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Assessing biodiversity in Europe — the 2010 report

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European Environment Agency

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Foreword

The European target of halting biodiversity loss by 2010 has brought visibility to Europe's wealth of natural capital and the essential ecosystem services that biodiversity delivers: providing food, fibre, medicines and freshwater; pollinating crops; filtering pollutants; and protecting us from natural disasters. It has raised awareness of the need to prioritise biodiversity in all areas of decision-making and in all economic sectors.

The present report considers the status and trends of pan-European biodiversity in a range of ecosystems, and the implications of these trends for biodiversity management policy and practice. It considers the key biodiversity policy instruments currently applied in Europe, the threats to biodiversity and the management implications of such threats across major habitat types. The report makes use of Streamlining European 2010 Biodiversity Indicators (SEBI 2010) and other relevant national and regional information sources that the European Environment Agency coordinates.

This report shows that Europe is still far from meeting its 2010 target and that we risk missing future targets unless we change the way that we are managing our environment. Shortcomings until now have included gaps in policy implementation and integration a lack of political will, insufficient financing and communication, the absence of readily quantifiable targets and inadequate knowledge and monitoring of biodiversity in Europe.

For change to occur, we need two core elements. First, we need hugely broadened public understanding and appreciation of biodiversity and its role in sustaining our societies and economies. This is crucial because it is ultimately popular recognition of the value of biodiversity and healthy ecosystems that is going to create the political will for action.

Clearly, though, this needs to be complemented by a second element, which is greater understanding on the part of policymakers of what is driving biodiversity loss and how we can halt and reverse it. In practice, this means steering private sector decision-making through a mixture of economic incentives and legal standards that protect the public good. It is unlikely that sufficient progress can be made without the fundamental step of embedding environment in the economy.

Recognising the urgent need to address these issues, in March 2010 EU Environment Ministers adopted the Headline Target of halting biodiversity loss and degradation of ecosystem services and restoring them, in so far as feasible, by 2020, while stepping up EU efforts to prevent global biodiversity loss. It also endorsed a Long-term Biodiversity Vision for 2050. The European Council further specified the need to establish a clear baseline, outlining criteria for assessing achievements. These ambitious initiatives will underpin the new EU Biodiversity Strategy, to be finalised by the end of 2010.

The EEA developed the EU 2010 Biodiversity Baseline in response to this need. The Baseline offers a comprehensive snapshot of the current state of biodiversity. It thereby supports the EU in developing the post-2010 sub-targets as part of the biodiversity strategy and provides factual data for measuring and monitoring progress in the EU from 2011 to 2020.

The EEA has also made considerable efforts to deliver biodiversity assessments during the International Year of Biodiversity. These include the present report and the '10 messages for 2010' — short assessments of specific ecosystems or issues related to biodiversity in Europe.

This report will be presented at the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (18–29 October 2010, Nagoya, Japan) to provide decision-makers with information on the status and management of biodiversity and ecosystems in Europe to assist in setting new global biodiversity targets.

Jacqueline McGlade

Executive Director
European Environment Agency

Executive summary

This report confirms the finding of the EEA's 2009 report 'Progress towards the European 2010 biodiversity target' (EEA, 2009a) that Europe will not achieve its target of halting biodiversity loss by 2010.

The present report considers the status and trends of pan-European biodiversity, and the implications of these trends for biodiversity management policy and practice. It considers the key biodiversity policy instruments currently applied in Europe, the threats to biodiversity and their management implications across major habitat types. The implications for biodiversity of cross-cutting issues such as tourism and urban planning are also considered, along with the challenges that remain for conserving and sustainably using of Europe's biodiversity. The report makes use of the SEBI 2010 indicators and other relevant national and regional information sources. It does not consider the biodiversity of EU overseas territories and outermost regions.

As a result of human activity, most of Europe's biodiversity exists within a mosaic of heavily managed land and highly exploited seascapes. To a large degree, this is linked to agricultural, forestry and fishery practices across the region. In recent decades, growing public and political awareness of biodiversity decline has led to improved commitments, policies and practices for the conservation and sustainable use of biodiversity throughout much of Europe, and there are indications that some aspects of biodiversity are improving in some areas.

Almost two decades after the Convention on Biological Diversity (CBD) came into force, biodiversity loss now has a high political profile at the global, regional and national levels. Governments have made ambitious commitments to act. Under the Swedish Presidency in 2001, for example, the EU agreed its 2010 biodiversity target in Gothenburg. At the Fifth Environment for Europe (EfE) Ministerial Conference (Kiev, Ukraine) in 2003, governments across the pan-European region agreed the Kiev Resolution on biodiversity and endorsed the 2010 target.

Despite such efforts, biodiversity loss continues in many parts of Europe. Major threats include habitat destruction and fragmentation, the establishment and spread of invasive alien species, pollution from agricultural runoff in many countries, increasing water abstraction and use, over-exploitation, and the increasing impact of climatic change.

There are indications that, where implemented successfully, Europe's key policy instruments have had positive impacts, with the status of some targeted species and habitats improving in parts of the region. In particular, the Birds Directive (EC, 2009e), the Habitats Directive (EC, 1992) and the Water Framework Directive (EC, 2000) have had important positive impacts on biodiversity in the EU. Growth in protected areas across the pan-European area has also been significant. Despite progress in enacting and implementing European policy, assessments at various scales show that a large proportion of habitats and species have an unfavourable conservation status. This highlights the urgent need to intensify conservation efforts.

Freshwater ecosystems are among the ecosystems facing most pressures in Europe, with the quantity and quality of habitats and abundance of many species declining. Natural wetlands (marshes and bogs) decreased by 5 % between 1990 and 2006 — the second largest proportional land cover change of all the major habitat classes — although inland surface water cover increased by nearly 4.4 %. Pollution, habitat degradation and fragmentation, and invasive species remain significant threats to freshwater ecosystems. However, legislation and investments, particularly in the EU, have improved the quality of freshwater ecosystems.

Mountain ecosystems in Europe are particularly diverse in habitats and species but are also especially vulnerable to impacts from changes in agricultural practices, tourism, infrastructural development and climate. International frameworks have been established to protect and manage mountain areas sustainably, for example the Alpine and Carpathian Conventions. However, the value of mountain ecosystems and their services to lowland economies, including water supply and regulation, is not widely recognised.

Forest ecosystems in Europe have endured dramatic historical declines, although in the last 20 years deforestation has largely been reversed. Decline is now limited to only a few regions and in some areas significant forest expansion has occurred. Around 3 % of European forests are protected for biodiversity conservation, 25 % of EU forests are excluded from wood harvesting, and forest certification schemes and sustainable forest management are increasingly common. The loss of forest biodiversity in Europe continues, however, with declining forest bird and mammal populations in some parts. Fragmentation and forest fires are major threats, although smaller woodlands and wood pastures are important for biodiversity in a mosaic landscape. Institutional changes, including privatisation in many former centrally planned economies, have led to intensified commercial forestry in unprotected areas, increasing pressures on biodiversity.

Coastal and marine ecosystems have lost considerable biodiversity in recent decades, mainly due to erosion of coastal and estuarine wetlands and dune systems, overexploitation of marine fisheries, and pollution. Some 45 % of assessed European fish stocks are outside safe biological limits. Invasive alien species remain a threat and are increasing rapidly in Europe's marine ecosystems. The reform of the EU Common Fisheries Policy calls for better stewardship. Meanwhile, the Marine Strategy Framework Directive, adopted in 2008, applies an ecosystem-based approach to managing the seas around Member States.

Agricultural ecosystems dominate much of Europe's landscape and biodiversity has fallen significantly in agricultural areas. For example populations of farmland birds have fallen 50 % since 1980. However, examples of positive changes can be seen across Europe. These include reduced nitrogen surpluses due to more careful application of fertilisers and wider uptake of environmentally-friendly management, such as organic farming and agri-environment schemes, which can support agricultural biodiversity. Recent reforms of the Common Agricultural Policy have encouraged these new approaches. However, there remains considerable potential to improve management of agricultural areas, to safeguard ecosystem services and integrate biodiversity into agricultural management practices.

Grassland ecosystems in Europe are experiencing a major decline in their biodiversity, such as butterflies. This is mainly caused by habitat loss and degradation due to intensified farming or abandonment of agricultural land. Climate change, air pollution and invasive alien species are also significant threats. Upland grasslands are declining in extent and are in poor condition, with their characteristic biodiversity showing significant and serious decline since 1990. The dry grasslands of Europe, in the Mediterranean and the steppes of eastern Europe are also under threat, mainly from desertification related to unsustainable management practices, exacerbated by climate change. Abandonment of sustainable grazing and traditional hay-making practices are particular problems for these areas.

Urban ecosystems are seldom well integrated into wider biodiversity considerations. Moreover, urbanisation and urban sprawl are significant factors affecting biodiversity in Europe through land-use change. The concept of 'green infrastructure' is gaining recognition in Europe and could strengthen sustainable management of urban and peri-urban natural areas, increasing people's contact with nature, reducing urban stress and helping climate change adaptation.

Successful conservation actions across the region could be expanded and scaled up to address major gaps. However, conservation activities alone are insufficient to address biodiversity loss in the region. One reason is that many of the direct drivers — and all of the indirect drivers — of biodiversity loss emanate from sectors beyond the control of conservation interventions alone.

In recent years, governments have taken steps to increase policy integration and coherence, for example with respect to EU fisheries and agriculture policies. However, these have not been sufficient to stem biodiversity loss. Continuing and deepening the mainstreaming of biodiversity in public and private sector decisions and policies (such as concerning trade, planning, transport, tourism and finance) would help address many of the underlying threats to biodiversity. Recent work to ascribe economic values to biodiversity and ecosystem services in and beyond these sectors can play a vital role in supporting such mainstreaming.

A more integrated approach to biodiversity management across sectors, and across administrative boundaries, at landscape and seascape scales would be an important step forward. This effectively amounts to wider application of the ecosystem-based approach. Efforts to link protected areas to the wider landscape, including through ecological networks and connectivity areas, need to continue with the aim of achieving multifunctional land-use planning at a regional scale.

Communication and education must continue to raise public awareness about biodiversity's importance, its links to livelihoods via ecosystem services, and its ongoing loss. These actions can encourage both individual action to conserve biodiversity and public support for changes in policy and practice.

Key gaps in knowledge remain across Europe, for example regarding the status of specific taxa and habitats (especially in eastern Europe) and interdisciplinary knowledge of the links between biodiversity change, ecosystem services and human well-being. Filling such gaps through further monitoring, research and assessment would enable better decision-making and policies on European biodiversity in the 21st century.

1 Introduction

This report considers the status and trends of European biodiversity, and the implications of these trends for biodiversity management policy and practice. The geographic scope of the report is pan-European, including the whole of Europe, Caucasus, Central Asia and Russia (Map 1.1). The report does not consider the biodiversity of EU overseas territories and outermost regions.

The present report uses the SEBI 2010 (Streamlining European 2010 Biodiversity Indicators) indicator set and other relevant information sources, and includes information from non-EEA countries where available. SEBI 2010 is a regional partnership between the European Environment Agency (and its European Topic Centre on Biological Diversity), the European Centre for Nature Conservation, the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), the European Commission, the Joint Secretariat of the Pan-European Biological and Landscape Diversity Strategy (PEBLDS), and the Czech Republic.

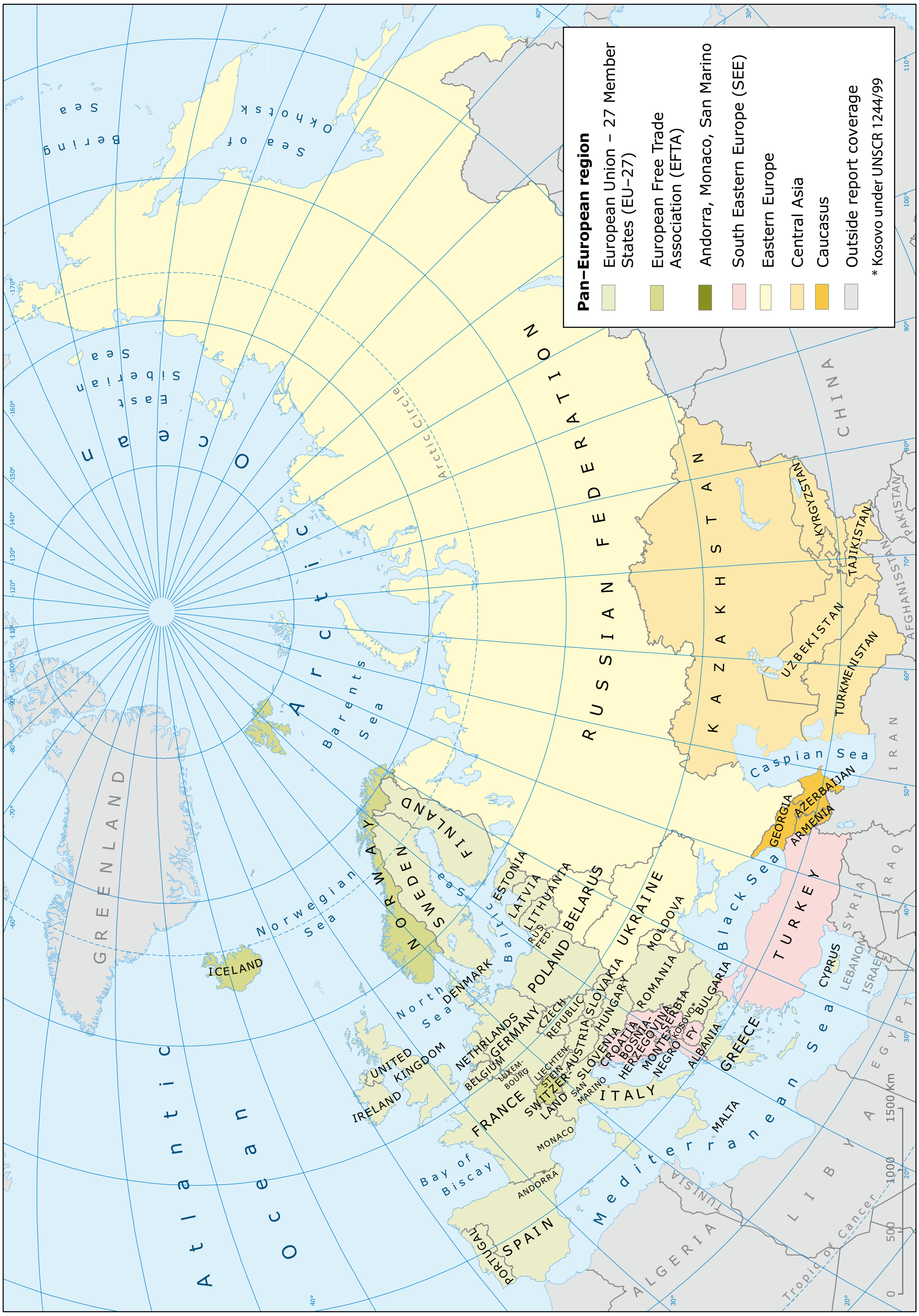
SEBI 2010 was established to help streamline national, regional and global indicators and, crucially, to develop a simple and workable set of indicators to measure progress and help achieve the 2010 target at the European scale. SEBI indicators have subsequently been used in other policy-relevant indicator sets such as the EEA Core Set of Indicators or the Environment Policy Review to monitor progress in implementation of the EU Sixth Environment Action Programme. The European Commission has used the SEBI 2010 indicator set to support its assessment of progress in implementing the Biodiversity Action Plan. Finally, SEBI 2010 works closely with the 2010 Biodiversity Indicators Partnership with the intention of ensuring close linkages across national, pan-European and global activities. The complete set of SEBI 2010 indicators grouped by the CBD focal area and EU headline indicators is shown in Annex 1 to the present report.

This report completes a five-year assessment cycle that started with a 2006 report on progress towards the 2010 biodiversity target (EEA, 2006a). It updates the findings from 2006 with the information gathered through SEBI 2010 and will be presented to the Conference of the Parties to the Convention on Biological Diversity (CBD) at its tenth meeting. It also complements other publications in 2010: the EEA's European Environment State and Outlook Report 2010 (SOER2010), the '10 messages for 2010' (EEA, 2010a), the EU 2010 Biodiversity Baseline (EEA, 2010d) and the scheduled update of the first SEBI 2010 report, describing the technical characteristics of the SEBI 2010 indicators (EEA, 2007e).

Information and assessments on European biodiversity should be seen in the context of the Biodiversity Information System for Europe (BISE), in particular the development of an EU Biodiversity Data Centre and the Pan-European Biological and Landscape Diversity Strategy (PEBLDS). These new developments will help address several of the knowledge gaps identified in this report.

Chapter 2 of the report considers the key biodiversity policy instruments currently applied in Europe. Chapter 3 addresses the status and trends of biodiversity, threats to biodiversity and management implications for major habitat classes (using the aggregated Corine classes defined for SEBI 2010 reporting) and includes text boxes on several key themes. Finally, Chapter 4 highlights key conclusions and identifies challenges that remain for conservation and sustainable use of Europe's biodiversity.

Map 1.1 The pan-European region covered in this report



2 Biodiversity policy in Europe

Biodiversity is now higher on the European political agenda than ever before. In 2001, the EU Strategy for Sustainable Development included a target to halt biodiversity decline by 2010. The following year, the Conference of the Parties to the Convention on Biological Diversity (CBD) agreed at its fifth meeting to reduce biodiversity loss significantly by 2010. Later that year, governments reaffirmed the CBD commitment at the World Summit for Sustainable Development in Johannesburg. Since then, considerable progress has been made towards conserving biodiversity in Europe.

At the fifth Environment for Europe (EfE) Ministerial Conference (Kiev, Ukraine) in 2003, the EU's 2010 target was endorsed at the pan-European level. The 'Kiev Resolution on Biodiversity' represents the framework for action. The EfE process has produced a large number of agreements, strategies and policies on nature conservation, including the Pan-European Biological and Landscape Diversity Strategy (PEBLDS), which governments endorsed in 1995.

Box 2.1 Article 17 reporting under the Habitats Directive

Article 17 of the Habitats Directive (EC, 1992) requires Member States to report every six years on progress in implementation. For the reporting period 2001–2006, 25 Member States provided the first detailed assessments of the conservation status of the 216 habitat types and 1 182 species listed in the directive and found within their territory. The scale of this reporting exercise is unparalleled in Europe and provides a first overview and point of reference for assessing future trends.

Article 1 of the Habitats Directive defines 'conservation status' as applied to habitats and species. The definitions take into account parameters affecting long-term distribution. For habitats, that includes the extent and surface of the habitat, its structure and functions. For species parameters include range, population size, age structure, mortality and reproduction. This forms the basis for developing a common assessment method and reporting format for the Member States (EC, 2009a).

The Directive's overall objective is that all habitat types and species of community interest should achieve 'favourable conservation status'. In simple terms, that means a situation where a habitat type or species is prospering in terms of both quality and extent/population, and has good prospects to do so in the future. The fact that a habitat or species is not threatened (i.e. does not face a direct extinction risk) does not mean that it is in favourable conservation status (EC, 2006c).

In the present report, the conservation status of habitats and species is categorised in four groups:

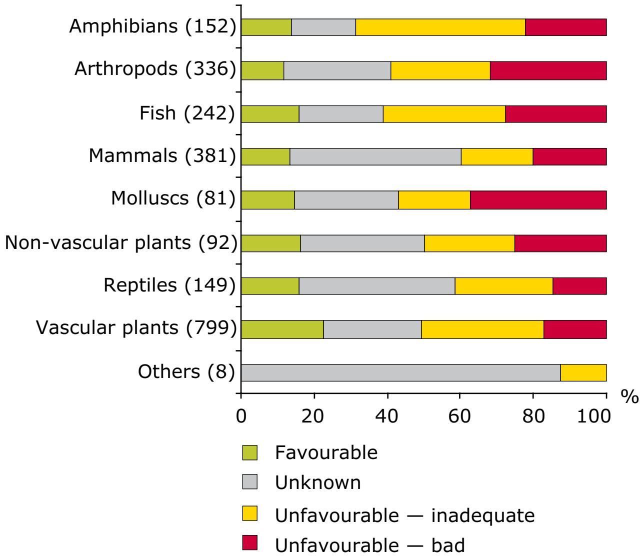
- 'Favourable' status implies that the habitat or species can be expected to prosper without any change to existing management or policies.
- 'Unfavourable — inadequate' implies that a change in management or policy is required but the danger of extinction is not high.
- 'Unfavourable — bad' implies that the habitat or species is in serious danger of becoming extinct (at least locally).
- 'Unknown' implies that there is no or insufficient information is available. This category includes the following categories from Article 17 reporting: 'unknown but not favourable', 'unknown' and 'not possible to assess'.

