Introduction

Part 2, 'Environment and climate trends', provides an overview of the state of and outlook for the European environment. It assesses progress towards achieving established European environment and climate policy goals and focuses primarily on the 2020-2030 time frame. Ten environmental themes are assessed (Chapters 3-12), complemented by a concise assessment of environmental pressures and sectors (Chapter 13). Chapter 14 builds on these assessments to provide an integrated picture of the European environment's state, trends and outlook in relation to the priority objectives of the Seventh Environment Action Programme (7th EAP).

Summary assessments are used throughout Part 2 to present the content in a systematic, concise and accessible way. These are based on a combination of available evidence and expert judgement, including inputs from stakeholders during their development. More specifically:

- The assessment of trends is based on available indicators and other information as observed over the past 10-15 years.

- The assessment of outlooks is based on modelled estimates of future developments, where available, expected developments in drivers of change, and expert consideration of the effects of policies currently in place.

- The assessment of the prospects of meeting selected policy targets and objectives is based on distance to target assessments where available, and expert judgement.

- The assessment of the robustness of the evidence base also identifies key gaps and indicates the degree of expert judgement used.

The summary assessment tables use a range of colour coding and symbols (see below) and contain short explanatory texts justifying the allocation of the colour codes and symbols.

Each chapter in Part 2 contains a range of summary assessment tables by theme, for example the impacts of air pollution on human health. These are then compiled into a headline table presented at the beginning of each chapter, along with the key messages. Chapter 14 contains an overall summary assessment table incorporating these and structured in accordance with the priority objectives of the 7th EAP.

Indicative assessment of past trends (10-15 years) and outlook to 2030		Indicative assessment of prospects of meeting selected policy objectives/targets		
	Improving trends/developments dominate	Year	☑	Largely on track
	Trends/developments show a mixed picture	Year	☐	Partially on track
	Deteriorating trends/developments dominate	Year	☒	Largely not on track

Note: The year for the objectives/targets does not indicate the exact target year but the time frame of the objectives/targets.

03. Biodiversity and nature

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Key messages

- Biodiversity and nature sustain life on Earth, delivering numerous essential ecosystem services. They are a vital element of our cultural heritage and treasured for their recreational, spiritual and aesthetic values. As a result, biodiversity loss has fundamental consequences for our society, economy and for human health and well-being.

- Despite ambitious targets, Europe continues to lose biodiversity at an alarming rate and many agreed policy targets will not be achieved. Assessments of species and habitats protected under the Habitats Directive show predominantly unfavourable conservation status at 60 % for species and 77 % for habitats. Biodiversity loss is not confined to rare or threatened species. Long-term monitoring shows a continuing downward trend in populations of common birds and butterflies, with the most pronounced declines in farmland birds (32 %) and grassland butterflies (39 %).

- There has been progress in some areas, such as the designation of protected areas: the EU Natura 2000 network now covers 18 % of the EU's land area and almost 9 % of marine waters, making it the world's largest network of protected areas.

- Europe's biodiversity and ecosystems face cumulative pressures from land use change, natural resource extraction, pollution, climate change and invasive alien species. These have a severe impact on ecosystem services — nature's benefits to people — as illustrated by the recent alarming loss of insects, especially pollinators.

- The broad framework of EU biodiversity policy remains highly relevant and is fit for purpose but the challenge is urgent and interlinked with the climate crisis. Targets will not be met without more effective implementation and funding of existing measures in all European environmental policies, as well as greater policy coherence with respect to biodiversity in agricultural and other sectoral policies. The wider application of ecosystem-based and adaptive management in combination with increased public awareness of society's dependency on biodiversity and nature are important steps forward.

Thematic summary assessment

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Terrestrial protected areas	Improving trends dominate	Developments show a mixed picture	☑ Largely on track
EU protected species and habitats	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Common species (birds and butterflies)	Deteriorating trends dominate	Deteriorating developments dominate	☒ Not on track
Ecosystem condition and services	Deteriorating trends dominate	Developments show a mixed picture	☒ Not on track

Note: For the methodology of the summary assessment table, see the introduction to Part 2. The justification for the colour coding is explained in Section 3.3, Key trends and outlooks (Tables 3.2, 3.3, 3.4 and 3.5).

