more integrated and regular reporting of results. An initial survey by the European Environment Agency (EEA-ETC/BD) in 18 European countries shows that, so far, only

([5]) Decision VII/30 and SBSTTA Recommendation X/5.

Box 4.9 Worst invasives — the American mink

The American mink, *Mustela vison*, was brought to Europe in the 1920s, mainly for fur farming. Animals have since escaped or been released and have established large breeding populations across Europe, reducing populations of native water mammals and birds, especially sea birds on which it preys. The Bern Convention has recommended its eradication, and a number of control campaigns have been launched, usually involving hunters and other volunteers in major trapping efforts. However, as it is almost impossible to eradicate the American mink from continental areas because of its high rate of reproduction, eradication has only been successful on some islands, such as in the outer archipelago of south-western Finland and eastern Sweden, and as shown in the example from Estonia below.

A so far successful mink campaign took place on the Estonian 1 000 km² island of Hiiumaa in 1998–2000, as a preparatory phase for establishment of the island's critically endangered European mink, *Mustela lutreola*, reserve. The American mink population was established on the island by escapes from a single mink farm which closed in 1996. After local hunters had only limited success, a specialist team from Belarus undertook four eradication campaigns in the course of which 53 American mink were caught. As subsequent inventories did not reveal signs of any remaining American mink, the eradication was finally considered successful in 2000. A programme to re-establish an island population of European mink began which is only now showing the very first signs of success.

Photo: Mink control campaign in Baltic coastal region, Sweden © Anja Kjellsson/Swedish Association for Hunting and Wildlife Management

Sources: Convention on the Conservation of European Wildlife and Natural Habitats. Standing Committee. Recommendation No. 77 (1999) on the eradication of non-native terrestrial vertebrates.
Hiiumaa example: Tiit Maran, Foundation LUTREOLA at Tallinn Zoo, Estonia.

a few headline indicators are reflected in national monitoring programmes (Nieto Serradilla and Delbaere, 2005). SEBI 2010 currently involves around 124 experts from 24 countries but will expand to reach a full pan-European dimension. Several workshops ([6]) have been organised to stimulate its implementation in EECCA and SEE. A lack of specialists in certain taxonomic groups, low awareness, the difficult accessibility of many areas, and a lack of funding for monitoring have been reported as the main bottlenecks (Delbaere, 2006). The latter is also a serious problem in EU Member States and EFTA countries.

As a first output of the SEBI 2010 process, a set of 24 indicators was delivered in January 2007 (EEA, in preparation). The development of the biodiversity headline indicators is thus largely on track, but adequate funding for the implementation in 2008 of the corresponding monitoring has not yet been secured.

Increasing public participation and environmental awareness is advocated by the Århus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. The Convention on Biological Diversity acknowledged its relevance for biodiversity conservation by adopting a Communication, Education and Public Awareness (CEPA) Programme (CBD, 2002a). The European Ministers of Environment further committed

([6]) Western Balkans, September 2006 (ECNC); Eastern Europe, the Caucasus and Central Asia, April 2006 (ECNC); the Caucasus, May 2006 (IUCN).

themselves in the Kiev Resolution on Biodiversity to implement national action plans in at least half of the countries by 2008 (see also Section 4.1).

Progress towards this target was reported during the Fourth Intergovernmental Conference on Biodiversity in Europe held in Croatia in February 2006 (Council of Europe and UNEP, 2006). Several initiatives have been launched:

- the Countdown 2010 alliance, initiated by IUCN — the World Conservation Union — and supported by the pan-European Biological and Landscape Diversity Strategy Council, the European Commission, several European countries, and other organisations;
- a number of regional projects in central and eastern Europe, including communication projects developed and implemented by the European Centre for Nature Conservation, with the support of Norway, the Netherlands and Switzerland;
- the European Nature Conference organised in September 2005 by Natuurmonumenten, EEB, ECNC, Eurosite and Europarcs with EUCC and others, in Apeldoorn, the Netherlands, bringing together more than 650 people and resulting in the Apeldoorn Appeal, which stressed the relevance of connecting people and nature;
- the Beautiful Europe Initiative of NatureNet Europe, focusing on finding common ground between nature conservation and stakeholders in land use, finance and other sectors of society.