In May 2006, the European Commission adopted the communication entitled 'Halting Biodiversity Loss by 2010 and Beyond' (EC, 2006a) and set out a detailed Biodiversity Action Plan to achieve this target (EC, 2006b). The Action Plan's mid-term report (EC, 2008a), published in December 2008, has provided the most ambitious assessment of the state of biodiversity in the EU to date. The Action Plan's final assessment will be published later in 2010.

As described in Box 2.1, the first assessment of the conservation status of habitats and species protected under the Habitats Directive (EC, 2009a) also provides a first overview and point of reference for assessing future trends. Troublingly, it shows that a large proportion of the habitats and species of Community interest have an unfavourable or unknown conservation status (Figure 2.1; Map 2.1). According to BirdLife International (2004) nearly half of all European bird species have an unfavourable conservation status (Figure 2.2). These findings demonstrate the urgent need for intensified conservation efforts.

Nevertheless, there are indications that the Birds and Habitats Directives can deliver positive results. In particular the Birds Directive has made significant progress towards halting the decline of many of Europe's most threatened birds. Key measures include designating Special Protection Areas (SPAs) as part of Natura 2000; adopting and implementing

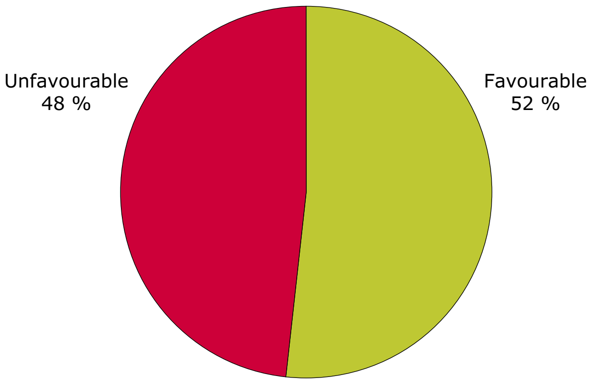
Figure 2.1 Conservation status of assessed species in EU-25, by taxonomic group



Note: Number of assessments in brackets.

Source: ETC/BD, 2008; SEBI 2010 Indicator 03.

Figure 2.2 Conservation status of all birds in EU-25



Source: BirdLife International, 2004.

international Species Action Plans (SAPs); additional measures by Member States; and empowering conservation NGOs (Donald et al. 2007).

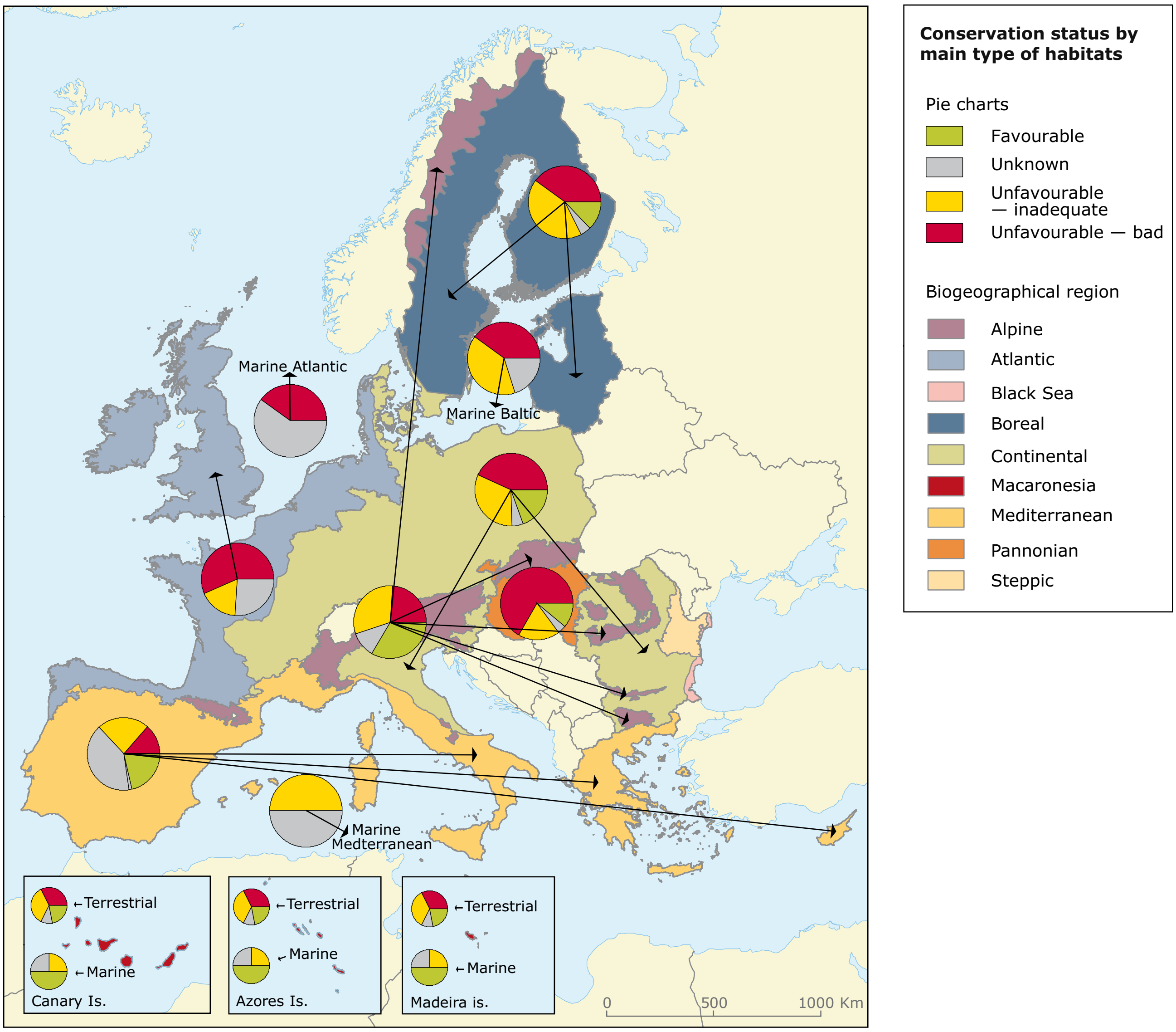
Under the Habitats Directive some species, including the wolf (*Canis lupus*), brown bear (*Ursus arctos*), Eurasian beaver (*Castor fiber*), Eurasian otter (*Lutra lutra*), Lake Constance forget-me-not (*Myosotis rehsteineri*) and the Troodos rockcress (*Arabis kennedyae*) are showing signs of recovery or positive trends (EC, 2009a). Temperate forest cover has also expanded over recent decades in Europe, showing the strongest sign of recovery of any major habitat type globally.

Outside the EU, the Bern Convention and its Emerald Network, aimed at conserving biodiversity in the pan-European region, is not as specific and binding as the Habitats and Birds Directives. Nonetheless, it obliges member countries to designate protected areas for selected species and nature types. Furthermore, Figure 2.3 illustrates that the total area of nationally designated protected areas in Europe has increased over time.

In addition, many other policies in Europe that are not biodiversity policies actually have an important impact and may contribute to conserving, managing and restoring biodiversity. For instance, the Common Agricultural Policy and the Water Framework Directive are both directly relevant to the management of biodiversity.

The EU also supports biodiversity through direct funding. For example, the LIFE+ funding programme has a window for nature and biodiversity. Furthermore, the Commission has

Map 2.1 Conservation status of assessed habitats in EU-25, by biogeographical region



Note: How to read the map: in the Mediterranean biogeographical region (see Box 2.2 for an explanation of biogeograhical regions) about 21 % of habitats have a favourable conservation status but 37 % have an unfavourable (bad/inadequate) status.

Source: ETC/BD, 2008; SEBI 2010 Indicator 05.

recommended that financial support for the Natura 2000 network be integrated into funding for different EU policy sectors in the period 2007–2013 (EC, 2004a). The aim of this 'integrated funding model' is to further embed the implementation of the EU biodiversity goals into other relevant policy sectors (WWF, 2009). Biodiversity conservation activities have also received financial support from other EU policy areas, such as from EU funds for agriculture and rural development (EAFRD), research (7th Framework Programme) and regional development (European Regional Development Fund, European Social Fund and Cohesion Fund).

Some key gaps remain in EU policy for conservation and sustainable use of biodiversity, for instance addressing the increasing number of invasive alien species. In December 2008, the EU adopted a Communication presenting policy options for an EU Strategy on Invasive Species (EC, 2008b). It is now preparing this strategy to be adopted in 2011. There is also a need to put in place an effective legal EU framework for conserving soil structure and functions, as soil biodiversity is also of fundamental significance to ecosystem health. The EU is also responsible for conserving the rich biodiversity of its overseas

Box 2.2 Biogeographical regions

From an ecological perspective, Europe can be divided into nine land and four marine biogeographical regions — areas with similar climate, altitude and geology, where certain habitats and species are typically found together. When a Member State assesses the conservation status of a species or habitat, the appropriate area for comparison is not the territory of that State but rather matching biogeographical regions within that Member State (EC, 2009a).

For the purpose of the Article 17 assessments of conservation status, nine terrestrial regions were considered:

- Alpine: mountain chains with high altitudes and cold, harsh climates, forests and rock peaks, including the Alps, Apennine, Carpathian, Pyrenees and Scandinavian mountains.
- Atlantic: Europe's western coastal areas, with flat lands and cliffs, plus major river estuaries.
- Black Sea: the western and southern shores of the Black Sea, extending through Bulgaria and Romania.
- Boreal: Europe's far north, extending into the Arctic Circle.
- Continental: the heartland of Europe — much of it agricultural — spanning 11 countries from France to Poland. Hot summers contrast with cold winters.
- Macaronesian: made up of Europe's volcanic islands in the Atlantic Ocean: the Azores, Madeira and the Canaries. Covering only 0.3 % of EU territory, this region is home to 19 % of habitat types of EU concern.
- Mediterranean: Europe's hot, dry, southern countries, with mountains, grasslands, islands and extensive coastlines.
- Pannonian: the steppes of Hungary and southern Slovakia, the dry grasslands of the Carpathian basin.
- Steppic: stretching from Bucharest (Romania) in the west, across the lower section of the flood plain of the Danube and to the north of the Black Sea, with low-lying plains and wetlands.

Similarly, four marine regions were considered:

- Atlantic: northern and western Atlantic, from the Straits of Gibraltar to the Kattegat, including the North Sea.
- Baltic: east of the Kattegat, including the Gulf of Finland and the Gulf of Bothnia.
- Macaronesian: exclusive economic zones of the Azores, Madeira and Canary Archipelagos.
- Mediterranean: east of the Straits of Gibraltar.

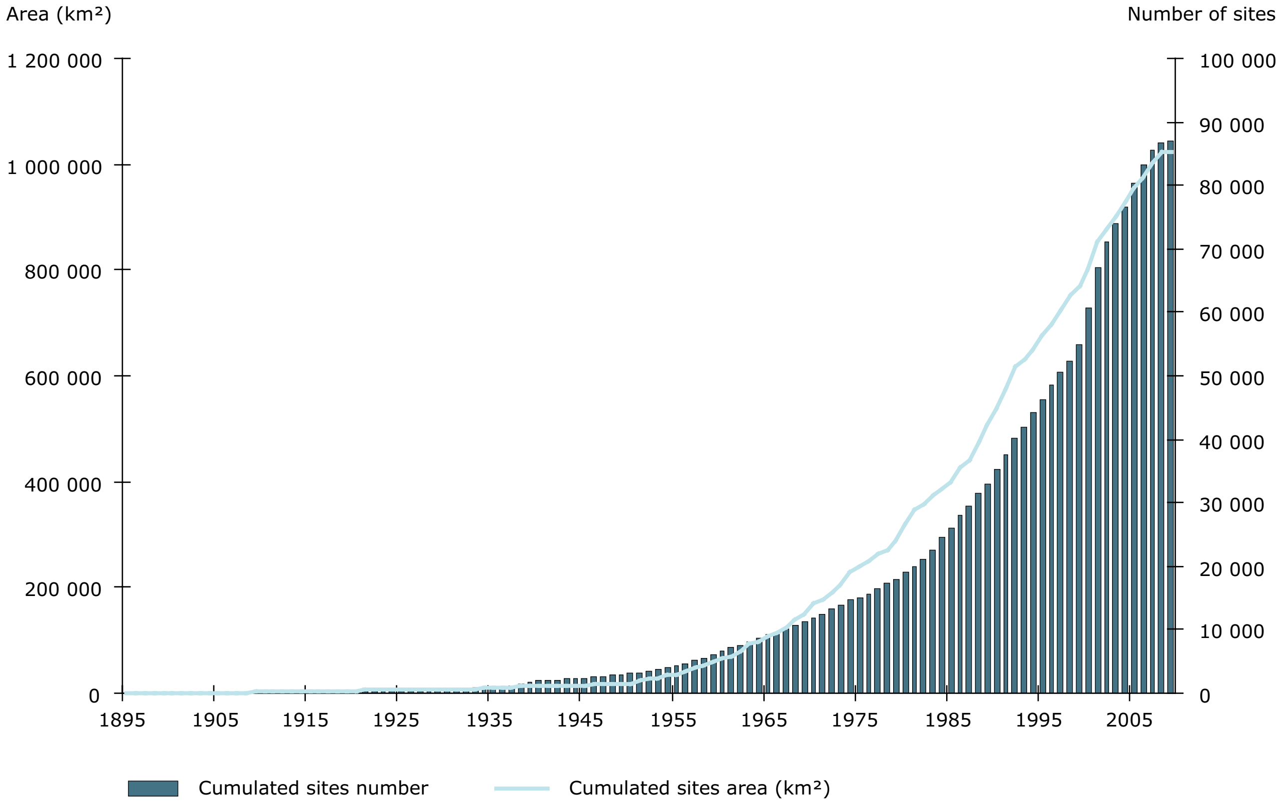
These marine regions are based on reported exclusive economic zones or other territorial claims. They were prepared purely for reporting under Article 17 and have no legal status.

territories and outermost regions. Additional measures to safeguard a network of Special Areas of Conservation and to facilitate landscape-scale initiatives for biodiversity in these regions need to be considered.

Many events in 2009 and 2010 at the EU and pan-European levels have paved the way for the tenth meeting of the Conference of the Parties to the CBD in October 2010 and efforts to agree a post-2010 vision and a target. Following the European Commission's communication on options beyond 2010 (EC, 2010a), the European Council committed at its meeting of 25–26 March 2010 (EC, 2010d) to a new long-term vision and mid-term headline target for biodiversity in the EU for the period beyond 2010. The new target is, 'To halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss.'

Biodiversity is primarily affected by drivers outside the direct influence of the environmental sector. A key challenge in Europe is therefore ensuring that policies in other sectors, such as agriculture, trade and planning, also take into account impacts and dependencies on biodiversity (see Chapter 4). Only continuous and concerted effort towards more sustainable consumption and production practices

Figure 2.3 Growth of nationally designated protected areas in 39 European countries



Note: How to read the graph: in 1995 there were more than 40 000 nationally designated sites covering over 600 000 km² within the 39 countries monitored. Overlap may exist due to multiple designations of the same site. The average overlap is around 14 % across Europe. At country level average overlap varies from 46 % in Germany, to 34 % for Estonia and less than 5 % in Turkey.

Source: CDDA, 2009; SEBI 2010 Indicator 07.

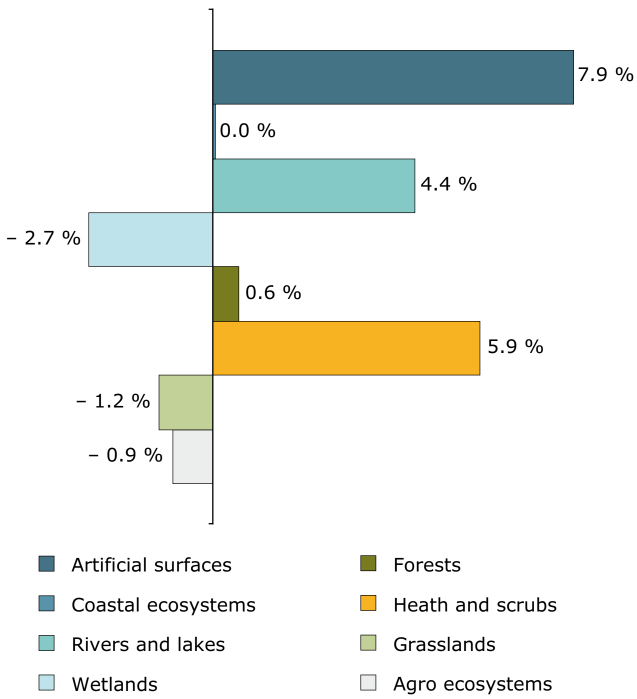
will ensure that positive trends in European nature and biodiversity conservation are maintained and negative trends reversed. This is essential to meet national, regional and global commitments to halt and reduce biodiversity loss and degradation of ecosystems and their services.

3 The state of biodiversity in major ecosystems

This chapter reviews biodiversity's status, trends and threats, and management implications for major pan-European habitat types (forest, mountain, grassland, freshwater, arctic, coastal and marine, agricultural and urban). The implications for biodiversity of cross-cutting issues such as tourism and urban planning are also considered. Box 3.1 sets out the main threats to biodiversity that are recognised in the Convention on Biological Diversity (CBD).

It should be noted that although ecosystems such as forest, mountain and freshwater are addressed separately in this chapter they occur together in both natural and managed landscapes. As such, an integrated approach is needed to conserve biodiversity in these ecosystems.

Figure 3.1 Land cover change between 1990 and 2006 — percentage change in area of major habitat classes



Note: EU-27 except Finland, Greece, Sweden and the United Kingdom.

Source: CLC, 2006; SEBI 2010 Indicator 04.

As a background to the information presented below, it should be noted that the land cover of the major habitat classes used in SEBI 2010 reporting (aggregated Corine classes) has altered appreciably in recent decades (Figure 3.1). In particular, artificial surfaces show the largest proportional growth, increasing by 7.9 % (equal to some 12 500 km^2) between 1990 and 2006. Heath and scrub habitat increased by 5.9 % (more than 13 000 km^2) and grassland decreased by 1.2 % (more than 4 000 km^2). Both changes are linked to land abandonment. Wetlands decreased by 2.7 % (more than 1 000 km^2), while rivers and lakes increased by 4.4 % (more than 1 500 km^2).

3.1 Freshwater ecosystems

Key messages

- Freshwater ecosystems provide various services, including cleaning water, preventing floods, providing energy and regulating freshwater resources.
- Freshwater ecosystems are under severe pressure in Europe, with the abundance of habitats and species declining. Pollution, habitat degradation and fragmentation, climate change and invasive species pose serious threats.
- Targeted responses in the European Union have improved water quality in freshwater habitats. The Water Framework Directive in particular will significantly contribute to this improvement.
- Restoring and preserving natural freshwater ecosystems has multiple benefits across a range of services and requires close coordination between nature protection, water uses, energy production and spatial planning.

Status and trends

Freshwater ecosystems are regarded as the most threatened ecosystem type (CBD, 2010). Many are far from their natural ecological state and have been modified significantly over time, with many small

Box 3.1 Threats to biodiversity

The CBD identifies five main direct threats to biodiversity globally.

Habitat loss and degradation
Habitat loss and degradation has been the single greatest pressure on biodiversity worldwide (GBO-3, 2010). Pressures on habitats include modifying and fragmenting freshwater ecosystems; losing and fragmenting natural habitats through land conversion (see Box 3.7 below); intensified agriculture; and land abandonment.

Invasive alien species
Invasive alien species are still a major threat to all types of ecosystems and species (GBO-3, 2010). The number of alien species in Europe continues to rise, posing an increasing risk for biodiversity (EEA, 2009a). The Delivering Alien Invasive Species Inventories for Europe (DAISIE) project has found that more than 90 % of alien species are introduced unintentionally, mostly by shipping and other forms of transporting goods.