03.
Biodiversity and nature

3.1
Scope of the theme

Biodiversity, or biological diversity, is the variety of life on Earth, within species, between species and of ecosystems (CBD, 1992). Biodiversity conservation is linked to its intrinsic value as well as the recognition that biodiversity and nature are a part of the natural capital (EC, 2011; EU, 2013) delivering numerous ecosystem services — or nature's contributions to people (IPBES, 2018). They are many and varied and include provision of food, pollination, carbon sequestration, mitigation of natural disasters, recreation and spiritual values, among many others (EU, 2013; EC, 2015; IPBES, 2018).

Europe's biodiversity has been shaped by human activity more than on any other continent and is continually under pressure as a result of our use of natural capital driven by human production and consumption (Chapter 1). The main drivers of biodiversity loss identified by the regional assessment report for Europe and Central Asia published by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2018) are land use change, including habitat loss, fragmentation and degradation, as well as climate change, extraction of natural resources, pollution and invasive alien species.

The impact of Europe's alarming rate of biodiversity loss is as catastrophic as climate change.

The evidence of the negative impacts of biodiversity loss and the threats that unsustainable exploitation of our natural world poses for the food and water security of billions of people has been growing at European and global level over several decades and is exemplified by the recent IPBES report (IPBES, 2019) (Chapter 1). The conclusion is that destruction and loss of biodiversity and nature is as catastrophic as climate change.

3.2
Policy landscape

The targets and commitments within the EU biodiversity strategy to 2020 and the key role played by the nature directives in their delivery provide a means for meeting the requirements set by a range of international conventions and agreements, e.g. the Convention on Biological Diversity, or CBD (CBD, 1992), and the Bern Convention (Council of Europe, 1979). The strategy to 2020 reflects the commitments taken by the EU in 2010 at global level in the scope of the strategic plan for biodiversity 2011-2020, including 20 Aichi biodiversity targets.

The 2020 headline target is 'Halting the loss of biodiversity and the degradation of ecosystem services and restoring them in so far as feasible, while stepping up Europe's contribution to averting global biodiversity loss'. This headline target is broken down into six specific targets that address a number of critical policy areas including protecting (and restoring) biodiversity and ecosystem services and greater use of green infrastructure; sectors (agriculture, forestry, fisheries); invasive alien species; and EU impacts on global biodiversity. The Seventh Environment Action Programme (7th EAP) fully embraces the objectives of the EU biodiversity strategy to 2020 and its 2050 vision, and it states that, by 2020, the loss of biodiversity and the degradation of ecosystem services should be halted and that by 2050 biodiversity is protected, valued and restored in ways that enhance our society's resilience.

Other sectoral and territorial policies also have an important impact, e.g. Water Framework Directive, Floods Directive, Marine Strategy Framework Directive, common fisheries policy (CFP), common agricultural policy (CAP), National Emission Ceilings Directive, climate change-related policies, Europe's bioeconomy strategy and cohesion policy (Chapters 4-8 and 13). These encompass the marine and freshwater environments as well as terrestrial areas, and agricultural policy has proved to be particularly influential in shaping our European landscapes and the nature they contain.

Biodiversity and ecosystem services are key elements of the 2030 agenda for sustainable development and several of the Sustainable Development Goals (SDGs), whereby, in addition to 'protecting the planet' they underpin sustainable livelihoods and futures. Table 3.1 presents a selected set of relevant key policy objectives and targets that are addressed in this chapter.

Biodiversity loss has significant environmental, economic and social consequences.

3.3 Key trends and outlooks

3.3.1 Terrestrial protected areas

► *See Table 3.2*

Protected areas benefit species, ecosystems and the environment overall. They provide significant economic and societal benefits, including employment opportunities. In particular, they contribute to people's health and well-being and have significant cultural value.

Europe's protected areas are diverse in character, varying in size, aim and management approach. They are large in number but relatively small in size. Approximately 93 % of sites are less than 1 000 ha and 78 % are less than 100 ha (EEA, 2018b). This reflects the high pressure on land use, arising from agriculture, transport and urban development. Large-scale nature reserves occur mostly in countries with low population densities, such as Finland, Iceland, Norway and Sweden (EEA, 2018b).