The third national biodiversity reports to the Convention on Biological Diversity (CBD, 2006) provide insight into progress with implementing national action plans. Of the 52 countries covered by this analysis, nine have CEPA action plans and nine others are currently preparing them, which yields a preliminary score of 35 % (Figure 4.13). Thus, the Kiev target of 50 % by 2008 seems realistic.

The most active EECCA country in implementing a CEPA strategy is Kazakhstan with its adoption, in September 2002, of the Concept for Environmental Education (CBD, 2006). The country is also active in the elaboration of the Education Strategy for

Box 4.10 The Caucasus region, a case for joint efforts in biodiversity conservation

As a biodiversity hot spot, the Caucasus ecoregion, which spans Armenia, Azerbaijan, Georgia and parts of Iran, the Russian Federation and Turkey, has been in particular focus over the last few years for the implementation of monitoring programmes and conservation.

The Caucasus Initiative was launched in 2001 by the German Federal Ministry of Economic Development and Cooperation with the aim of enhancing collaboration with Caucasian countries on the protection of nature and biodiversity conservation through cross-border projects.

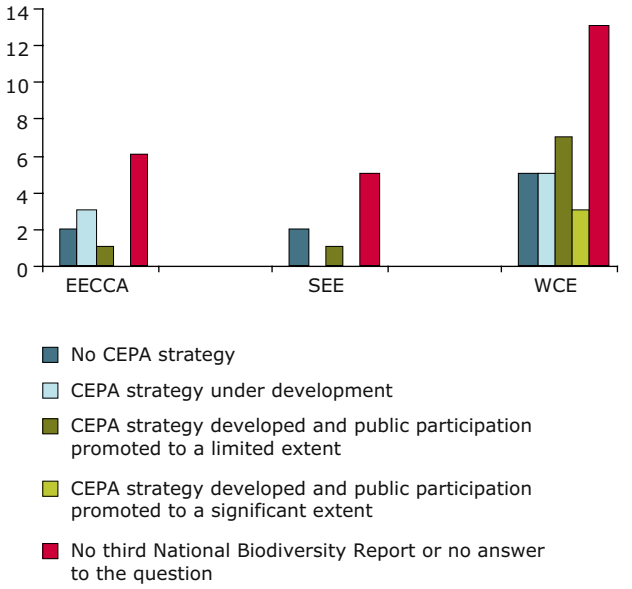
Within this framework and in collaboration with the Critical Ecosystems Partnership Fund and the MacArthur Foundation, WWF's Caucasus Programme Office prepared an Ecoregional Conservation Plan (ECP) — a comprehensive strategy to conserve and restore the ecoregion's biodiversity over several decades that is also a practical instrument for the implementation of the Convention on Biological Diversity (CBD). The implementation of the ECP is to be guided by the Regional Council for Biodiversity Conservation and Sustainable Management of Natural Resources in the Caucasus.

The Caucasian countries' Ministerial Conference on Nature Protection in the Caucasus — Promoting Transboundary Cooperation for CBD Implementation took place in Berlin in March 2006, organised by KfW Development Bank and WWF-Germany. This high-level political platform gave governments and international organisations an opportunity to discuss their activities to protect biological diversity and to announce commitments to their implementation of the ECP. Additionally, a Regional Monitoring Network was established to evaluate the current status of biodiversity in the Caucasus ecoregion.

A Caucasus Protected Areas Fund was also launched at the Caucasus Ministerial Conference. Developed in collaboration by the German Government, WWF, and Conservation International, the new fund will provide up to half of the basic annual operating costs of priority protected areas.

Source: WWF, 2006a.

Figure 4.13 Progress in the implementation of the Communication Education and Public Awareness (CEPA) Programme



Source: Third National Biodiversity Reports to the Convention on Biological Diversity.

Sustainable Development for the Asia-Pacific region (UNESCO, 2005). Kyrgyzstan, Tajikistan, Uzbekistan and Armenia report that strategies are under development. According to the Kyrgyz Third National Biodiversity Report, public awareness at a community level is currently very restricted, and the potential role of NGOs in its development is recognised.

Little information is available from SEE countries. Romania reports that a communication strategy has been developed, but has not yet been formally endorsed. Among the WCE countries that have reported, only Finland has developed a CEPA strategy and promoted public participation to any significant extent. According to the Finnish development plan (2003–2008) for the National Board of Education approved by the Council of State in December 2003, principles of sustainable ecological, social and economic development are fully integrated in the educational and research system.