Pollution and nutrient load
Pollution from nutrients (nitrogen and phosphorous) and other sources threatens biodiversity in terrestrial, inland water and coastal ecosystems (GBO-3, 2010). During the last two decades, pollution has fallen significantly in numerous European rivers (EEA, 2010a) but micropollutant contamination, such as from pharmaceuticals, cleaning agents, pesticides and industrial chemicals, is an issue of increasing concern. Nitrogen deposition to terrestrial and coastal ecosystems remains a significant threat to European biodiversity.

Overexploitation and unsustainable use
Overexploitation and destructive harvesting practices exert significant pressure on biodiversity globally (GBO-3, 2010). Pressures include rising demand for limited freshwater resources (e.g. from agriculture or tourism), overexploitation of fish stocks and other marine organisms, and unsustainable forest management.

Climate change
Climate change is already affecting biodiversity and impacts are projected to increase significantly in coming decades (GBO-3, 2010). Warming temperatures can limit suitable habitat availability and more frequent extreme weather events and changing weather patterns are expected to have significant impacts on biodiversity. Increasing ocean acidification and rising sea levels are projected to impact biodiversity significantly in coming decades.

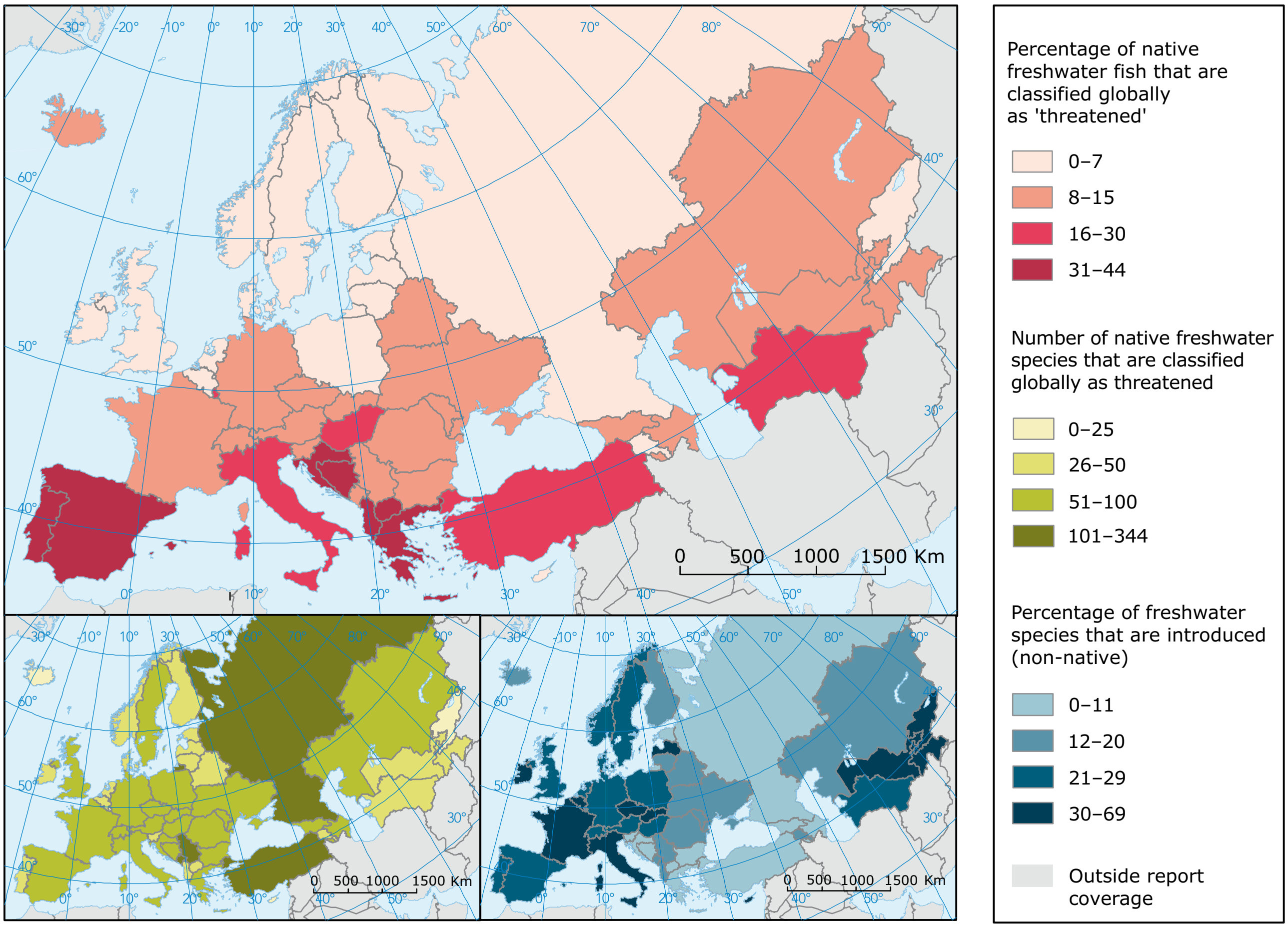
lakes and streams disappearing from the landscape as a consequence of agricultural intensification, draining and urbanisation (EEA, 2006a).

Unfortunately, historic information and long-term data are rare for freshwater biodiversity and key environmental drivers such as temperature and habitat change. Where available, this information is mostly gathered at the national scale, rather than at the catchment area or continental scales (Tockner et al., 2008). This is despite the fact that the catchment area must be considered the key spatial unit to understand freshwater ecosystem processes and biodiversity patterns.

According to Member States reporting under the Habitats Directive, 30 % of Europe's freshwater habitats have an 'unfavourable — bad' conservation status, with nearly 33 % classified as 'unfavourable — inadequate' (EC, 2009a; Figure 3.2). In the case of wetlands (mires, bogs and fens) the situation is much worse, with some 56 % classified as 'unfavourable— bad' and another 30 % as 'unfavourable — inadequate' (EC, 2009a; Box 3.2).

The World Conservation Union (IUCN) has reported that some 38 % of Europe's freshwater fish species are threatened with extinction (IUCN, 2007). Other freshwater biodiversity also has poor conservation status, with 15 % of European dragonflies and damselflies threatened with extinction (Kalkman et al., 2010) and 23 % of European amphibians classified as threatened (Temple and Cox, 2009). The four species of freshwater crabs occurring in Europe are all considered 'near threatened' (Vié et al., 2009).

Map 3.1 Threatened and introduced freshwater fish species in the pan-European region



Source: EEA, 2007a.

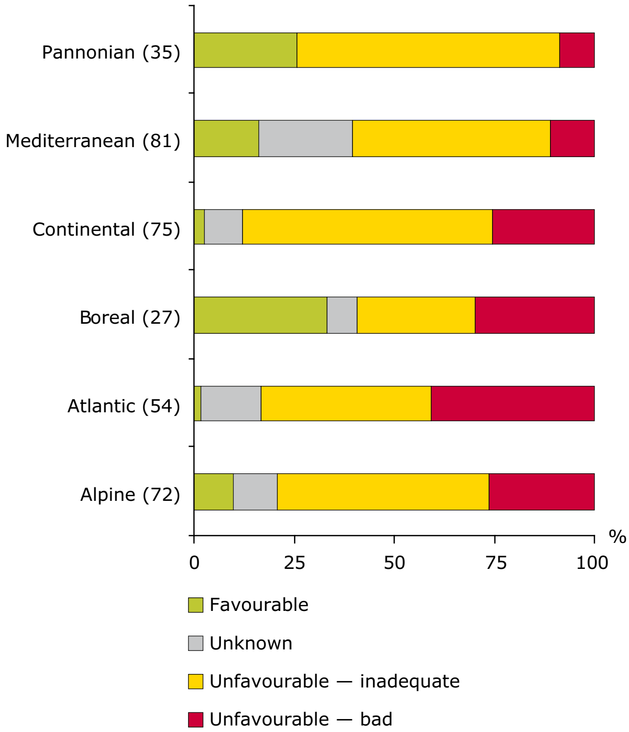
At the pan-European scale, the first analyses of data on freshwater biodiversity show that more than 75 % of European catchment areas are subject to multiple pressures and have been heavily modified, resulting in serious threats to their biodiversity (Tockner et al., 2008). Furthermore, up to 40 % of native fish have disappeared at the catchment scale, especially long-migrating species such as sturgeons, allis shad (Alosa alosa) and lampreys (Tockner et al., 2008).

Biochemical Oxygen Demand (BOD) and total ammonium concentration have decreased in European rivers over the period 1992–2007, corresponding to the general improvement in wastewater treatment (Figure 3.3). BOD and ammonium concentrations are generally highest in eastern, southern and south-eastern European rivers. The largest declines in BOD are evident in the rivers of western Europe, while the biggest drops in ammonium concentration are apparent in eastern European countries.

Concentrations of BOD and ammonium are key indicators of the organic matter and oxygen content of water bodies. They normally increase as a result of organic pollution due to discharges from waste water treatment plants, industrial effluent and agricultural run-off. Severe organic pollution may lead to rapid de-oxygenation of river water along with increased ammonium levels and consequent disappearance of fish and aquatic invertebrates.

The most important sources of organic waste load are household waste water, discharges from industries such as paper production or food processing, and occasional silage or slurry effluents from agriculture. Increased industrial and agricultural production, coupled with a greater percentage of the population being connected to sewerage systems, initially resulted in increased discharge of organic waste into surface water across most European countries after the 1940s. Over the past 15–30 years, however, biological treatment of

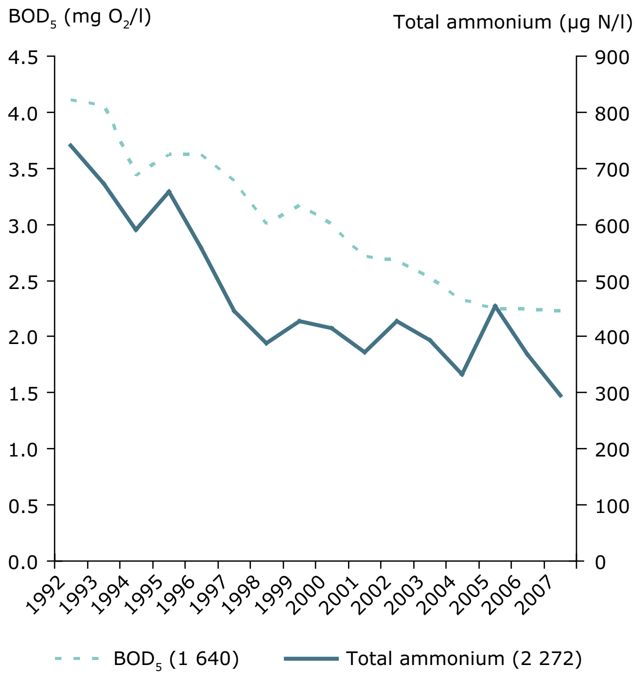
Figure 3.2 Conservation status of assessed freshwater animal species in EU-25, by biogeographical region



Note: Number of assessments in brackets.

Source: ETC/BD, 2008.

Figure 3.3 Biochemical Oxygen Demand (BOD_5) and total ammonium concentrations in rivers between 1992 and 2007



Note: How to read the graph: between 1992 and 2007, BOD_5 decreased from 4 mg O_2/l to 2 mg O_2/l and ammonium from 700 µg N/l to 300 µg N/l

Source: Waterbase, 2009; SEBI 2010 Indicator 16.

Box 3.2 Mires, including bogs and fens

Mires are often grouped together with inland waterways but often have little in common in terms of species, threats or responses. For example, invasive species currently do not appear to be an acute threat to mire diversity (Nobanis, 2009). The largest share of the total European mire area lies in the Nordic countries and available data indicate a considerable decline in mire biodiversity in this region (Normander et al., 2009), with a drastic fall in pristine mire area, and declining bird and butterfly populations. In the EU, drainage ditches, afforestation, tree felling, river diversion, flooding and fertilisation are major threats (Minayeva et al., 2009; Bragg and Lindsay, 2003). Between 1990 and 2006 some wetlands (marshes and bogs) decreased in area by 5 %.

The Water Framework Directive (EC, 2000) protects Europe's inland waters but there is no similar directive for mires, bogs and fens. Internationally, mires are protected under the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971). While the loss of wetland habitats in Europe is continuing, there is some progress in conserving 'wetlands of international importance' under the Convention. This is indicated by the steady increase in the area designated in the past decade and the growing number of restoration and local community awareness projects in many countries. However, Ramsar sites still face many threats and most have reported negative changes in ecological state.

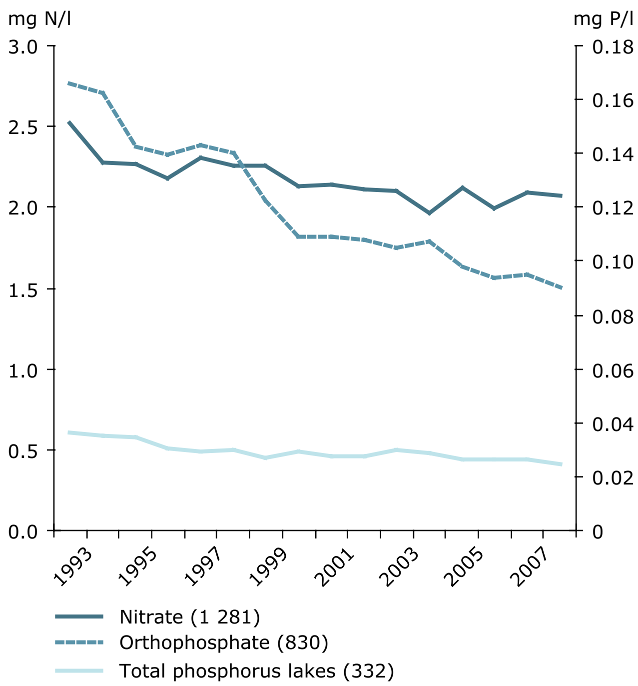
wastewater has increased and organic discharges have consequently decreased throughout Europe.

Nutrient levels in freshwater habitats are decreasing. The average nitrate concentration in European rivers has decreased since 1992, from 2.5 mg N/l to 2.1 mg N/l, reflecting the effect of measures to reduce agricultural inputs of nitrate. Nitrate levels in lakes are generally much lower than in rivers but there has also been a 15 % reduction of the average concentration in lakes (Figure 3.4).

Agriculture is the largest contributor of nitrogen pollution but the Nitrates Directive (EC, 1991b) and national measures have reduced nitrogen pollution from agriculture in some regions during the last 10–15 years. European air emissions of nitrogen oxides have declined by one third over the last 15 years and the deposition of nitrogen on inland surface waters has also fallen.

Phosphorus concentrations in European rivers and lakes generally decreased during the last 15 years

Figure 3.4 Concentrations of nitrate and orthophosphate in rivers and total phosphorus in lakes in the period 1992–2007



Note: Total number of stations in parenthesis. Concentrations are expressed as weighted means of annual mean concentrations for rivers and lakes. Only stations with time series of seven years or more are included.

Source: Waterbase, 2009; SEBI 2010 Indicator 16.

as a result of better wastewater treatment and reduced phosphate content in detergents. In many rivers the reduction started in the 1980s. During recent decades phosphorus concentrations have also fallen gradually in many European lakes due to nutrient removal measures introduced by national and European legislation, particularly the Urban Waste Water Treatment Directive (EC, 1991a). As treatment of urban wastewater has improved and many wastewater outlets have been diverted from lakes, point source pollution is gradually becoming less important. Agricultural inputs of phosphorus are still significant and need increased attention for lakes and rivers to achieve a good status.

Indicators of improved water quality, notably the return of species such as salmon and common otter in increasing numbers in Denmark, the Netherlands and the United Kingdom (EEA, 2010a), demonstrate positive trends for some species in some areas. While there has been progress in reducing the pressures on freshwater habitats, nutrient impacts persist. Although there remains considerable potential for restoring freshwater habitats throughout pan-Europe, many EU river basins are unlikely to achieve the Water Framework Directive requirement of good ecological status by 2015 (EEA, 2010a).

Threats

Habitat loss and degradation: heavy modification of river systems (e.g. drainage and damming) and fragmentation may seriously affect freshwater biodiversity, interrupting migration of fish, preventing access to spawning sites and impoverishing freshwater habitats (EEA, 2010a).

Invasive alien species: with increased travel, trade and tourism, the pan-European area is likely to see a significant increase in invasive alien species (CBD, 2010). This is already a significant problem in some catchment areas, such as Central Asia and the Atlantic coast, where the share of non-native fish exceeds 40 % (Tockner, 2008; Map 3.1).

Pollution and nutrient load: although pollution has fallen significantly in numerous European freshwater habitats in the last two decades (EEA, 2010a), micro-pollutant contamination (chemical pollution, such as endocrine disruptors, from private households, agriculture and industry) has become a cause for concern, with many adverse impacts on aquatic ecosystems (FOEN, 2009). The Nitrates Directive and the Urban Waste Water

Directive have markedly improved many rivers and lakes in recent decades (EEA, 2009a). The Water Framework Directive represents a further step forward, as it brings together existing EU water legislation and sets the goal of 'good ecological status' for water bodies by 2015.

Overexploitation and unsustainable use: water scarcity and over-abstraction have resulted in increased concentrations of pollutants (EEA, 2010a). Unsustainable hunting and fishing practices (EEA, 2006a), tourism and recreational activities have also impacted on freshwater biodiversity.

Climate change: freshwater biodiversity is highly vulnerable to climate change, with species and habitat dynamics largely interrelated. Increased CO_2 concentrations and rising temperatures affect processes such as photosynthesis, respiration and decomposition (EEA, 2010b). Further impacts of climate change on freshwater biodiversity include: annual runoff increasing and decreasing, drought and flooding, phenological changes and an increase in invasive alien species.

Management issues

Freshwater ecosystem biodiversity across Europe is managed using protected areas and measures pursuant to the Water Framework Directive, which advocates an ecosystem services approach.

There is significant potential to reduce biodiversity loss in freshwater systems. Opportunities include reversing the trend of wetland habitat loss in Europe; removing pressure from water abstraction, drainage or damming; removing underlying causes for converting wetlands to forest; and limiting fragmentation from urbanisation and transport development. The negative impacts of tourism, recreational activities, unsustainable hunting and fishing in freshwater habitats can be greatly reduced.

Additional issues to be tackled include invasive species and agricultural runoff (EEA, 2009a). Addressing the drivers of habitat loss and fragmentation is essential, while also assessing in detail some of the least studied freshwater ecosystems such as riverine floodplains and deltas, which are among the most threatened (Tockner et al., 2008).

A large proportion of Europe's freshwater habitats and species are protected under EU directives (notably the Birds and Habitats Directives) but the key legislation for protecting Europe's waters is the Water Framework Directive, which could go a long way in solving the issues raised in this section. The Water Framework Directive is relevant to nature protection, requiring that countries establish a register of areas designated as requiring special protection for the conservation of habitats and species dependent on water (Article 6). The Water Framework Directive was adopted due to increasing awareness of the importance of conserving riverine and wetland habitats. Its main objective is to achieve good water status by 2015. Although we will not know its true impact for a number of years, it appears to contain the measures needed to address biodiversity protection and sustainable use of Europe's freshwater ecosystems (EEA, 2010a).

The Water Framework Directive defines the ecological status that freshwater ecosystems need to reach but gives EU Member States flexibility and discretion in restoring such habitats. Some non-EU countries have comparable policies and targets regarding water protection and management. However, increased enforcement and monitoring is essential for most pan-European freshwater habitats.

3.2 Mountain ecosystems

Key messages

- European mountain regions provide essential ecosystem services such as supplying and regulating water for communities in both mountain and lowlands areas. They also host a high diversity of habitats and species, many adapted to extreme climatic conditions.
- Mountain ecosystems are fragile and vulnerable, and are severely threatened by land abandonment or intensified agriculture, infrastructure development and rapid climate change.
- Several important factors increase resilience to the major threats to mountain ecosystems. In addition to designating protected areas, measures to improve connectivity and ecosystem-based management are key for conserving mountain ecosystems, particularly helping adapt to climate change.
- Urgent action is needed to minimise the risk of local extinction of several species and to counteract the effects of habitat fragmentation and changes in land use.
- International cooperation across European mountain ranges can support improved integrated management practices.