The two most important European networks of protected areas are Natura 2000 in the EU Member States and the Emerald network outside the EU, established under the Bern Convention (Council of Europe, 1979). There are also other important international designations, such as UNESCO (United Nations Educational, Scientific and Cultural Organization) biosphere reserves, Ramsar and UNESCO World Heritage sites. The main goal of the Natura 2000 network is to safeguard Europe's most valuable and threatened species and habitats, listed under the Birds and Habitats Directives. Member States have to design and implement the necessary conservation measures to protect and manage identified sites: Special Areas of Conservation (SACs) under the Habitats Directive and Special Protection Areas (SPAs) under the Birds Directive.

Measuring progress in relation to designation and management of Natura 2000 sites is a central part of the EU 2020 biodiversity strategy headline target and 2050 vision as well as the global Aichi biodiversity target 11, which aims to conserve at least 17 % of terrestrial and inland water areas by 2020 and ensure that those areas are well connected and efficiently managed. Natura 2000 has stimulated a remarkable increase in the area protected in Europe, and presently the network covers 18% of the 28 Member States' (EU-28's) terrestrial area, with around 28 000 sites (EEA, 2018c). Together with marine Natura 2000 sites, the network encompasses nine terrestrial biogeographical regions and five marine regions (Figure 3.1) (EEA, 2018c).

There are various benefits stemming from Natura 2000. Common methodology and criteria adopted across the EU for the establishment of sites ensure better ecological coherence than if the network were organised within each Member State only. This helps, for example, migratory species and designation of sites across national borders. While the Natura 2000 network targets particular species and habitats, other species also benefit from the establishment of sites, in the so-called 'umbrella effect' (van der Sluis et al., 2016). It is estimated that there are between 1.2 and 2.2 billion

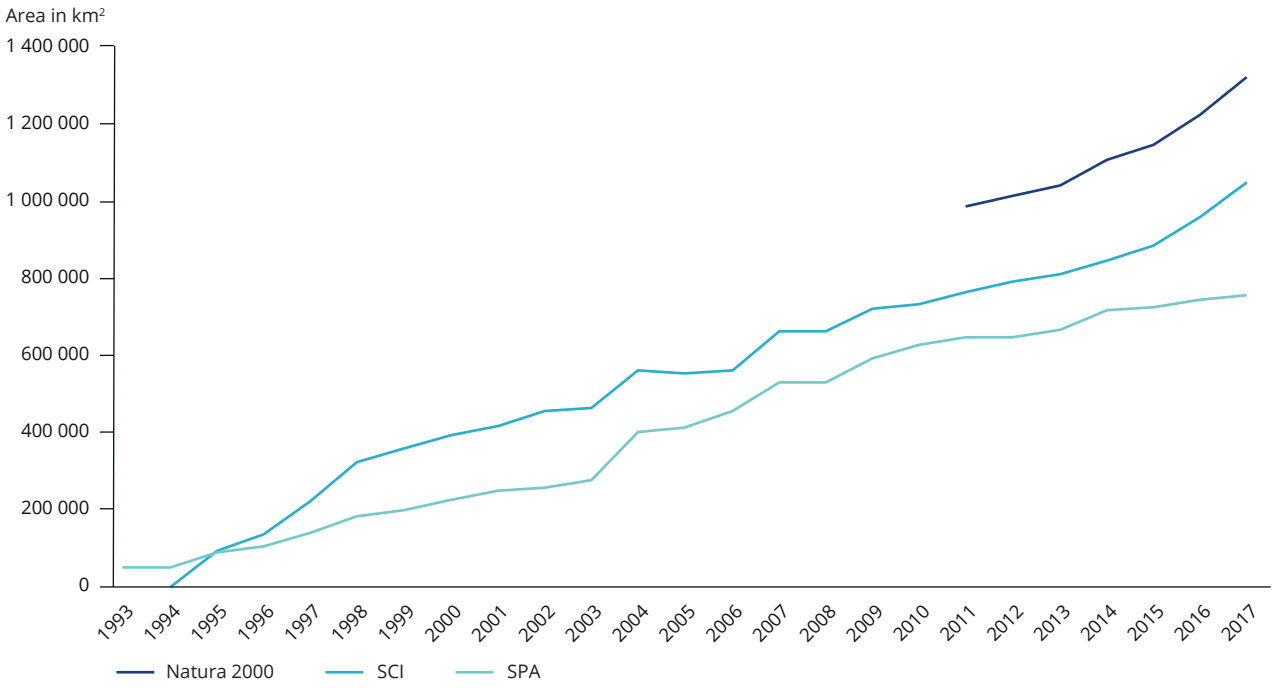
TABLE 3.1 Overview of selected policy objectives and targets

Policy objectives and targets	Sources	Target year	Agreement
Biodiversity and ecosystems			
Biodiversity and the ecosystem services it provides — its natural capital — are protected, valued and appropriately restored for their intrinsic value and essential contribution to human well-being and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided	2050 vision of the EU biodiversity strategy to 2020	2050	Non-binding commitment
Protect species and habitats under the nature directives	Birds Directive, Habitats Directive (EU, national); EU biodiversity strategy to 2020, Target 1; Action plan for nature, people and the economy	2020	Legally binding and non-binding commitments
Maintain and restore ecosystems and their services	EU biodiversity strategy to 2020, Target 2; 7th EAP; SDG 15	2020	Non-binding commitment
Achieve more sustainable agriculture and forestry	EU biodiversity strategy to 2020, Target 3; 7th EAP	2020	Non-binding commitment
Make fishing more sustainable and seas healthier	EU biodiversity strategy to 2020, Target 5; 7th EAP;	2020	Non-binding commitment
Combat invasive alien species	Regulation on invasive alien species; EU biodiversity strategy to 2020, Targets 4, 5 and 6; 7th EAP	2020	Legally binding
Help stop the loss of global biodiversity	EU biodiversity strategy to 2020, Target 6; 7th EAP	2020	Non-binding commitment
Improve knowledge of pollinator decline, its causes and consequences; tackle the causes of pollinator decline; raise awareness, engage society at large and promote collaboration	EU pollinators initiative	2020	Non-binding commitment
Integrate green infrastructure (GI) into key policy areas, improving the knowledge base and encouraging innovation in relation to GI, improving access to finance including supporting EU-level GI projects.	Green infrastructure — Enhancing Europe's natural capital (GI strategy)	2020	Non-binding commitment

visitor days to Natura 2000 sites each year, generating recreational benefits worth between EUR 5 and 9 billion per year (Brink et al., 2013). The overall economic benefits of the Natura 2000 network stemming from the provision of various ecosystem services have been estimated to be in the order of EUR 200 to 300 billion/year (Brink et al., 2013).

An important characteristic is that Natura 2000 sites are not necessarily pristine areas, stripped of human impact. Their aim is not to exclude economic activity and, in fact, around 40 % of the Natura 2000 total area is farmland, and forests make up almost 50 %. The main objectives within Natura 2000 sites are to avoid activities that could seriously disturb the species or damage the habitats for which the site is designated and to take positive measures, if necessary, to maintain and restore these habitats and species to improve conservation. While this approach encourages sustainable management, the network can still be subject to significant pressures, such as the intensification or abandonment of traditional, extensive farming practices or even land abandonment, in particular in areas with natural constraints. Natural, old-growth forests are also subject to management intensification and their unique biodiversity and structural features are irreversibly lost. Management of the sites is therefore a decisive factor in achieving the conservation aims; however, we currently lack comprehensive information on how efficiently these sites are managed. Integration of Natura 2000 objectives into spatial planning is crucial. In particular, maintaining or improving connectivity between sites is of utmost importance. The Joint Research Centre

FIGURE 3.1 Area of Natura 2000 sites designated under the EU Habitats and Birds Directives in 2017



Note: The Natura 2000 network is composed of SPAs and SCIs. SPAs are Special Protection Areas, designated under the Birds Directive. SCIs include sites and proposed Sites of Community Importance and Special Areas of Conservation, designated under the Habitats Directive. Many sites are designated under both directives (as both an SCI and an SPA). The calculation of the Natura 2000 area taking this overlap into account is available only from 2011 onwards.

Source: EEA (2018c).