Status and trends

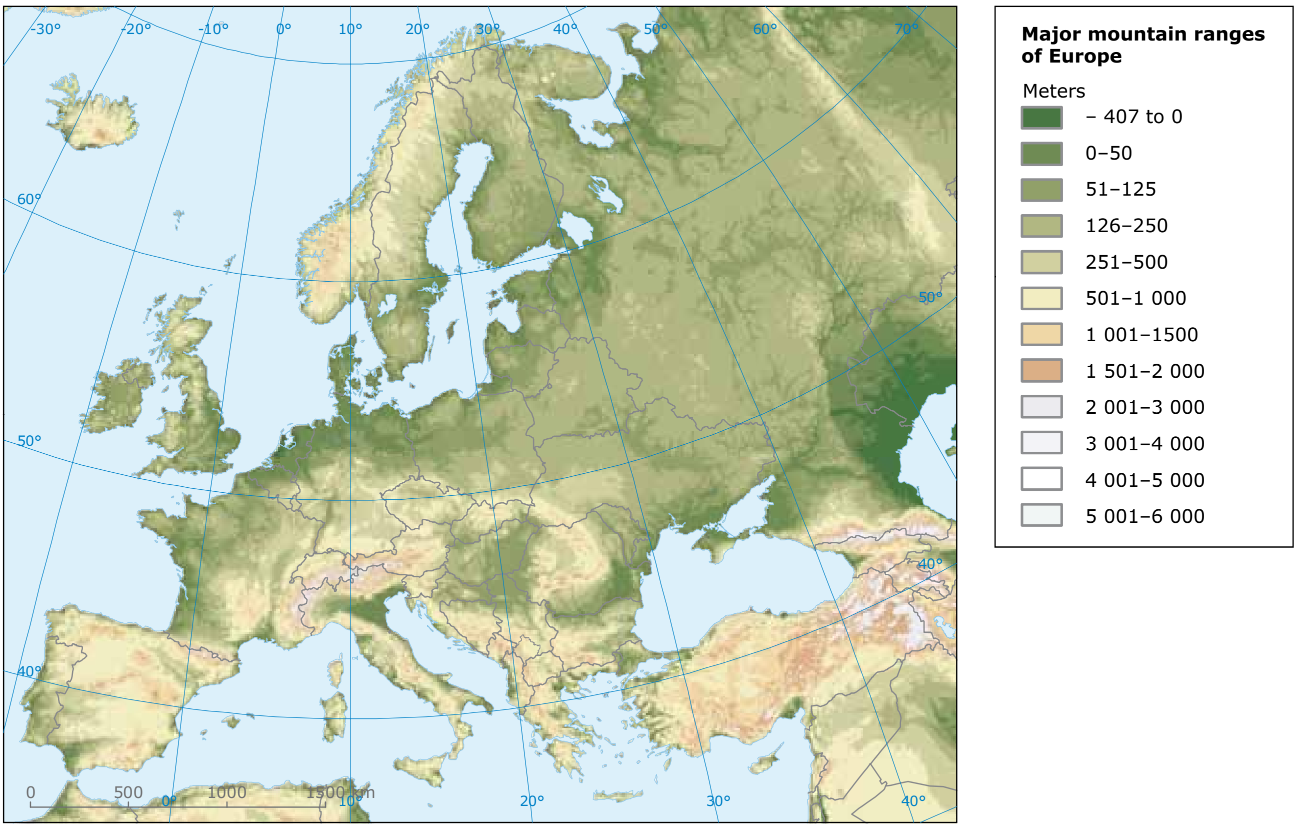
According to research in the EU-27, Norway and Switzerland, around 40 % of the total land area of these countries is classified as mountain area and around 60 % of the total population lives in or near mountain areas (Nordic Centre for Spatial Development, 2004). Mountain areas vary significantly throughout the pan-European region and include areas such as the Alps, the Carpathians and the Caucasus mountains. Mountain areas host higher species richness and levels of endemism than adjacent lowlands due to their ecological isolation and special climate conditions combined with their biogeographic history (EEA, 2006a).

European mountain areas are extremely diverse in terms of biology, landscapes, languages and cultures. It is estimated that there are approximately 30 000 animal species in the Alps, and also about one third of all European flora (CBD, 2003). About 9 % of European butterflies are threatened with extinction, with most European endemic butterflies being restricted to mountainous areas (van Swaay et al., 2010). Approximately three quarters of the vascular plants of the entire European continent grow in the Alpine region (WWF, 2004), of which the endangered and widely known edelweiss is a good example.

The Carpathians are one of Europe's largest mountain ranges and host the headwaters of several major rivers (Carpathian Convention, 2009). The Carpathians are an important reservoir for biodiversity and a key refuge for large mammals such as the brown bear, wolf and lynx. They are also home to populations of European bison, moose, wildcat, chamois, golden eagle, eagle owl, black grouse and many endemic insect species and plants. The mountains of Central Asia are a biodiversity hotspot (Myers et al., 2000) in the pan-European region. Central Asia has many mountains above 6 500 meters in elevation. Their ecosystems range from glaciers to desert, and they hold a large number of endemic plant and mushroom species (Carpathian Convention, 2009). Map 3.2 shows the major European mountain ranges.

The western Caucasus is one of the few large mountain areas of Europe that humans have not significantly altered, containing extensive tracts

Map 3.2 Major mountain ranges of Europe



Source: Global Digital Elevation Model (GTOPO30) USGS EROS Data Center.

of undisturbed mountain forests. This area has a great diversity of ecosystems, with endemic plants and wildlife. It is also the place of origin and reintroduction of the mountain sub-species of the European bison. Water is inherently a crucial issue for mountain ecosystems and it is important to preserve or re-establish healthy water systems (Alpine Convention, 2009).

The CBD report on threats to mountain biodiversity lists a number of impacts on threatened species (CBD, 2003). Populations of 'flag' species such as the snow leopard and Argali sheep have been drastically reduced due to poaching. Today, there are no more than 200 leopards and 150 Argali in the Russian part of Altai-Sayan left. It is estimated that 70 % of the endangered species' trade to Europe from Asia now passes through Central Asia (CBD, 2003).

Threats

Habitat loss and degradation: mountain landscapes are particularly fragile and susceptible to change and degradation. They include a wide range of small and unique habitats that may be particularly sensitive to disturbance by human activity (UNEP, 2007). Pressure on mountain forests in many parts of the world is increasing. Travel to mountain areas, which already attracts up to 20 % of global tourism, is increasing rapidly (UNEP, 2007).

Invasive alien species: recent studies have shown that invasive species are being encountered at ever higher altitudes (Pauchard et al., 2009).

Pollution and nutrient load: pollution of mountain rivers occurs through wastewater discharge or water abstraction (EEA, 2009b). Other impacts occur indirectly. For example, higher runoff rates may worsen water quality as it transports sediments and eroded soil. A regional assessment of European mountain lake ecosystems has shown that high mountain lakes are sensitive to environmental change and that many countries have recorded effects of air pollution and lake acidification (EMERGE, 2002).

Overexploitation and unsustainable use: tourism often involves the development and intense use of tracks, paths and sports slopes by vehicles, non-motorised transport and pedestrian traffic. Visitors are also usually concentrated in small areas, contributing to increased noise and waste. The negative environmental effects of poorly managed tourism can include vegetation clearing and soil erosion, removal of scarce habitats, altering critical landscapes and water flows, water and air pollution, and wildlife relocation or behavioural changes.

Climate change: mountain areas are among the most sensitive to climate change, through changes to temperature, precipitation and runoff (CDE, 2009). For example, climate-induced glacier shrinkage could threaten the water balance of some inner alpine regions. Retreating glaciers may no longer be able to balance the river discharge during hot and dry summer months, with reduced water availability as a result (Zappa and Kan, 2007).

Management issues

Mountains are not covered by a specific policy framework. Management of mountain ecosystems is thus governed by policies in other sectors such as agriculture, water, transport or tourism. International frameworks and cooperation between mountain areas become especially important when different mountain regions contribute water to the same river (EEA, 2009b). Integrated management approaches are required that value the services that mountainous areas provide, counteract the already visible effects of habitat fragmentation and changes in land use, and minimise the high risk of local extinctions of several species.

Protected areas alone are not sufficient to conserve mountain biodiversity in the long term (Kohler and Heinrichs, 2009). Protecting nature and conserving biodiversity successfully requires ecologically compatible actions across an entire mountain region, particularly outside protected areas. Connectivity measures are crucial for conserving mountain ecosystems beyond protected areas, particularly as an adaptive response to climate change. Current efforts to create a functioning ecological network in the Alps can contribute to conserving the extraordinarily rich Alpine diversity. Sustainable grazing and hay meadow management are also essential to sustain the rich invertebrate diversity of mountain regions.

An important ecosystem service in mountain regions and adjacent metropolitan areas is the provision of drinking water. Large-scale disturbances may lead to increased runoff and consequently reduced water storage in catchments, which may lessen water security and increase soil erosion, flooding and debris flow activity. Furthermore, accelerated decomposition of organic matter as a result of canopy openings (from disturbances) and increased temperatures may stimulate the leaching of nitrates and other nutrients, diminishing water quality (Jandl et al., 2008).

The sustainability of mountain natural resources and communities depends on having management forms that are adapted to local conditions and situations (FAO, 2007a). Under appropriate management, mountain ecosystems provide many benefits to lowland regions (FAO, 2007a). Many socio-economic sectors both benefit from and influence these resources.

Mountain resources are often undervalued or given away for free but to ensure proper conservation and management of finite resources it is important to attempt to assign true economic values (Mountain Partnership, 2009). Examples are the lease of land at a market value (which can still be lower than the true economic value), charging royalties for mountain trekking and

Box 3.3 Tourism and biodiversity in Europe

Tourism is a significant and growing industry in the pan-European region, particularly impacting biodiversity in coastal, freshwater, mountain, and forests ecosystems. In 2009, the UN World Tourism Organization estimated that by 2020 more than 717 million international travellers will visit areas of Europe. Nearly half (346 million) will travel to the Mediterranean, resulting in additional pressure on the already fragile ecosystems there, especially the coveted sea and beaches (De Stanfano, 2004; EEA, 2007b).

From day trippers visiting Finnish national parks to seasonal skiers in the Swiss Alps, from birdwatchers in Spain's largest wetland to sunbathers in the Greek Isles, the literature documents how tourism is increasing pressure on Europe's unique animals, plants and vital ecosystems. While the findings suggest growing awareness of the importance of preserving these wild habitats and species, and the role they can play in fostering a more competitive tourism industry, the behaviour and practices of those involved in the industry is still lagging behind (Kemp, 1999; Russell, 2007).

Tourism's most obvious impacts on European biodiversity can be seen on the coast (EEA, 2007b). Research shows a lack of regulation, enforcement and coordination at many levels and with other sectors, which is contributing to the further demise of Europe's endangered species and habitats (CSIL, 2008). At the once underdeveloped National Marine Park in Zakynthos, Greece, for example, both the national government and the European Commission have needed to intercede at different times to halt tourism-related development and activities from encroaching on the nesting beaches for the endangered loggerhead turtle (Ryan, 1991; Margaritoulis and Casale, 2007; UNEP, 2009).

In the Baltic Sea, national and regional legislation and enforcement were considered insufficient to protect the sea's fragile biodiversity and support growth in tourism. Policy challenges included a lack of national and international laws, complicated and inefficient management structures, poor awareness and public participation in decision-making and insufficient engagement with private interests (Schernezski and Neumann, 2002; Schernewski and Sterr, 2002; Jedrzejczak, 2004; Jedrzejczak et al., 2005). In October 2009, the European Council endorsed a new EU Strategy for the Baltic Sea Region, identifying ecotourism as a key component for sustainable development in the region.

The impacts of tourism can also be seen on other ecosystems. In the Mediterranean, tourism is often blamed for destroying important freshwater ecosystems, fragmenting and lowering groundwater levels and drying out wetlands (De Stanfano, 2004). More than 50 % of the 25 000 plant species found in the Mediterranean are endemic. More than 50 % of the 253 endemic fish species are threatened with extinction, mainly due to unsustainable and sometimes illegal water extraction and pollution related to tourism (Smith and Darwall, 2006).

Mountain ecosystems are also heavily affected. For example, as competition for the growing number of tourists in the European Alps has increased in the last 15 years (Keller, 2004), so has infrastructure development at higher altitudes. This has mean ever more second homes, new roads and snow cannons to ensure the greatest opportunities for skiers. With climate change affecting, for example, the length of the snow season, Alpine tourism has also expanded what it offers in other seasons to include outdoor sports that take their toll on the environment. Such investment has had negative impacts on the landscape as well as the traditional communities, since first documented by Barker in 1982. These activities degrade the fragile mountain environment and affect the natural food chain, reducing species diversity and the incidence of rare plants. They also affect insect populations, insectivorous birds and possibly even small mammals (Williams, 1998).

Box 3.3 Tourism and biodiversity in Europe (cont.)

In the Bavarian Alps, even the perceived 'eco-friendly' use of mountain huts by hikers has been shown to alter the natural competition of species at high altitudes. One study found that the use of the huts contributed to an increased number of corvids, such as Carrion crows, magpies, jays and nutcrackers. Their presence in turn affected local food chains. As a consequence, conservation efforts to protect threatened species, like grouse, could be undermined by mountain tourism (Storch and Leidenberger, 2003).

Like other industries, tourism is likely to be affected by climate change on a large scale. In the Arctic, where some of the greatest impacts are expected, tourism is on the rise. While tourism offers many economic opportunities for people in the region, UNEP-GRID warned in 2009 about the dangers of uncontrolled tourism on this unique area, arguing for stricter policies and practical guidelines to ensure tourism is sustainable (UNEP-GRID, 2009).

Tourism also contributes to biodiversity loss by helping spread invasive alien species. This is expected to escalate with increased travel and climate change, wreaking havoc on Europe's wildlife and wild places despite efforts to halt their intrusion (EEA, 2009c).

On the positive side, where sustainable tourism policies are established and effectively implemented, tourism can assist biodiversity conservation and local communities. For example, in the Dadia-Lefkimi-Soufli Forest Reserve in north-east Greece, community involvement is seen as essential to ensuring the reserve's success (Valoras et al., 2002; Svorounou and Holden, 2005; Hovadas and Korfiatis, 2008). Further north, Europe's largest marine protected area, the Wadden Sea, is recognised internationally for its important role as a staging area for millions of birds on the North-East Atlantic Flyway. Policies and investments in educating and informing tourists about the natural values of the Wadden Sea have paid off for biodiversity conservation. Many of the millions of tourists who visit the area each year now recognise its natural significance and help make the case for its protection (Lotze et al., 2005; Stevens and Associates, 2006). The recent decision of Unesco to declare the Wadden Sea as a World Heritage Site is largely because it has the support from the local communities, which benefit from nature tourism.

Tourism has also shown that it can support biodiversity protection through protected areas, and the benefits of these areas go beyond nature conservation (Stolton, 2009). A Flash Eurobarometer survey of Europeans in 2009 found that only 6.3 % listed nature as their primary motivation for taking a holiday in 2008, while 36.5 % stated it was for rest and recreation (Eurobarometer, 2009). However, a Eurobarometer survey two years earlier on attitudes about biodiversity loss found that 55 % of the respondents thought biodiversity was important because it provided rest and recreation (Blackman, 2009). Other benefits are equally important to local stakeholders. The Pan Parks initiative, for example, has selected five parks as test sites for generating tourism-related income. The goal is to see these important biologically diverse protected areas become self-sufficient, both from management and financial perspectives. Voluntary certification and outreach to local businesses can help support the parks (Pan Parks Foundation, 2009).

There is a range of examples of community-based and region-wide efforts to promote sustainable tourism and thereby lessen the impacts on Europe's biodiversity (Todorovic, 2003; Nylander and Hall, 2005; EU, 2009). At the global level, the Linking Tourism and Conservation initiative of UNEP/GRID seeks to take advantage of the interests of tourists visiting protected areas and to multiply existing good examples where tourism is supporting biodiversity conservation (UNEP-GRID, 2009).

Much of the literature emphasises the potential for sustainable tourism to provide economic, social and environmental benefits for communities. However, it also stresses that these activities must be coupled with effective regulation, coordination and information at all levels (Papayannis, 2004). While individuals have a role to play in reducing their ecological footprint, ensuring tourism is developed and regulated in a sustainable manner, and at the scale needed to protect Europe's biodiversity, is seen to be the principal responsibility of the local, provincial, national and regional authorities — not the industry or businesses or the tourists themselves.

In conclusion, research on the impacts of tourism policies on Europe's wild animal and plant species and their habitats is largely based on specific local and regional examples. There is growing evidence of the links between Europe's biodiversity loss and a lack of coordination, enforcement and development of tourism policies. Therefore, further studies and policies are urgently needed to address these issues.

developing frameworks for beneficiaries to pay for the ecosystem services provided by mountain environments.

3.3 Forest ecosystems

Key messages

- Forests provide a wide range of ecosystem services such as soil protection and regulating watersheds and local hydrological systems. They regulate the local, regional and global climate, store carbon, and purify air and freshwater.
- Deforestation has historically been a major issue in Europe. During the past 20 years, deforestation has been under better control and limited to only a few regions; overall there has been an expansion of forest cover in Europe.
- Using protected areas and other management measures, European countries are protecting and restoring their forest biodiversity. Around 3 % of European forests are protected for biodiversity conservation (or over 8 % if Russia's forest area is excluded) and 25 % of EU forests are excluded from wood harvesting.
- Forest certification schemes are being implemented in many European countries and within the pan-European forestry process 37 countries are participating in the development and implementation of criteria and indicators for sustainable forest management.
- Europe is, however, still struggling to halt the loss of forest biodiversity. Institutional changes, including privatisation in many formerly centrally planned economies, have led to an intensification of commercial forestry in unprotected areas, increasing pressures on biodiversity.

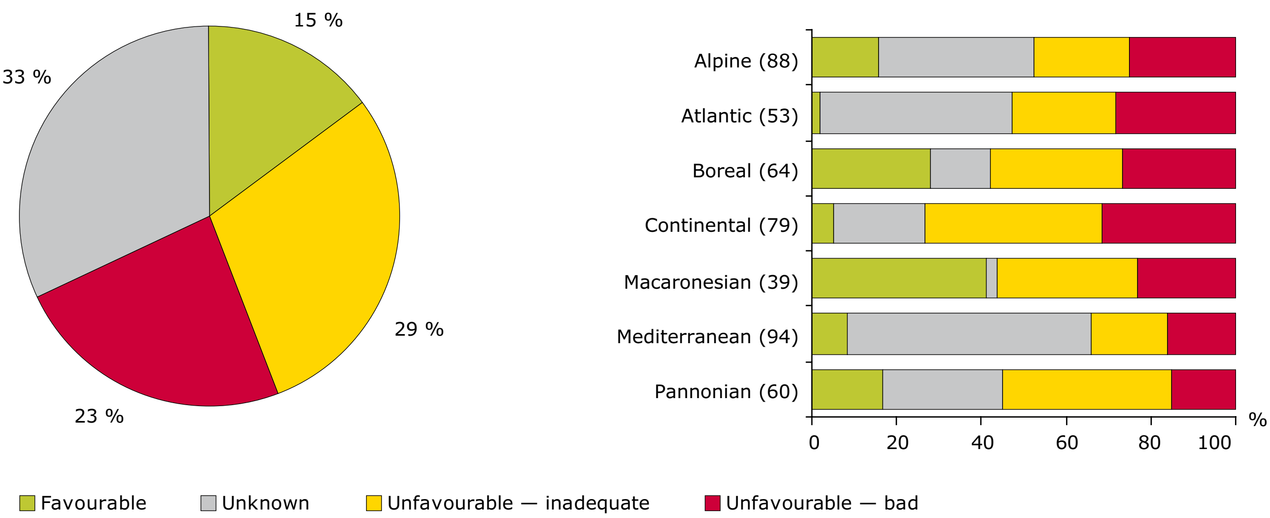
Status and trends

EU forests and other wooded areas now cover 176 million hectares, which is more than 42 % of the EU land area (EC, 2010b). However, there are significant differences in the extent and distribution of forests in different regions of the EU (EEA, 2010a).