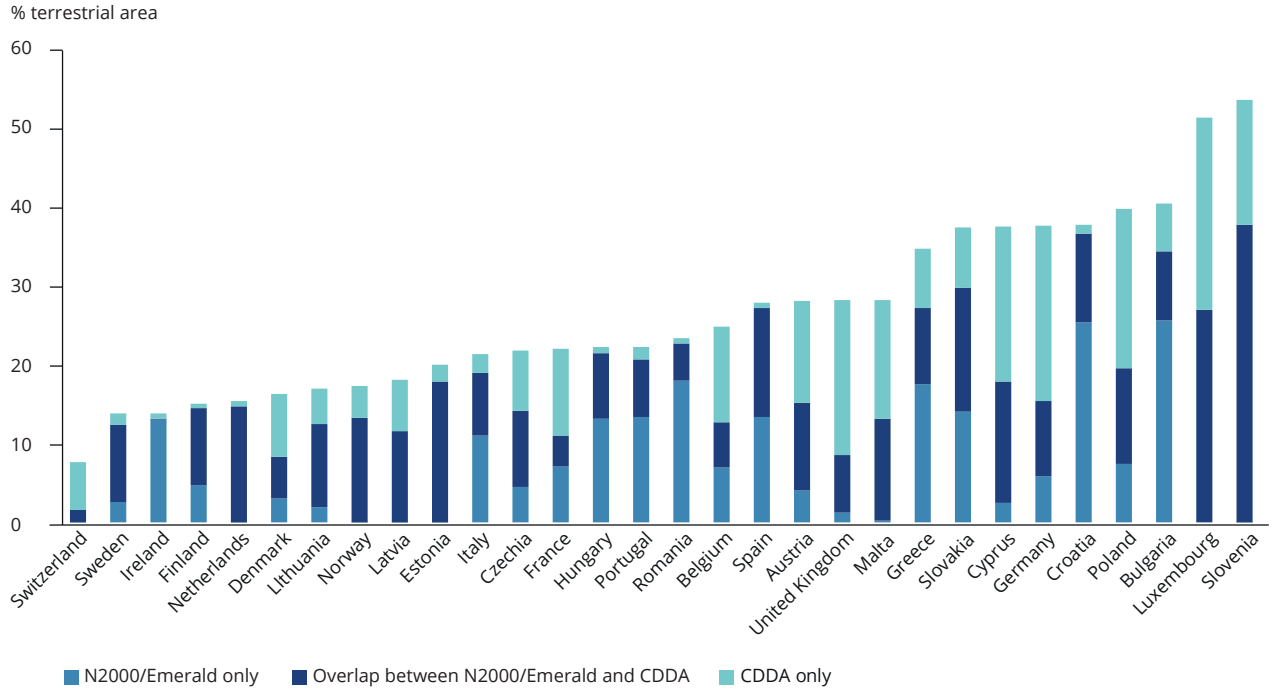
of the European Commission (JRC) has created an indicator of protected area connectivity (ProtConn) (JRC, 2019b) that quantifies how well networks of protected areas are designed to support connectivity and is based on assumed species distances between protected areas (Saura et al., 2018). In the EU, the indicator shows an average value of more than 18 % and therefore meets the connectivity element of Aichi biodiversity target 11. The ProtConn value varies, however, throughout Europe: it is lowest in the Netherlands (6.7 %), varies between 8 and 12 % in Finland, Ireland, Italy, Sweden and the Baltic States and is highest in Bulgaria, Croatia, Czechia, Germany, Poland and Slovenia (25 % or more) (Saura et al., 2018).

The Natura 2000 network covers 18 % of the EU's land area, with around 28 000 sites.

The Emerald network is an ecological network of areas of special conservation interest set up by the Contracting Parties to the Bern Convention. It is conceptually similar to Natura 2000, but it incorporates a wider group of countries. As the EU is a signatory to the Bern Convention, the Natura 2000 network is considered the EU Member States' contribution to the Emerald network. Outside the EU, the Emerald network is still in the early stages, and since December 2017 two European countries have officially adopted Emerald sites on their territories: Norway and Switzerland.

At the end of 2017, 14 Member States had designated more than 17 % of their land area as Natura 2000 sites: Bulgaria, Croatia, Cyprus, Estonia, Greece, Hungary, Italy, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia and Spain (EEA, 2018c). The degree of overlap between Natura 2000 and national designations illustrates the extent to which countries have made use of their nationally designated areas to underpin Natura 2000 and to what extent Natura 2000 sites extend beyond national systems (EEA, 2018b) (Figure 3.2).