Data on the total area of forest in Europe show an expansion in forest cover in most countries between 1990 and 2005 (EEA, 2009d), partly due to afforestation programmes and natural regeneration on abandoned agricultural or formerly grazed land (EC, 2006d). However, these statistics can mask decreases in areas of natural forest and increases in plantations of non-native species, such as eucalyptus (e.g. Pereira et al., 2001).

The conservation status of species and habitats of European interest differs strongly between biogeographical regions but more than half of species and nearly two thirds of habitats have an unfavourable conservation status. In particular, 52 % of forest species of European interest have

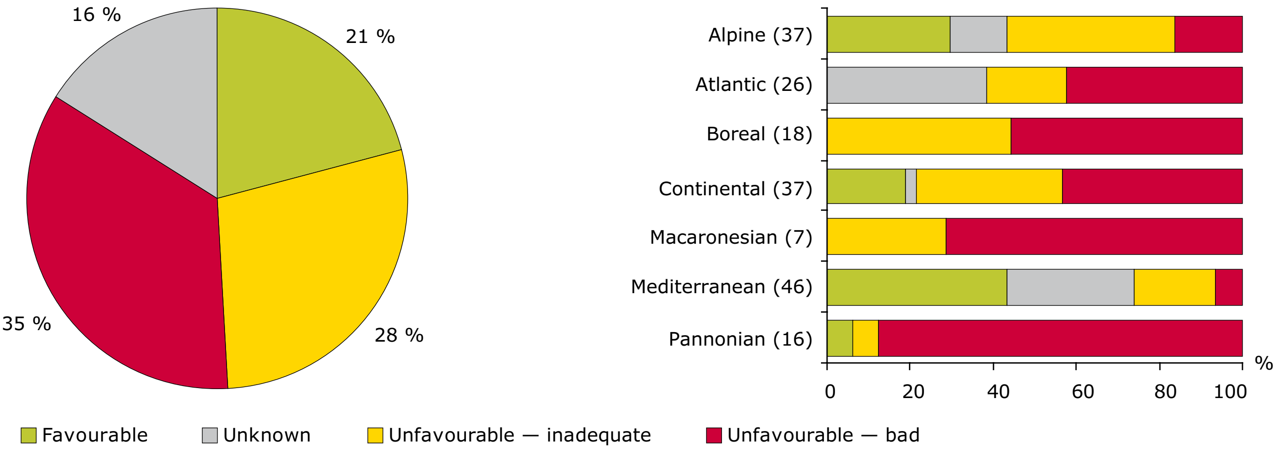
Figure 3.5 Conservation status of species of Community interest in forest ecosystems in EU-25



Note: Number of assessments in brackets.

Source: ETC/BD, 2008.

Figure 3.6 Conservation status of habitat types of Community interest in forest ecosystems in EU-25



Note: Number of assessments in brackets.

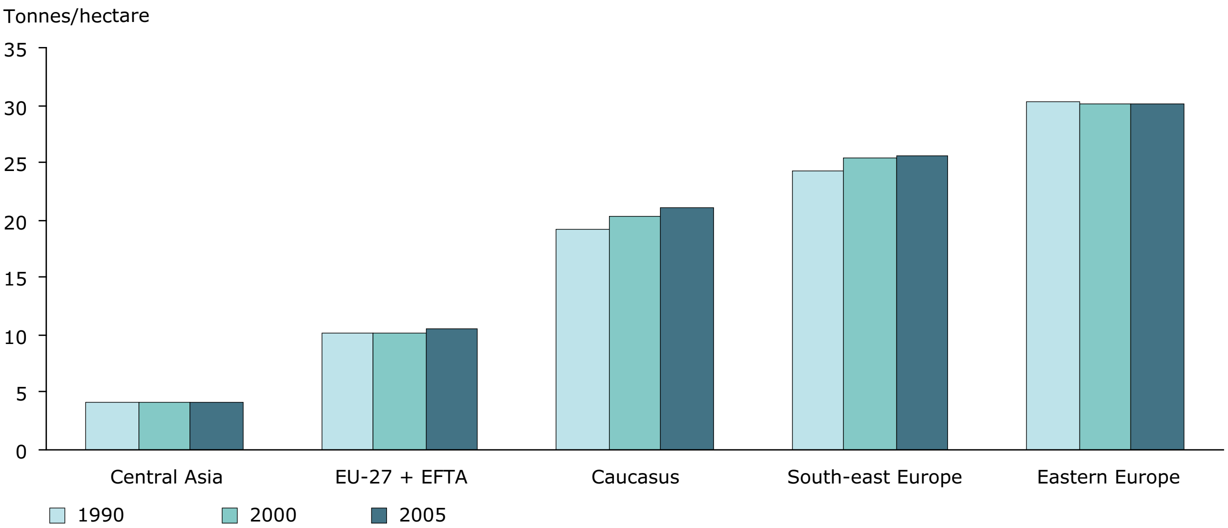
Source: ETC/BD, 2008.

an 'unfavourable' conservation status (Figure 3.5). Only 15 % of the assessments report a favourable conservation status. The Macaronesian and Boreal regions report the highest percentage of favourable assessments (ETC/BD, 2008).

Even more worrying, of the 73 forest habitat types listed in the Habitats Directive that were assessed, 63 % had 'unfavourable' conservation status, while just 21 % were 'favourable' (Figure 3.6). In contrast to the situation with respect to species, the highest percentage of favourable assessments was in the Mediterranean and the Alpine regions, with no favourable assessments reported in the Atlantic, Boreal and Macaronesian regions.

Within the SEBI 2010 set of indicators, two specific indicators have been selected to address sustainable management of forest ecosystems: forest growing stock, increment and fellings; and deadwood. The first provides information on the stock size, wood production and production capability. Deadwood provides additional information on the state of the ecosystem, as a proxy for the state of many

Figure 3.7 Deadwood in pan-European forests, 1990–2005



Source: FAO, 2005; SEBI 2010 Indicator 18.

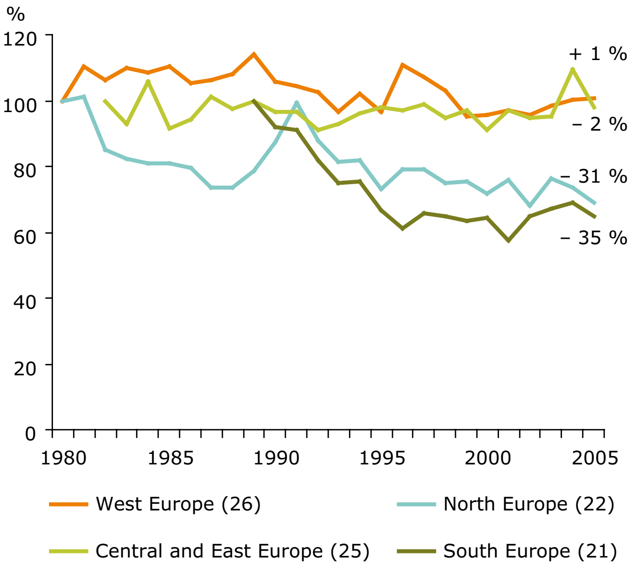
invertebrate species, whose status is difficult to measure

Deadwood volumes have strongly decreased since the middle of the 19th century due to intense forest exploitation and widespread burning of small wood and other debris. Between 1990 and 2005, however, they increased overall by about 4.3 % (Figure 3.7), perhaps due to increased compliance with sustainable forest management principles (UNECE/FAO, 2007). However, these data should be interpreted with caution. First, deadwood inventory methods and data reliability differ between countries. Second, management objectives and practices regarding deadwood may vary between countries and forests depending on the local conditions. For example, in forests with a relatively high risk of fire, pest outbreak or diseases, the amount of dead wood may be kept to a minimum.

One critical indicator of biodiversity that is totally dependent on deadwood is the status of saproxylic beetles, which was assessed at in pan-Europe region and the EU-27. At the pan-European level nearly 11 % of assessed species were considered threatened, while a slightly higher proportion of threatened species was seen in the EU-27 (14 % threatened) (Nieto and Alexander, 2010).

Indicators are also available that directly monitor forest-dependent species such as birds. Figure 3.8 illustrates that between 1980 and 2005, the population size of common forest bird species declined by 31 % in northern Europe and 35 % in southern Europe while remaining relatively stable in western and eastern Europe. As a particular example, populations of lesser-spotted woodpecker (*Dendrocopos minor*) and willow tit (*Parus montanus*) declined more steeply in western Europe than in central and eastern Europe. Both depend on deciduous forests with old trees and deadwood (EEA, 2008).

Figure 3.8 Populations of common forest bird species in four European regions



Note: Number of species per indicator in brackets.

Source: PECBM, 2007.

Threats

Habitat loss and degradation: increased fragmentation, mainly due to urban and transport infrastructure, threatens forest ecosystems across Europe. It is often masked in the aggregated data and reporting on trends in forest growth, volume and area of forested land.

Invasive alien species: movement of plant stock and tourism can introduce species. For example, 19 EU Member States have reported and taken official measures to control the pathogen Phytophthora ramorum, which affects rhododendron, viburnum and camellia shrubs (RAPRA, 2009).

Pollution and nutrient load: air pollution is a major threat to Europe's forest biodiversity. For example, air pollution can degrade or destroy culturally and historically important ancient woodlands and associated species (EEA, 2010a). Forest soil acidification is widespread in Europe, despite now being below critical loads in many countries. It is mainly caused by atmospheric depositions of pollutants, especially related to nitrogen emissions, which can affect tree roots and soil biodiversity and also impair the supply of nutrients to plants (ICP Forests, 2009).

Overexploitation and unsustainable use: intensifying forest management using fertilisers has a serious impact on biodiversity. Forest pests also cause problems to varying degrees, with the overall damage often less severe in well managed forests. In addition, a much larger proportion of forest fires recorded during the past 20 years are attributed to man-made sources.

Climate change: climate change is likely to affect forest stands directly through changing temperature and precipitation patterns (especially on the edge of tree species distribution), and indirectly, by altering the distribution and frequency of viruses, pests, small fires and wind damage.

Box 3.4 Forests — mechanisms for adapting to climate change

Tree populations have three biological adaptation options to avoid extinction in a rapidly changing climate:

- **persistence** based on the inherent flexibility (or 'plasticity') of tree species, enabling them to withstand a wide range of environments;
- **genetic adaptation** to new conditions in existing locations;
- **migration** to areas with more suitable conditions.

Climate change is likely to favour species with high levels of plasticity (whereas low plasticity may lead to extinction). At forest ecosystem level, the co-existence of tree species with different plasticity levels can act as a buffer against changes.

In many parts of Europe, the rate of climate change is likely to exceed the adaptive capacity of many wild and domesticated plant species, including forest trees, which have the highest levels of genetic diversity of any group of plants and have wide geographic and ecological ranges.

In Europe, maintaining forest genetic diversity plays a crucial role in sustainable forest management and conserving forest biodiversity by ensuring a continuous evolutionary process within tree populations and maintaining the resilience of forest ecosystems. Widely distributed tree species in Europe are unlikely to face extinction at the species level due to climate change but some local populations are likely to decline, in particular at the edge of distribution ranges. However, tree species with scattered and/or limited distributions are more vulnerable and may face serious threats, including at the species level.

Including genetic diversity considerations in practical forest management is highly recommended as a means to diversify and reduce risk. It also benefits society by ensuring a supply of goods and services from forests. Climate change's impacts on competition between trees and other living organisms (plants, insects, pests, fungal and bacterial diseases) may also significantly affect the survival of tree species, forest habitats and biodiversity.

There is evidence that evolution in tree populations can occur over a few generations or less than 200 years, while local adaptation of tree populations can occur even over one generation. Estimates of migration rates differ considerably among tree species but they are considered to be less than 100 metres per year on average. A study estimated that migration rates of more than 1 000 metres per year will be needed to respond to future climate change (EEA, 2010c). It is therefore unlikely that natural migration will cope with rapid climate change. Assisted migration will therefore be needed, especially for tree species in fragmented landscapes and with small population sizes (EEA, 2010c).

Management issues

The EU Forest Strategy, EU Forest Action Plan and other policies that indirectly address forest issues are assessed by the European Union, the United Nations Economic Commission for Europe Timber Committee, and the Ministerial Conference on the Protection of Forests in Europe (MCPFE). In addition, a number of sub-regional processes and initiatives contribute to the policy framework for forests, including the Alpine Convention, Carpathian Convention and south-east European (Balkan) mountain initiative.

Several developments have impacted on European forest resources. First, to various extents policies in Europe have changed in recent years to reflect increased public interest in sustainable development. Support for recycling (including of paper) has increased in many European countries. More recently, renewable energy has also been promoted as a major component of environmental policies. Within the forest sector, policies have encouraged the production of non-market benefits and, particularly in western Europe, forestry has been promoted as an alternative to agriculture.

Another notable development has been institutional and administrative changes in the way that governments act within the sector. In recent years, many forest sector institutions and legal frameworks have adapted to changing circumstances (e.g. separation of 'authority' and 'management' functions for public forests). Some countries have partially privatised state forest assets and, in eastern Europe, restoring forests to their previous owners has created a vast number of small private forest owners. Furthermore, where significant areas of forest remain in public ownership, many governments have encouraged their public forest managers to act more like private forest owners by setting clear commercial targets and more clearly separating the different roles of the forestry administration.

Since the 1970s, forestry throughout North America and Europe has undergone a massive structural change, heralded by the spread of advanced mechanisation and outsourcing of forest work as the standard mode of operation in more and more enterprises and countries. The combined effect has been dramatic falls in the number of forest workers and the emergence of private contractors brought in to harvest wood. Most experts believe that independent contractors tend to ignore concerns about biodiversity (Puumalainen et al., 2002). The use of certification standards may be an effective way to ensure that negative effects on biodiversity are limited.

Demands on forests and their services will become stronger, more complex and spatially more diversified. Producing timber and pulp and other traditional forest resources will have to be balanced against providing other kinds of goods and services (e.g. bioenergy, but also cultural services and water management) from forest ecosystems. Green (public) procurement policies, Payment for Environmental Services (PES) schemes and other incentive structures related to 'greening the economy' and creating a 'carbon neutral' society are likely to become more important mechanisms to influence forest management. However, they will not compensate fully the decrease in income from wood production. As a result, the profitability of forest management will continue to be a challenge.

3.4 Coastal and marine ecosystems

Key messages

- Coastal and marine ecosystems provide a range of services including defence against rising sea levels, oxygen production, nutrient cycles, carbon sequestration, food, bioremediation of waste and pollutants, and a variety of aesthetic and cultural values.
- Available information indicates that the loss of biodiversity in all European seas and coasts is considerable and shows little sign of being reduced; however integrated data and information to document the extent and severity of problems are lacking.
- Data compiled under Article 17 of the Habitats Directive reveal that the unknowns for marine species and habitats are much greater than those for terrestrial ecosystems.
- Overexploitation of marine fisheries is a major threat to marine ecosystems. Many fishery resources are still not being used sustainably with some 45 % of assessed European stocks falling outside safe biological limits.
- Invasive alien species remain a threat.
- EU governments agree that an ecosystem-based approach is the best means to manage and govern activities affecting the marine environment. Synergies between the marine and maritime policy framework and well established marine nature protection policy will benefit European marine biodiversity.

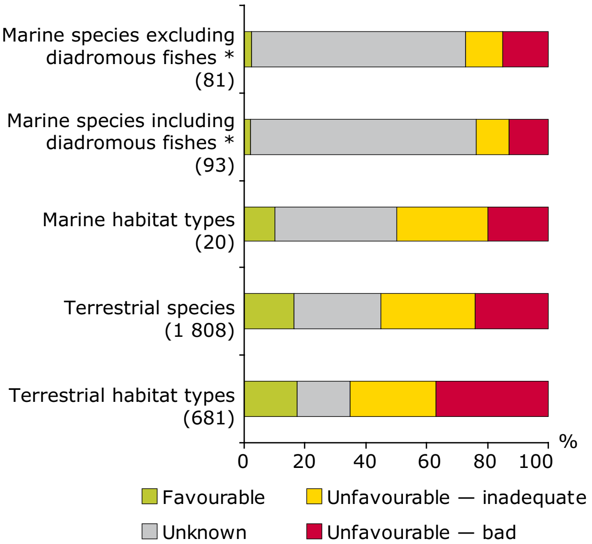
Status and trends

Oceans and seas cover more than half of the territory of the EU-27. Of the 64 large marine ecosystems (LMEs) defined worldwide (Sherman et al., 1990), 13 are located around the European continent. The LMEs of the Baltic Sea, Black Sea, Celtic-Biscay shelf, Mediterranean Sea and North Sea are linked to and influenced by the coastal zones and inland catchments of the EU area. Habitats range from highly productive near-shore regions to the deep sea floor inhabited only by highly specialised organisms.

Some environmental changes at the global and European scale are likely to have significant and far-reaching consequences for marine biodiversity. In addition to fisheries, marine ecosystems provide other key services both globally (e.g. oxygen production, nutrient cycles, carbon capture through photosynthesis and carbon sequestration) and at the regional and local scales (e.g. coastline protection, bioremediation of waste and pollutants, and a variety of aesthetic and cultural values) (MARBEF, 2008).

Biodiversity loss impairs a marine ecosystem's capacity to deliver services such as providing food, maintaining water quality and recovering from perturbations (Worm et al., 2006). According to the IUCN Red List of Threatened Species, approximately 3 000 marine species have been assessed globally for the threat of extinction. At the European level, approximately 22 % of marine mammals were classified as in 'threatened'

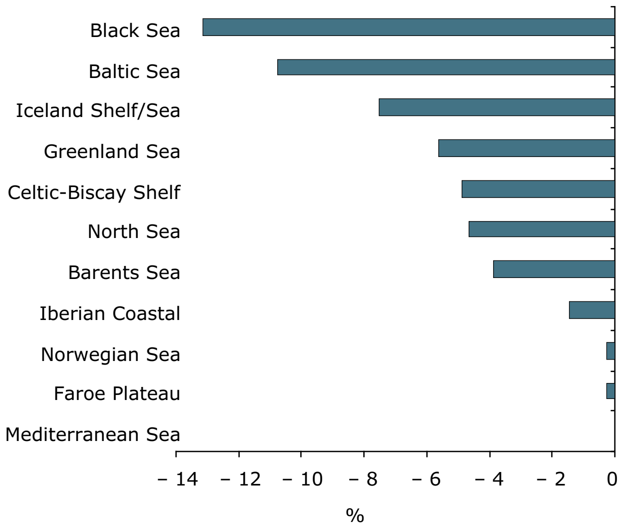
Figure 3.9 Conservation status of marine habitat types and species of Community interest in EU-25



Note: * = migrating between fresh and salt water. Number of assessments in brackets.

Source: ETC/BD, 2008.

Figure 3.10 Marine Tropic Index percentage change in Europe between 1950 and 2004



Note: How to read the graph: The MTI for the Black Sea was about 13 % lower in 2004 than it was in 1950.

Source: Sea Around Us Project, 2009; SEBI 2010 Indicator 12.

categories, with 7.4 % rated as 'critically endangered', 7.4 % as 'endangered' and 7.4 % as 'vulnerable' (Temple and Terry, 2007; IUCN, 2010).

According to reporting under Article 17 of the Habitats Directive, less than 5 % of marine species and 10 % of marine habitats have a favourable conservation status, while for coastal habitats only 10 % have a favourable status, and more than 30 % have an 'unfavourable — bad' status (ETC/BD, 2008; Figure 3.9).

Fishing has led to local extinctions, especially among large, long-lived and slow-growing species with narrow geographical ranges (MEA, 2005). Destructive fishing practices, in particular trawling and dredging, change the structure of marine ecosystems with consequences for their capacity to provide ecosystem services.

A further impact of fishing is by-catch, for example of small whales in the Mediterranean, the Celtic-Biscay shelf, the North Sea and the Arctic and marine turtles in the Mediterranean. Seabird by-catch, both by long-lines and gill nets, affects many European bird species, including, the critically endangered Balearic Shearwater, endemic to the EU.

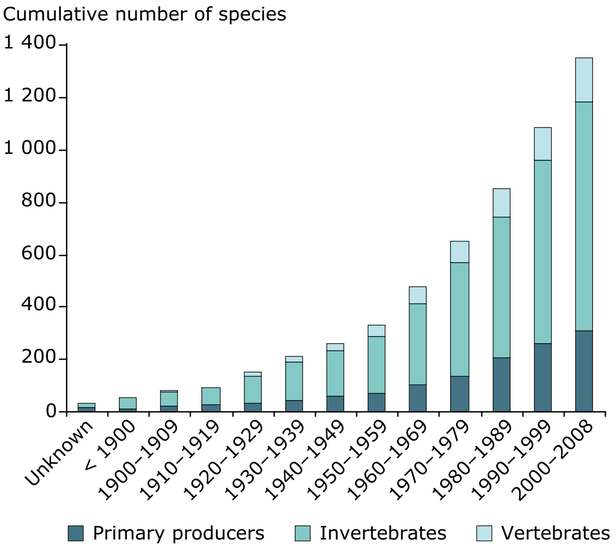
The Marine Trophic Index (MTI) measures the degree to which countries are 'fishing down the food chain', with fish catches increasingly consisting of smaller fish that are lower in the food chain. The index has been endorsed by the CBD as a measure of marine biodiversity, overall ecosystem health and stability, but also serves as a proxy measure for overfishing. Examining change in the MTI over time reveals how much a country is altering fish stocks in the marine ecosystem (Figure 3.10). If the change is negative, it means the overall trophic structure of the marine ecosystem is becoming depleted of larger fish higher up the food chain, and smaller fish lower in the food chain are being caught. However, if the change in the MTI is zero or positive, the fishery is either stable or improving. The MTI declined in 11 European seas since the mid 1950s, indicating the unsustainability of fisheries in those waters (EEA, 2009a).

Threats

Habitat loss and degradation: marine and coastal biodiversity face an unprecedented range of pressures (see below) causing habitat loss and degradation. Coastal habitats are fragile and are being destroyed to make way for housing, industry, agricultural land and infrastructure for tourism and transport (see Box 3.3 on tourism above).

Invasive alien species: coastal waters are especially prone to invasive alien species, introduced both intentionally and unintentionally. In Europe, the

Figure 3.11 Alien species in European marine and estuarine waters



Note: The indicator on the cumulative number of alien species established in Europe includes data from all European countries with marine or estuarine waters, as well as non-European countries bordering European seas. In the 1990s, the total number of alien marine species increased to around 1 000. Casual records are included except for those dating from before 1920 and those relating to species that were not sighted again and are therefore assumed extinct. For an additional 31 species (15 primary producers, 16 invertebrates) the date of establishment is unknown.

Source: SEBI 2010 Expert Group on invasive alien species, based on national data sets (Belgium, Denmark, Germany, Malta and the United Kingdom) available online; review papers (the Netherlands and Turkey); NEMO database for the Baltic; Black Sea database; HCMR database for the Mediterranean; project reports (ALIENS, DAISIE); and the contributions of experts from France, Spain and Russia made during a dedicated workshop; SEBI 2010 Indicator 10.

cumulative number of alien species has been increasing constantly since the 1900s (Figure 3.11). Unlike terrestrial and freshwater species, whose increase may be slowing or levelling off, the number of alien species introduced to marine and estuarine waters continues to increase.

Pollution and nutrient load: eutrophication continues to be a major problem affecting most European seas. Nitrogen and phosphorus loads originating from agricultural runoff and households encourage phytoplankton blooms, which perturb the pelagic system (i.e. open sea). Despite reduced point sources of nutrient pollution (sewage and industrial waste), non-point (or diffuse) sources of pollution (agricultural runoff) continue to be a problem (EEA, 2005a, 2005b; EC, 2007a; Andersen and Conley, 2009).

Marine litter is increasingly recognised as a modern form of pollution, with entanglement and ingestion of marine litter causing direct damage to wildlife, including most marine top predators (Cuttelod et al., 2009; Gregory, 2009). For example, Young et al. (2009) report that the Laysean albatross has a deadly diet composed of large amounts of plastic. There is increasing concern about the role of micro-plastics as a vector in transporting persistent and toxic substances, and the risk that ingesting plastic debris and micro-plastics can introduce toxic chemicals into the food chain.

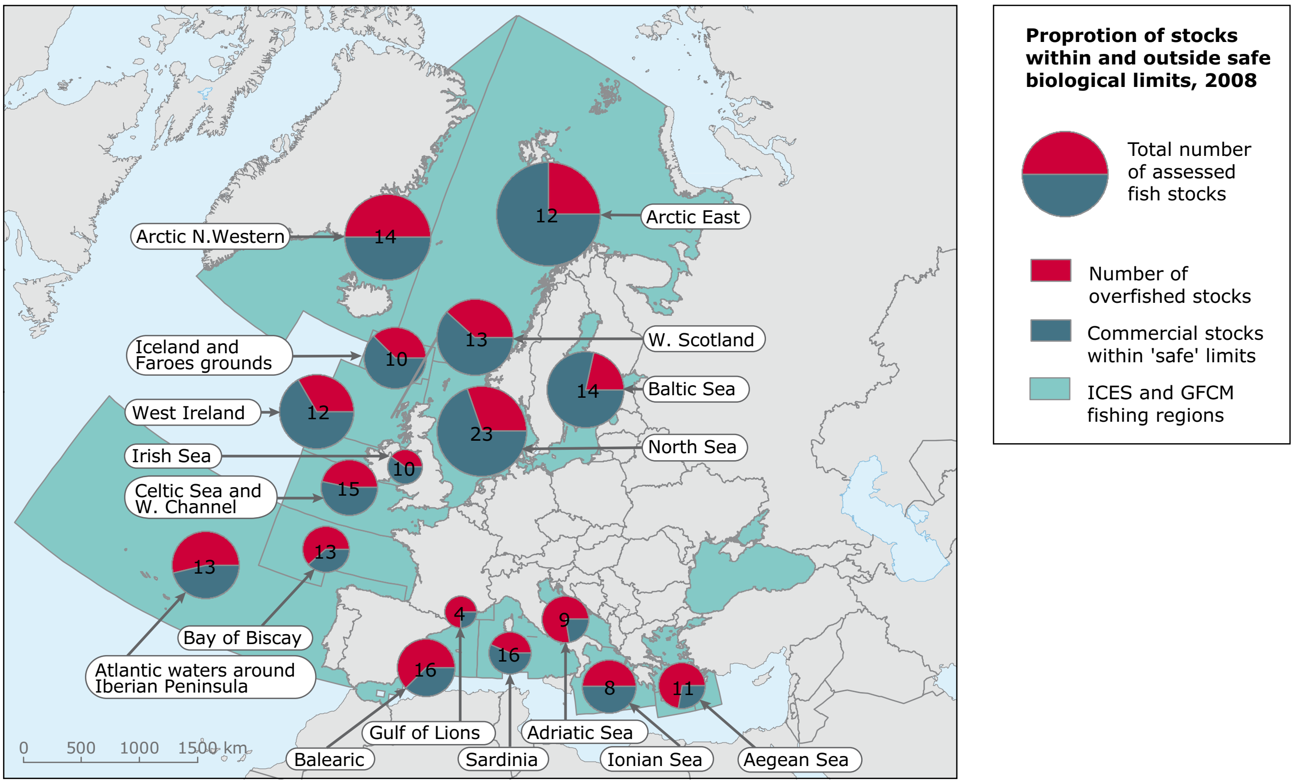
Pollution sources in open marine systems include oil and gas platforms and ever-increasing maritime traffic. Major oil spills in the open sea are relatively rare in European waters but may have big impacts, also on the coastal zone. The role of river inflows is most important for enclosed seas like the Baltic and Black Seas. The pressure of industrial pollution can be shown by the elevated levels of heavy metals, pesticides and hydrocarbons and plastic derivatives that accumulate in living fish (EEA, 2006a; EEA, 2007c).

Overexploitation and unsustainable use: overexploitation of fish stocks and other marine organisms has significant impacts ecosystem goods and services. Fishing fleet overcapacity is a severe problem for European marine ecosystems (EC, 2009b), with 88 % of Community fish stocks fished beyond Maximum Sustainable Yields. Less fishing pressure now would allow stocks to recover, delivering greater yields in future years. Troublingly, however, 46 % of overfished Community fish stocks are even outside safe biological limits that may not allow recovery (Map 3.3; EEA, 2009a).

Besides overexploitation of commercial fish stocks, current fishing practices can also threaten other marine ecosystem components, e.g. marine mammals, seabirds and sea floor habitats. As a consequence, marine habitats become less resilient and more vulnerable to other pressures, such as alien invasive species (EEA, 2007c).

Climate change and ocean acidification: impacts on marine biodiversity are already visible and are very likely to cause large-scale alterations within marine ecosystems: sea surface temperatures and sea levels are rising; sea ice cover is decreasing; and the chemical, physical and biological characteristics of the sea are changing (EEA, 2010b). Coastal and estuarine wetlands and dune systems and the biodiversity therein will be particularly under threat from rising sea levels and changing erosion and accretion patterns (EEA, 2010b).

Map 3.3 Status of fish stocks in the International Council for the Exploration of the Sea (ICES) and General Fisheries Commission for the Mediterranean (GFCM) fishing regions of Europe



Note: The chart shows the proportion of assessed stocks that are overfished (red) and stocks within safe biological limits (blue). The numbers in the circles indicate the number of stocks assessed within the given region. The size of the circles is proportional to the magnitude of the regional catch.

Source: GFCM, 2005; ICES, 2008; SEBI 2010 Indicator 21.

Several studies in Europe confirm that marine fish and invertebrate species respond to ocean warming by shifting latitudinal and depth range (Dulvy et al., 2008; Cheung et al., 2009). For instance, the fish species composition in the North Sea has changed from 1985 to 2006 in response to higher water temperatures. In general, small species of southerly origin increased while large northerly species decreased, although this can also be partly explained by commercial overexploitation of large predator fish species (Hiddink et al., 2008). Many fish also experience what is called an 'oxygen squeeze' in warmer water, where less oxygen is available. As the fish adapt to the warmer temperature their metabolism speeds up and they grow more quickly, often to a smaller adult body size because of the limited oxygen supply.

Ocean acidification may cause serious adverse impacts on the marine environment, preventing the process of calcification (Hoegh-Guldberg et al., 2007). Even if atmospheric CO_2 levels were reduced, it would take tens of thousands of years for ocean chemistry to return to a pre-industrial conditions (Orr et al., 2005).

Management issues

Designation of protected areas is the primary means of conserving biodiversity in Europe's marine areas, although in recent years there is increasing use of ecosystem approaches to balance the many demands on the marine environment.

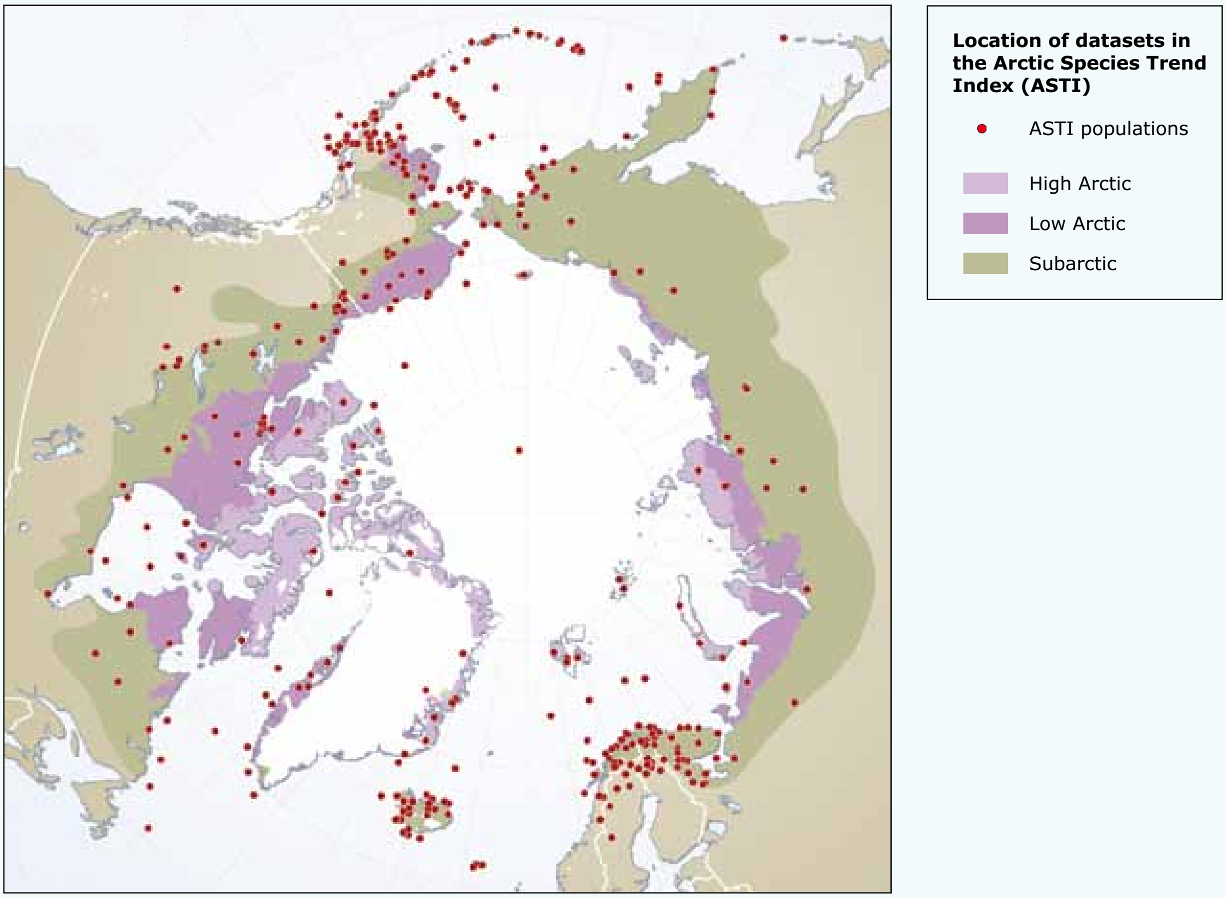
European marine biodiversity is primarily protected by establishing Natura 2000 sites under the Habitats and Birds Directives but compared to the terrestrial environment there are serious delays in identifying areas and even longer delays in assessing their status (EC, 2009c). This is in part because effective protection of marine areas requires international collaboration.

Box 3.5 Arctic biodiversity assessment

In 2005, the Arctic Climate Impact Assessment (ACIA) recommended that long-term Arctic biodiversity monitoring be expanded and enhanced (ACIA, 2005). The Conservation of Arctic Flora and Fauna (CAFF) Working Group responded by implementing the Circumpolar Biodiversity Monitoring Program (CBMP, 2010). The CBMP is tasked with developing an integrated, interdisciplinary and collaborative Arctic biodiversity monitoring programme that enhances our ability to detect important trends and to provide such information to the public and policymakers. After the CBMP was established, it was further agreed that it was necessary to provide policymakers and conservation managers with a synthesis of the best available scientific and traditional ecological knowledge on Arctic biodiversity. This initiative is known as the Arctic Biodiversity Assessment (ABA) and was endorsed by the Arctic Council in 2006. The geographic area covered by the ABA is shown in Map 3.4.

The first deliverable from the ABA — the 'Arctic Biodiversity Trends 2010: Selected Indicators of Change' report — was released in May 2010. This presents a preliminary assessment of status and trends in Arctic biodiversity and is based on the suite of indicators developed by the CBMP. Twenty-two indicators were selected to provide a snapshot of the trends being observed in Arctic biodiversity today. The indicators were selected to cover major species groups with wide distribution across Arctic ecosystems. Each indicator chapter provides an overview of the status and trends in a given indicator, information on stressors, and concerns for the future. The report presents key findings reflecting information in the 22 indicators. A more complete scientific assessment of biodiversity in the Arctic will emerge from the full Arctic Biodiversity Assessment, currently being prepared.

Map 3.4 Location of datasets in the Arctic Species Trend Index



Source: CAFF, 2010.

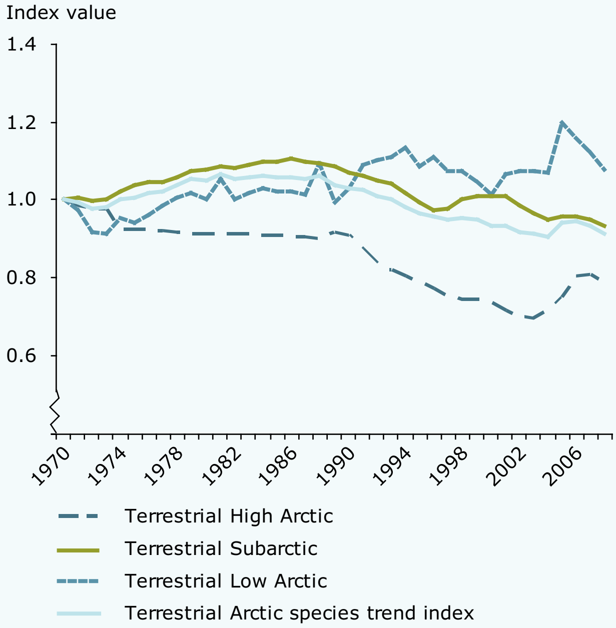
Box 3.5 Arctic biodiversity assessment (cont.)

Tracking trends in Arctic wildlife: the Arctic Species Trend Index

The Arctic Species Trend Index (ASTI) was commissioned and coordinated by the CBMP. ASTI was developed to provide a pan-Arctic perspective on trends in Arctic vertebrates. Tracking this index will help reveal patterns in the response of Arctic wildlife to growing pressures and thereby help predict trends in Arctic ecosystems.

A total of 965 populations of 306 species were used to generate the ASTI (see Map 3.4). Overall, the average population of Arctic species rose by 16 % between 1970 and 2004, although this trend is not consistent across biomes, regions or groups of species. The terrestrial index shows an overall decline of 10 %, largely reflecting a 28 % decline in terrestrial High Arctic populations such as caribou, lemmings, and High Arctic Brent goose (Figure 3.12). These may be due partly to the northward movement of southern species in combination with increasing severe weather events in the High Arctic and changing tundra vegetation. Although both freshwater and marine indices show increases, the data behind the freshwater index is currently too sparse in terms of species and populations, while the marine index is not spatially robust.

Figure 3.12 Index of terrestrial species disaggregated by Arctic boundary for the period 1970–2004



Note: High Arctic, n = 25 species, 73 populations; Low Arctic, n = 66 species, 166 populations; Subarctic, n = 102 species, 204 populations.

Source: CAFF, 2010.

By December 2009, about 2 000 sites, either fully or partly marine, had been proposed or classified under the Habitats and Birds Directives. Together they cover an area of approximately 167 000 km^2, mostly in near-shore areas (ETC/BD, 2008; EC, 2009c). In some marine regions, biodiversity protection measures have been developed in cooperation with regional seas conventions, which provide advanced mechanisms and guidance to halt marine biodiversity loss (EC, 2009b; EEA 2010b). Studies show that establishing protected areas may help increase abundance and biomass of individuals, raise the proportion of larger and older individuals, enhance the fisheries yield outside the protected area and increase the dominance of large predator species (Garcia-Charton et al., 2008). It has also been shown that the extent of recovery increases with the age and size of the protected area (Claudet et al., 2008).

The Integrated Maritime Policy (IMP) complements the Natura 2000 network of marine protected areas while not unduly compromising economic development. The Marine Strategy Framework Directive (EC, 2008c) completes the coverage of the whole water cycle by EU legislation and uses the approaches already enshrined in the Water Framework Directive. Crucially, it applies an ecosystem-based approach to managing human activities that impact the marine environment. In addition, it specifies the designation of marine protected areas as a means for Europe's seas to achieve 'good environmental status' by 2020 (EC, 2007b; EC, 2009d; EC, 2010c). This reflects the fact that an ecosystem approach to managing our seas is needed to conserve biodiversity and maintain resources (Gaines et al., 2010).

In view of the severe ecosystem pressures linked to fisheries, the European Commission's recent Green Paper on the Reform of the Common Fisheries Policy (EC, 2009d) calls for better stewardship of marine resources. To face these challenges fisheries communities need support in adapting to an ecosystem management approach.

Despite specific policies to reduce pressures, eutrophication and pollution will continue to have negative impacts for years to come. As a key action against pollution, policies to reduce emissions and regulate the use of hazardous substances have been developed at global, European and national levels. In general, concentrations of hazardous substances in European seas have been decreasing. However, the persistence of many such substances and the amounts already released in the environment mean that negative effects will continue for decades. In addition, new substances that cause concern will continue to appear, such as residues from pharmaceutical products. Diffuse inputs into the marine environment are now recognised as highly significant for some heavy metals (Rodrigues et al., 2009) and plastic debris is a continuing problem (Gregory, 2009). Combating the effects of such pollution, in addition to climate change and ocean acidification, is a major challenge.

3.5 Agricultural ecosystems

Key messages

- Along with providing food, fibre and fuels, agricultural ecosystems provide other vital services, such as pollination and natural pest control.
- Intensified agriculture and land abandonment are the main threats of agricultural ecosystems. In particular, less diverse crops, simplified cropping methods, use of fertilisers and pesticides and homogenisation of landscapes all have negative effects on biodiversity. Land abandonment causes the loss of specialised species and damages the habitats associated with extensively farmed agro-ecosystems.
- Several pressures from agriculture have been addressed directly by reducing nitrogen surpluses and losses and indirectly by promoting environmentally friendly management, such as organic farming practices through Agri-Environment Schemes (AES).
- To adapt to climate change, an integrated approach handling both agricultural productivity and biodiversity issues is necessary.
- Agricultural ecosystems should be managed in such a way that their ecosystem services are maintained sustainably.

Status and trends

Agriculture is the main land use in the EU-27, occupying 47 % of the territory (EC, 2007c). As a result, a large number of highly valued wildlife species and semi-natural habitat types in Europe are dependent on extensively managed agricultural land. However, increasing demand for food and energy crops is putting more pressure on extensive agriculture and natural systems. Furthermore, biodiversity on grazing land and extensive meadows threatened by reduced management of the land (abandonment and marginalisation) (EEA, 2005b; EEA, 2010a).

Seventy per cent of species of European interest linked to agro-ecosystems and 76 % of habitats have an unfavourable conservation status (Figures 3.14 and 3.15).

More than 80 % of assessments for amphibians linked to agro-ecosystems are unfavourable, while mammals and invertebrates are the only species groups with favourable assessments (less than 10 %). Plants are one of the species groups with the highest percentage of unknown assessments (ETC/BD, 2008).

Since 1980, the population of European common birds has declined by 10 % (Figure 3.16). Among them, farmland birds have declined by around 50 %, although populations have been relatively stable since 1995. Increased specialisation and intensification as well as habitat loss have driven the decline of farmland birds (EEA, 2009a). Increased agricultural production in eastern Europe, if linked to higher inputs of nutrients and pesticides, combined with further land abandonment in some parts of Europe and the abolition of set-aside areas in 2008, may lead to a new decline in biodiversity.

Despite the availability of good data for farmland bird species, it is widely acknowledged that agricultural practices affect many habitat types other than agricultural land in the narrow sense. Halada et al. (in press) listed all the habitat types in Annex I of the Habitats Directive whose conservation status directly or indirectly depends on agricultural practices such as grazing or mowing. These habitat types include types of heath, wetlands, forest and even sand dunes. There is large variation across Europe, however, in the types of habitat affected

Box 3.6 Grasslands

Europe does not have grasslands like the prairies, the Pampas or the Serengeti. Practically all grassland is linked to agriculture, except for natural grasslands such as on mountain summits. Grassland can also be an intensive monoculture, such as Lolium spp. grasslands in the Netherlands.

Europe is experiencing a major decline in biodiversity associated with grasslands. In Europe, the major threat to semi-natural grasslands and their biodiversity is habitat loss and degradation due to intensification or abandonment of agricultural land. Habitat fragmentation, conversion to biofuel production or forestry, climate change, air pollution and invasive alien species are also significant threats.

The area of grasslands in Europe is decreasing; an area approximately twice the size of Luxembourg was lost between 1990 and 2006. The main causes are increasing urban sprawl and forestry.

About half of Europe's endemic species depend on grasslands, whether in mountains, lowlands, river plains or coastal areas. Many grasslands originate in traditional agricultural landscapes. Modern intensification, however, brings many of these ecosystems under threat (Veen et al., 2009). In particular, 76 % of the assessments of grassland habitats of European interest are unfavourable (ETC/BD, 2008).

Grasslands are a key habitat for birds and butterflies and are in decline. Of the 152 grassland bird species, 89 (59 %) have an unfavourable conservation status in Europe (BirdLife International in Veen et al., 2009). This is a slight deterioration compared to a decade before, when 81 grassland species had an unfavourable conservation status. A number of the currently threatened species were formerly common in Europe, such as the lapwing (*Vanellus vanellus*), the European starling (*Sturnus vulgaris*) and the corn bunting (*Miliaria calandra*) (Tucker and Heath, 1994 in Veen et al., 2009).

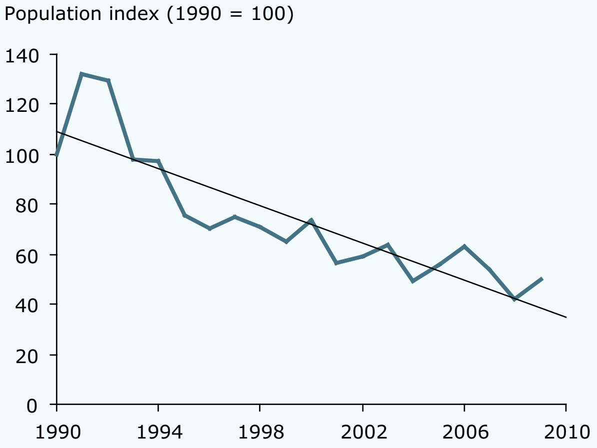
Grassland butterflies have declined by almost 70 %, indicating a dramatic loss of grassland biodiversity (Figure 3.13). The main driver behind the decline of grassland butterflies is changes in rural land use: agricultural intensification where the land is relatively flat and easy to cultivate, and abandonment in mountains and wet areas, mainly in eastern and southern Europe. Agricultural intensification leads to uniform, almost sterile grasslands, where the management is so intensive that grassland butterflies can only survive in traditional farmed low-input systems (High Nature Value Farmland) as well as nature reserves, and marginal land such as road verges and amenity areas.

Upland grasslands are declining in extent and are in poor condition. Their characteristic biodiversity, especially butterflies, has shown seriously declined since 1990. This is particularly due to abandonment of sustainable grazing or hay making.

Dry grasslands are the most prevalent grassland type in the Mediterranean region and the steppes of Eastern Europe. Dry grasslands are important for bird conservation — more than 400 Important Bird Areas (IBAs) in Europe contain steppe or dry calcareous grassland.

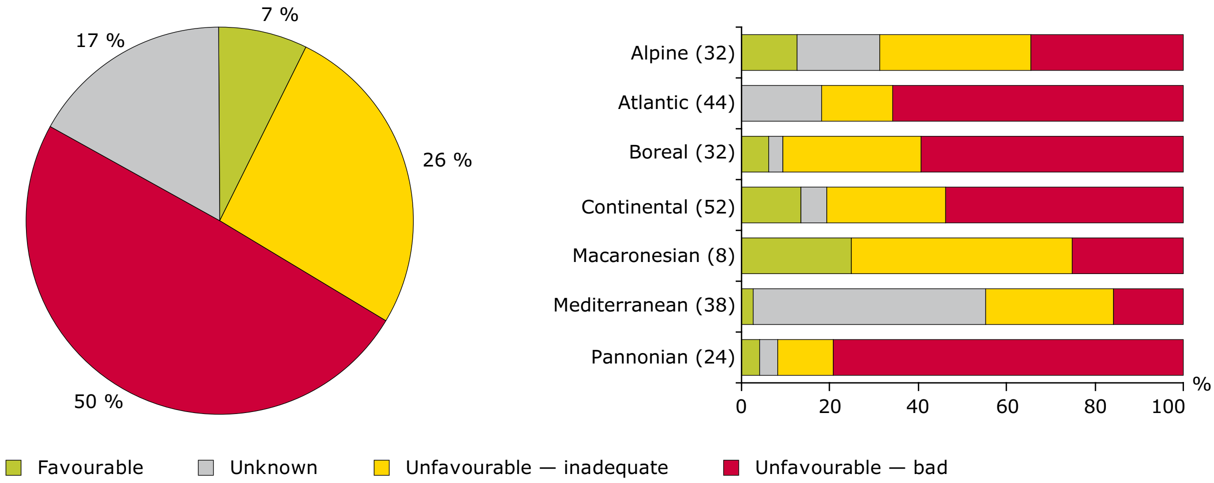
Several Prime Butterfly Areas also occur in dry grasslands and depend on sustainable grazing or hay cutting to sustain the abundance of larval foodplants and butterfly diversity. The main threat to dryland biodiversity in Europe is desertification caused by change in water regimes due to unsustainable use, poor agricultural practices and land abandonment leading to soil erosion, exacerbated by climate change (IUCN, 2008). Efforts to improve understanding of how dryland ecosystems function are under way. Recent work shows that shrub encroachment can reverse desertification in semi-arid Mediterranean grasslands, leading to enhanced vascular plant richness, contrary to the findings in other parts of the world (Maestre et al., 2009).

Figure 3.13 Trends in the population index of grassland butterflies in Europe



Source: De Vlinderstichting/Butterfly Conservation Europe/ Statistics Netherlands, 2010; SEBI 2010 Indicator 01.

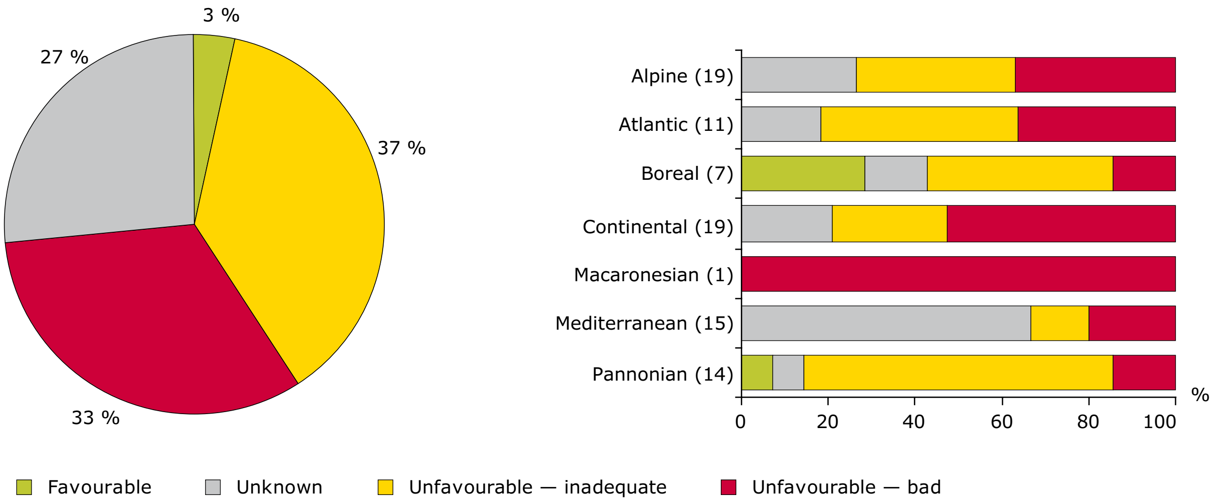
Figure 3.14 Conservation status of habitat types of Community interest in agro-ecosystems in EU-25



Note: Number of assessments in brackets.

Source: ETC/BD, 2008.

Figure 3.15 Conservation status of species of Community interest in agro-ecosystems in EU-25



Note: Number of assessments in brackets.

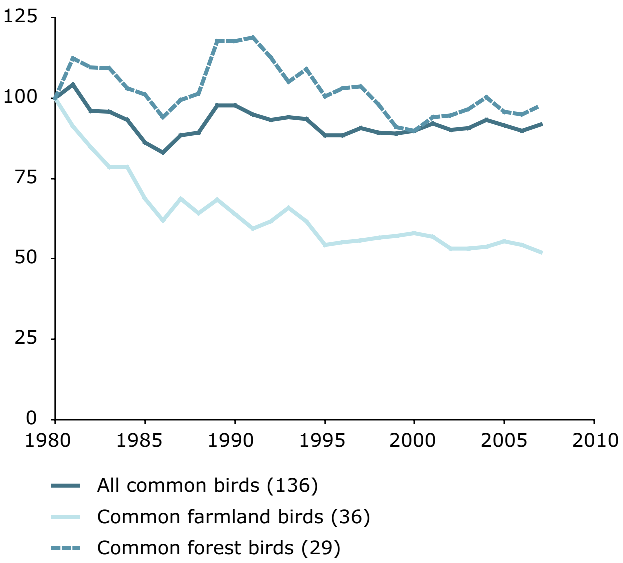
Source: ETC/BD, 2008.

and their specific links to agricultural management practices.

The biodiversity most important for agriculture, yet arguably also the most unknown and neglected, is soil biodiversity. The species richness below ground is certainly greater than above ground (Heywood, 1995) but most soil organisms are still unknown (Wall et al., 2001). Indeed, one study estimates that only 1 % of soil microorganism species are known (Turbé et al., 2010). This biodiversity underpins processes and ecosystems services that are essential for agriculture, such as soil formation, maintaining soil fertility, water cycle regulation and pest control (Turbé et al., 2010). The precise ecological and economic value of these services is still largely unknown.

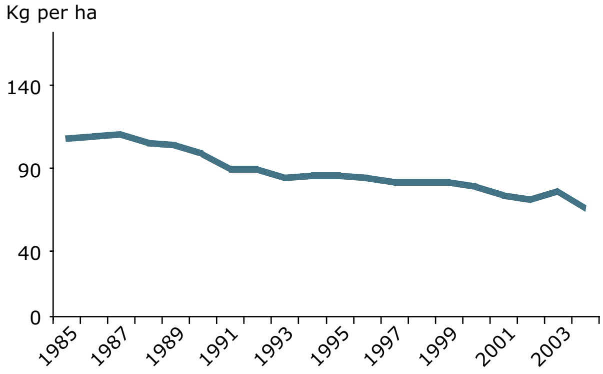
Pressures on soil biodiversity are certainly increasing. For example erosion, a natural process that is exacerbated by human activities such as overexploitation of agricultural lands (Gardi et al.,

Figure 3.16 Trends in the population index of common birds in Europe



Source: EBCC/RSPB/BirdLife International/Statistics Netherlands, 2009; SEBI 2010 Indicator 01.

Figure 3.17 Nitrogen balance per hectare of agricultural land in OECD countries



Source: Based on OECD, 2008b; SEBI 2010 Indicator 19.

2009), can remove fertile soil that took hundreds of years to form. Inventories and monitoring are necessary to better understand soil biodiversity and the threats it faces (Gardi et al., 2009).

Animal genetic resources for food and agriculture are an essential part of the biological basis for world food security (FAO, 2007b). Europe is home to a large proportion of the world's domestic livestock diversity, with more than 2 500 breeds registered in the Food and Agriculture Organization (FAO) breeds database (EEA, 2006a) and many native breeds are endangered. At EU level the Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture (EC, 2004b) and the rural development programmes under Regulation 1698/2005 (EC, 2005) are co-funded instruments for conserving genetic resources. In Austria, for example, preservation of plant varieties and rearing of endangered breeds is supported through measures implemented in the Agri-Environmental Schemes (AES) under the EU Regulation 1698/2005. In 2008 about 4 400 agricultural holdings, that is about 4 % of all holdings participating in the Austrian AES, were involved in the AES measure 'keeping of endangered breeds' (BMLFUW, 2009).

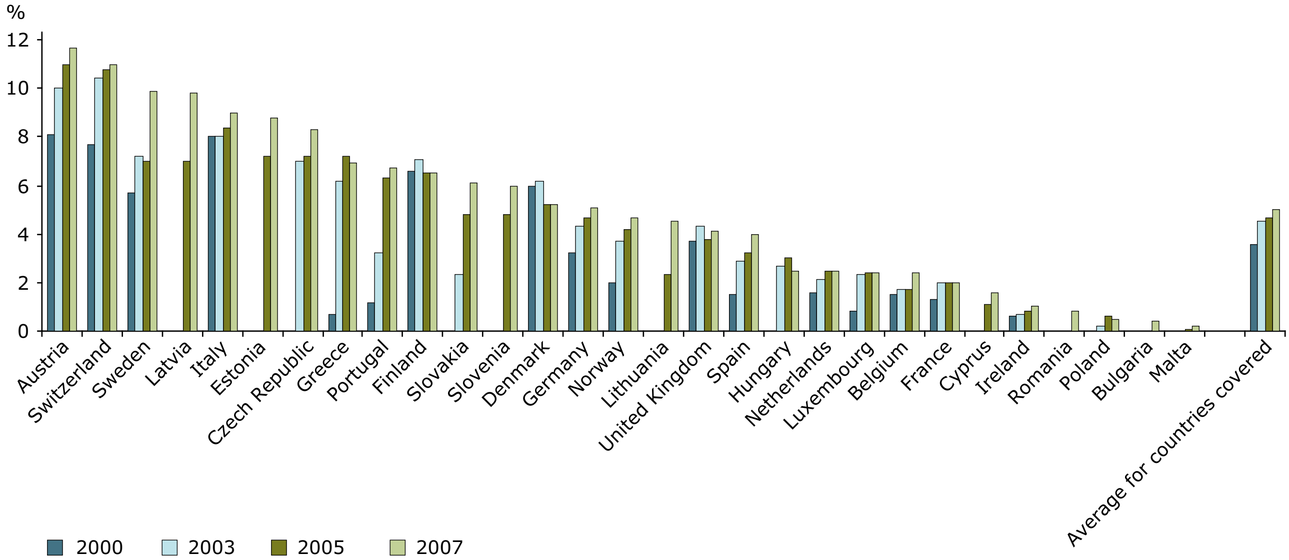
In Europe 44 % of emissions of eutrophying substances and 27 % of emissions of acidifying substances come from agriculture (EEA, 2007c). Although aggregated emissions of acidifying pollutants decreased in most EEA member countries between 1990 and 2006, half of the area of EU-25 natural and semi-natural habitats was still exposed to atmospheric nitrogen depositions above the critical load in 2004. (The critical load is the level above which harmful effects in ecosystem structure and function may occur, according to present knowledge.)

The National Emission Ceiling Directive (2001/81/EC), one of the main EU instruments for reducing nitrogen and sulphur emissions, binds EU Member States to respect emission ceilings by 2010. The current proposal for revising the Directive includes provisions on monitoring the effects on aquatic and terrestrial ecosystems within all types of Natura 2000 sites (EEA, 2009a).

Agricultural nitrogen balances (nitrogen surplus) are declining (Figure 3.17) but they are still high in some countries, particularly in lowland western Europe, notably the Netherlands and Belgium (229 and 184 kg N/ha, respectively). The average gross nitrogen balance in the period 2000–2004 in the EU-15 was 83 kg N/ha (OECD, 2008a).

Organic farming is increasing across Europe (Figure 3.18). Omitting synthetic herbicides and mineral nitrogen fertilizers, along with more diverse crop rotations, reduces detrimental impacts on biodiversity. Positive effects of organic farming on biodiversity are found especially in intensively managed agricultural landscapes (Bengtsson et al., 2005).

Figure 3.18 Share of total utilised agricultural area occupied by organic farming



Note: Area covers existing organically-farmed areas and areas in process of conversion. The values for the following are estimates: France (2000), Luxembourg (2005), Poland (2005), Denmark (2007), Luxembourg (2007), Malta (2007), Poland (2007), Romania (2007).

Source: Based on Eurostat, 2009; data for Switzerland from BDM, 2009; SEBI 2010 Indicator 20.

Threats

Habitat loss and degradation: the loss of landscape corridors like hedgerows and grassy field margins causes fragmentation and decreases species diversity (e.g. Marshall and Moonen, 2002; Smith et al., 2008). This calls for joint efforts at field-, farm- and landscape-scale to provide larger resource patches managed and using extensive farming methods that increase biodiversity (Whittingham, 2007).

Invasive alien species: many of the problems caused by invasive alien species that are most expensive to resolve arise first and foremost in agriculture (e.g. Amaranthus spp.). Many of the invasive weeds affecting agriculture and natural grasslands have been spread around the world as contaminants in crop seed (IUCN, 2001).

Pollution: inefficient use of nitrogen and synthetic chemicals causes problems for biodiversity both in agricultural ecosystems and in other ecosystems subject to runoff from agricultural land through freshwaters into coastal and marine waters.

Overexploitation: intensification is the main threat to biodiversity in agricultural ecosystems. Indices of national agricultural intensity (cereal yield (t/ha), fertiliser use (t/ha), number of tractors per unit area of agricultural land and livestock density (head of cattle/ha of grassland)) showed significant negative correlation with mean national trends of all farmland bird species (Donald et al., 2006).

Climate change: agricultural ecosystems are not only impacted by climate change, they can also act as sources and sinks of greenhouse gases. Livestock accounts for a significant proportion of greenhouse gas emissions. Increased use of biomass from agriculture to produce bioenergy is often seen as an option to reduce greenhouse gas emissions.

Management issues

The value of Europe's agricultural land for biodiversity is recognised in current legislation and management practices, especially organic farming methods. Significant challenges lie ahead, however, related to intensification and abandonment, and increasing demand for biofuels. Furthermore, global demand for meat and milk is set to double by 2050 (FAO, 2006).

Europe has significant areas of 'High Nature Value Farmland' (HNV), providing a habitat for a wide range of species (Paracchini et al., 2008). In High Nature Value (HNV) farmland, farming practices are associated with high biodiversity values. HNV farmland is characterised by a high proportion of semi-natural vegetation with a mosaic of low intensity agriculture and semi-natural structural elements (e.g. field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers), and farmland that supports rare species or a high proportion of European or world populations (EEA, 2010a).

Maintaining HNV systems is critical to sustaining and developing biodiversity. As such, it is one of the mandatory impact indicators in the Common Monitoring and Evaluation Framework of the CAP. However, market pressures may lead to harmful intensification or abandonment of HNV farmland. In the European Alps, 40 % of all farm holdings were abandoned in the period 1980–2000 (Tasser et al., 2007). Natural forest regrowth in these areas means the long-term loss of species-rich agricultural habitats (Gellrich et al., 2006).

The Common Agricultural Policy (CAP) provides direct support to farmers. In 2003 the CAP shifted away from subsidies based on production to those based on farming areas, with the goal of making these progressive so that the largest farms take a smaller proportion of total funds than previously. While some production-oriented financing remains, this shift should in principle reduce incentives for intensive farming that has high impacts on biodiversity. Moreover, the 2003 reforms (and a further 2008 'health check') introduced a system of 'cross-compliance' to ensure that farmers receiving subsidies followed EU environmental legislation.

The CAP now plays an important role in financing biodiversity. The most substantial contribution that can assist biodiversity comes from agri-environmental schemes (for which EUR 20.3 billion has been allocated for the period 2007–2013). The geographic pattern of agri-environment expenditures shows large differences in Europe, since such schemes are adopted voluntarily. Extremely low disbursements for these schemes are seen in Latvia, Romania, France, Scotland and most of Spain. The highest expenditures are found in Austria, England, Finland, Sweden and parts of Italy (BirdLife International, 2009b).

Unfortunately, despite recognition of agriculture's heavy impact on nature, the CAP is not changing sufficiently to reduce biodiversity loss (EEA, 2009e). In several EU countries, direct support is provided on an historic basis, which in practice favours more productive land, usually farmed intensively. Moreover, cross-compliance rules can only make a small contribution to biodiversity conservation because although they limit environmentally damaging practices, they cannot really ensure active management of ecosystems rich in biodiversity. By contrast, agri-environmental measures may explicitly target management practices beneficial to biodiversity but relatively little is spent on areas with a high proportion of HNV farmland. The inconsistent application and distribution of CAP support across Pillars (in particular Pillar 2), measures and farm systems suggest insufficient support for favourable management of HNV farmland (EEA, 2009e).

The European model of multifunctional sustainable agriculture can address these challenges. Raising awareness and increasing public support for agriculture's role in the provision of public goods is at the heart of this discussion (EEA, 2009e). Debate is underway on the future of the CAP beyond 2013, including in terms of environment and biodiversity, and the multiple objectives of the CAP reform reflect the varied functions that agro-ecosystems serve.

Increasing the share of renewable energy in total EU energy consumption is a key policy objective in the European Union. Biomass is by far the most important renewable energy source, providing two thirds of the total energy produced from renewables (EEA, 2007d). The substantial rise in the use of biomass from agriculture and other sectors for producing transport fuels and energy can put significant environmental pressures on farmland or forest biodiversity. Positive effects on biodiversity have been noted in degraded or marginal areas where new perennial mixed species (grassland, trees) have been introduced to restore ecosystem functioning and increase biodiversity (CBD, 2008).

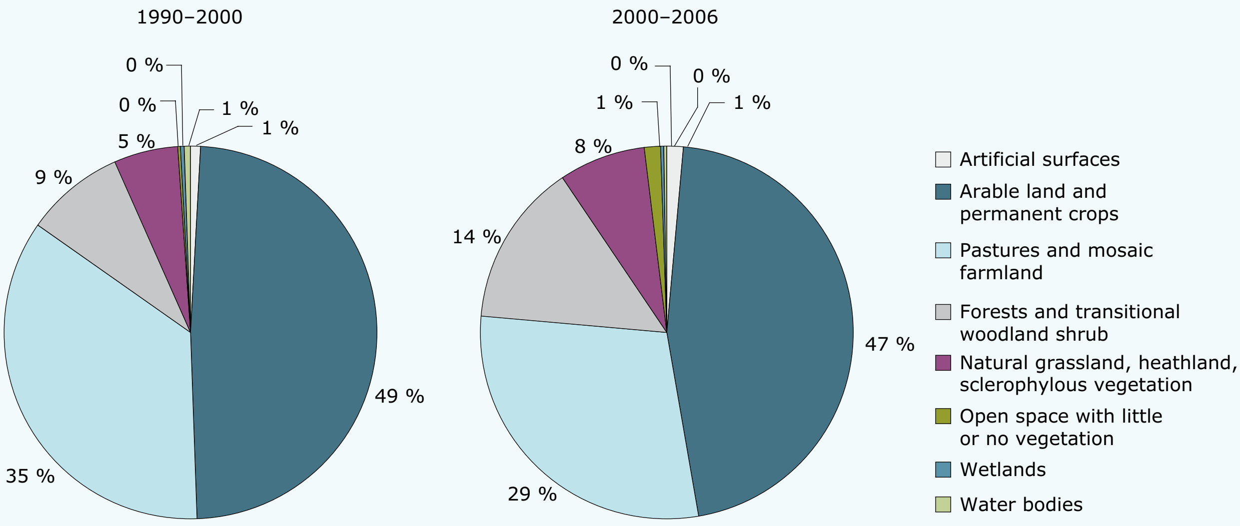
Box 3.7 Urban ecosystems

Key messages

- Overall, the conversion of natural or semi-natural land to urban uses reduces biodiversity.
- In a highly urbanised continent such as Europe, tackling the relationship between biodiversity and the development of towns and cities is crucial to help halt biodiversity loss.
- Urban development can also present opportunities for enhancing biodiversity. For example, taking a 'green infrastructure' approach can facilitate urban development that is consistent with existing landscape features and benefits both people and biodiversity. That includes maintaining important ecosystem services and increasing resilience to climate change.

Urban sprawl is commonly used to describe physically expanding urban areas. The European Environment Agency (EEA) has described sprawl as the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas. It is the result of a mix of forces, including transport links, land prices, individual housing preferences, demographic trends, cultural traditions and constraints, the attractiveness of existing urban areas and, importantly, the application of land use planning policies at both local and regional scales (EEA, 2006b). Urban sprawl is usually associated with the push of urban areas into agricultural land (EEA, 2006c) (Figure 3.19).

Figure 3.19 Origin of urban land uptake as a percentage of total uptake, derived from land cover accounts: 24 countries in Europe, 1990–2000 (left); and 36 countries in 2000–2006 (right)



Source: CLC, 2006; SEBI 2010 Indicator 04.

Urban development and urban sprawl are significant factors affecting biodiversity in Europe, with biodiversity generally decreasing along an urban gradient (from rural areas to city centres) (Blair and Launer, 1997). As cities grow, the range of plant and animal species supported is restricted and the species present may be those most adaptable to the urban environment, rather than more typical native species. Both of these factors contribute to the homogenisation of biodiversity in urban areas (McKinney, 2006).

Loss of landscape features, character and biodiversity

Within urban areas, denser development often occurs at the expense of green space, particularly gardens which can (in aggregation) be the largest green space type (Pauleit and Golding, 2005). While the effects of increasing urban density may be limited in isolation, over time the cumulative effect is likely to reduce urban biodiversity significantly.

Box 3.7 Urban ecosystems (cont.)

Habitat fragmentation
Many of Europe's habitats are already highly fragmented and at risk further fragmentation due to urban development and land-use changes (Benedict and McMahon, 2006). The links between fragments are an important determinant of biodiversity (Sylwester, 2009). In an urban context, it is necessary to understand habitat fragmentation and connectivity to manage the effects of urban development on biodiversity. The EEA estimates that nearly 30 % of EU land is highly fragmented (EEA, 2010d).

Green infrastructure
The term 'green infrastructure' has its origin in two concepts: linking parks and other green spaces for the benefit of people; and, conserving and linking natural areas to benefit biodiversity and counter habitat fragmentation (Sylwester, 2009). Green infrastructure has the potential to improve the biodiversity of urban areas by improving the connectivity with rural areas (and other habitat fragments) and enhancing the natural characteristics of existing landscape features, as well as providing other multiple benefits such as increasing resilience to climate change, improving the human health and wellbeing, and providing flood regulation. This 'multifunctionality' provides for the integration and interaction of different functions or activities on the same piece of land.

In Europe, green infrastructure planning is increasingly recognised as a valuable approach for spatial planning, providing an improved green structure for the landscape. It also serves as a mechanism for more informed decision-making and more 'joined-up' thinking in relation to urban and regional environmental planning (Sylwester, 2009). Using a green infrastructure approach can therefore facilitate land development and conservation in a way that is consistent with existing natural features, delivering multiple benefits to people and biodiversity.

4 Conclusions, way forward and knowledge gaps

European biodiversity has declined dramatically in the last two centuries, with the conversion of natural habitats to meet growing demands for food, energy and infrastructure. Although the pace of change has varied across the region and has generally slowed considerably in the last couple of decades, agricultural land use now accounts for almost half of the European terrestrial area.

In coastal and marine areas, industrial fishery operations have had similarly large impacts, affecting both fish populations and habitats throughout European coastal and marine waters. Nearly half of assessed fish stocks in Europe fall outside safe biological limits. The majority of biodiversity in Europe now exists within a mosaic of heavily managed land and seascapes, and is to a large degree linked to agricultural, forestry and fishery practices across the continent.

In recent decades, growing awareness of biodiversity decline has led to improved commitments, policies and practices for the conservation and sustainable use of biodiversity throughout much of Europe. Biodiversity is now higher on the political agenda in Europe than ever before. Significant targeted responses have been made by public, civil society and private institutions to restore habitats, protect threatened species and reduce the main threats to biodiversity in Europe.

As a result of the policies adopted and implemented at international and European scales, including the Birds, Habitats, and Water Framework Directives, there are indications that some aspects of biodiversity are improving in status in parts of Europe. There have been significant increases in forest cover in the last two decades across northern Europe and the status of many waterways has improved across Europe as a result of reduced industrial and agricultural pollution in many countries. Recovery plans have been documented and are being implemented for many of Europe's threatened species, with some successes.

While ambitious targets are being set in Europe to halt biodiversity loss and some progress is being made, many threats remain and new ones are growing. This erodes the ability of ecosystems to provide services to people in Europe and beyond. Threats to Europe's biodiversity include habitat loss and degradation, unsustainable harvesting, establishment and spread of invasive alien species, pollution from agricultural runoff in many countries, unsustainable forest and agriculture management, increasing water abstraction and use, and increasing climatic change impacts, especially in southern and northern Europe, and in mountainous areas across the region. The loss of wetland and dryland habitats also continues.

Future progress in addressing these threats and conserving Europe's remaining biodiversity will depend on success in four key areas:

1. **Enhanced implementation** of measures targeted at biodiversity conservation. There has been progress in protecting and restoring threatened species and habitats across much of Europe, and protected areas and sustainable farmland and forestry management practices have grown steadily. However, there remains considerable opportunity to scale up such practices across the region, including coastal and marine areas. Such direct efforts for biodiversity conservation are a cornerstone of conservation. They are essential to manage the most important threats and conserve the most threatened biodiversity. However, alone they are insufficient to address biodiversity loss in the medium and long term because many of the direct drivers, and all of the indirect drivers of biodiversity loss, emanate from other sectors.

2. **Policy coherence** on biodiversity is required with other sectors. In order to conserve and sustainably use biodiversity, policies in other sectors that have an impact on or depend on biodiversity need to be supportive. These include those on trade, agriculture, fisheries, planning, transport, health, tourism, and the financial sector, including insurance. In many EU countries, considerable funding for managing biodiversity in landscapes is

obtained from the Common Agricultural Policy. Mainstreaming biodiversity into these areas — in both the public and private sectors — is essential for an integrated approach to biodiversity conservation. Successful mainstreaming will require all sectors to recognise the value of biodiversity. Recent efforts to ascribe accurate economic values to biodiversity and ecosystem services, for example 'The Economics of Ecosystems and Biodiversity' (TEEB, 2010), provide a basis for mainstreaming.

3. **A more integrated approach across sectors and administrative boundaries**, at landscape and seascape scales. This entails applying the ecosystem approach more widely, and requires cooperation across sectors for successful implementation. The present report shows that management of some habitat types, such as forestry and freshwater systems, is already starting to apply such approaches. Others, such as marine habitats, mountains and agricultural land, have not yet been adjusted sufficiently. Integrating protected areas, ecological networks, connectivity areas, production and urban landscapes into multifunctional land-use planning at a regional scale will be an essential element of a successful European conservation strategy. Likewise at watershed and landscape scales, the integration of biodiversity and natural resources management, including that of water, will require dialogue and agreement between the multiple stakeholders using, depending on, and managing such resources.

4. **Public awareness** of the relevance of biodiversity to the lives of European citizens, and the consequences of biodiversity loss at local, European and global scales, needs to be raised. Significant efforts are therefore required on communication, education and public awareness, to complement the policy framework and to encourage both individual action for biodiversity conservation, and a supportive public opinion for changes in policy and practice.

This report shows that, particularly regarding forest habitats, public awareness of the value of sustainable practices and recycling is increasing. This can be enhanced by publicising how more sustainable practices can benefit both society and the ecosystems themselves.

Despite being the region with the longest and broadest biodiversity knowledge base, key knowledge gaps remain across Europe. Filling such gaps would support action and policies across the four key areas.

Knowledge gaps exist in individual elements of biodiversity. Little is known, for example, about many aquatic systems (and especially floodplains and deltas), genetic diversity beyond the agricultural sector, and for many taxa at the species level. Considerable further work is required to assess the status of plants, invertebrates and fungi, and to assess trends in species status. A global base of species level assessments (or 'Barometer of Life') would cost some EUR 45 million, according to recent estimates (Stuart et al., 2010).

In addition to knowledge of specific elements of biodiversity, interdisciplinary knowledge gaps are particularly apparent, with little in the way of accumulated knowledge on the interlinkages between biodiversity, ecosystem services and human well-being. Recent efforts to link biodiversity science with economics have been particularly promising but further interdisciplinary research and assessment would support strengthened decision-making and policymaking processes on European biodiversity in the 21st century.

Key gaps in knowledge that emerge from this report are as follows.

- Data availability: Data beyond EU-27 Member States are often limited, especially European-level information on biodiversity (species, communities and genetic stock). Generally, data for marine species and habitats are much scarcer than for terrestrial ecosystems, and across Europe some important ecosystem types (e.g. marine and coastal) are among the least studied. Data are often lacking at relevant scales, e.g. for key environmental drivers or habitat change. This information would help set solid and relevant targets and continually improve sustainable management schemes.

- Adaptation strategies: Information on adaptation measures and strategies is often insufficient for many European ecosystems to counteract adverse climate change impacts and maintain ecosystem goods and services (e.g. FAO, 2009). While climate change considerations have largely driven the debate on adaptive capacity and vulnerability, there is now increased recognition of the multidimensional nature of drivers of change, responses and feedback mechanisms (e.g. CDE, 2009).

- Ecosystem services: Enhanced information on environmental, economic and social benefits of the ecosystem services supplied by biodiversity is lacking to inform sustainable management of ecosystems and raise public awareness of biodiversity's value and the link to livelihoods. The value of non-marketed goods and services are an important element in this.

- Optimal land-use strategies: It is important to finding the optimal mix of protected and productive areas, whether used for intensive agriculture or biomass for energy. More detailed data and analysis are needed to assess the extent and consequences of losing natural habitats through land conversion for increased biomass e.g. biofuel feedstock production (FAO, 2008). Ecosystem approaches are also particularly well suited for addressing competing land-use issues in a systematic and holistic framework, even in the absence of economic valuations, and they have considerable potential as an integrated management tool (Hicks et al., 2008).

- Sustainable management indicators: More knowledge on sustainable management indicators is required along the lines of the pan-European indicators of sustainable forest management.

- Green infrastructure: More information is required on the potential benefits of a green infrastructure approach to facilitate land development and land conservation together in a way that is consistent with existing natural features to deliver multiple benefits to people and biodiversity.

Recognising the urgent need to address these issues and reverse the trends of biodiversity loss and ecosystem degradation, the Environment Council adopted the 2020 Headline Target on 15 March and the European Council endorsed the Long-term Biodiversity Vision on 26 March 2010. These ambitious initiatives will underpin the new EU biodiversity strategy to be finalised by the end of 2010. In its conclusions, the European Council specified that the strategy to address biodiversity loss and ecosystem degradation should set a clear baseline outlining the criteria against which achievements are to be assessed.

EEA developed the EU 2010 Biodiversity Baseline (EEA, 2010) to respond to this need. It offers a comprehensive snapshot of the current state of biodiversity. It thereby supports the EU in developing the post 2010 sub targets as part of the biodiversity strategy and provides factual data for measuring and monitoring progress in the EU from 2011 to 2020. This new information tool demonstrates that a large proportion of European species and habitats are either facing extinction, have an unfavourable conservation status or their status is unknown. It highlights the urgent need for conservation actions and intensified efforts.

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Annex 1 SEBI 2010 set of indicators

CBD focal area	Headline indicator	SEBI 2010 specific indicator
Status and trends of the components of biological diversity	Trends in the abundance and distribution of selected species	1. Abundance and distribution of selected species a. birds b. butterflies
	Change in status of threatened and/or protected species	2. Red List Index for European species
		3. Species of European interest
	Trends in extent of selected biomes, ecosystems and habitats	4. Ecosystem coverage
		5. Habitats of European interest
	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance	6. Livestock genetic diversity
	Coverage of protected areas	7. Nationally designated protected areas
		8. Sites designated under the EU Habitats and Birds Directives
Threats to biodiversity	Nitrogen deposition	9. Critical load exceedance for nitrogen
	Trends in invasive alien species (numbers and costs of invasive alien species)	10. Invasive alien species in Europe
	Impact of climate change on biodiversity	11. Impact of climatic change on bird populations
Ecosystem integrity and ecosystem goods and services	Marine Trophic Index	12. Marine Trophic Index of European seas
	Connectivity/fragmentation of ecosystems	13. Fragmentation of natural and semi-natural areas
		14. Fragmentation of river systems
	Water quality in aquatic ecosystems	15. Nutrients in transitional, coastal and marine waters
		16. Freshwater quality
Sustainable use	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management	17. Forest: growing stock, increment and fellings
		18. Forest: deadwood
		19. Agriculture: nitrogen balance
		20. Agriculture: area under management practices potentially supporting biodiversity
		21. Fisheries: European commercial fish stocks
		22. Aquaculture: effluent water quality from finfish farms
	Ecological Footprint of European countries	23. Ecological Footprint of European countries
Status of access and benefits sharing	Percentage of European patent applications for inventions based on genetic resources	24. Patent applications based on genetic resources
Status of resource transfers	Funding to biodiversity	25. Financing biodiversity management
Public opinion (additional EU focal Area)	Public awareness and participation	26. Public awareness

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