FIGURE 3.2 **Country comparison — share of country designated as terrestrial protected area and the overlap between Natura 2000 or Emerald sites and national designations**



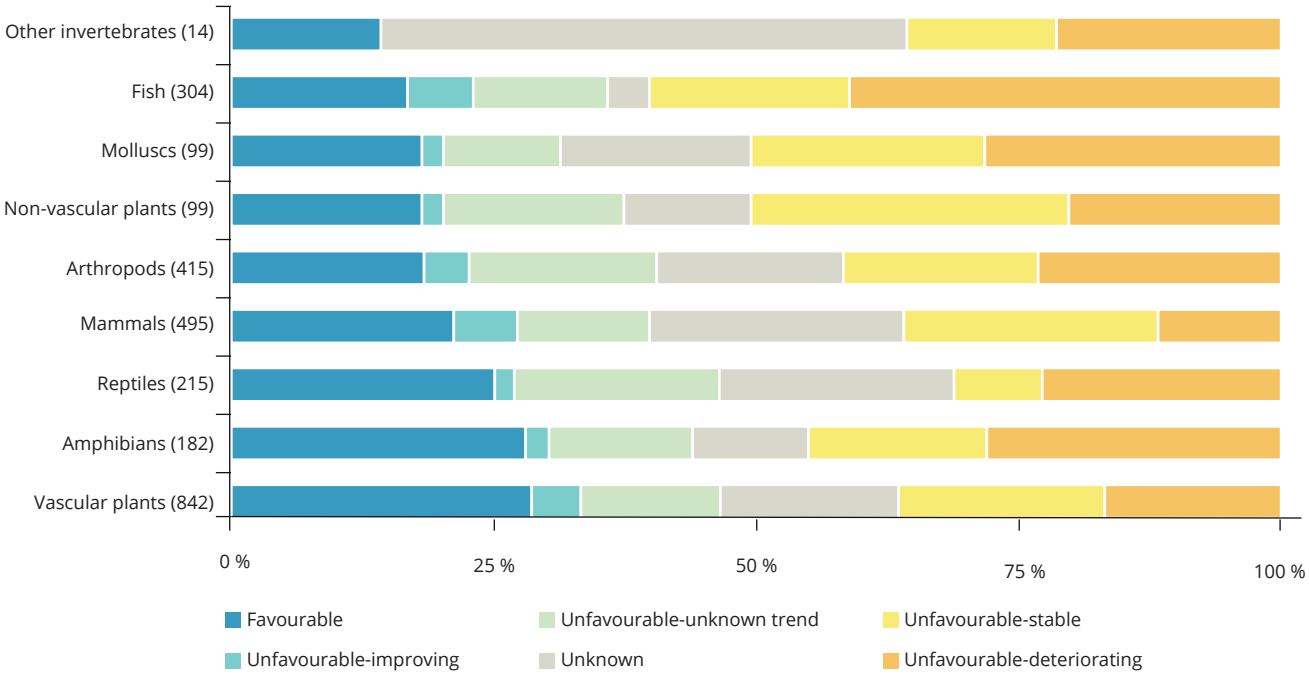
Note: A 'nationally designated protected area' (CDDA) is an area protected by national legislation. If a country has included sites designated under international agreements such as the EU Birds and Habitats Directives, or the Bern or Ramsar Conventions in its legislation, the corresponding protected sites, such as the Natura 2000 (N2000), Emerald or Ramsar sites, of this country are included in the CDDA.

Source: EEA (2018b).

TABLE 3.2 **Summary assessment — terrestrial protected areas**

Past trends and outlook		
Past trends (10-15 years)		There has been a steady increase in the cumulative area of the Natura 2000 network in EU Member States in the last 10 years, along with consistent growth in protected areas in all European countries.
Outlook to 2030		Designation of protected areas is not in itself a guarantee of effective biodiversity protection. Establishing or fully implementing conservation measures and management plans to achieve effectively managed, ecologically representative and well-connected systems of protected areas are crucially important and remain a challenge up to 2030.
Prospects of meeting policy objectives/targets		
2020	☑	The global Aichi biodiversity target 11 of 17 % of terrestrial areas conserved has been reached in Europe. In the EU, the Natura 2000 network already covers 18 % of the land area.
Robustness		Long-term data on the coverage of nationally designated protected areas in the EEA member countries and candidate countries (EEA-39) and consistent data on the Natura 2000 area are available. Information is lacking on the effectiveness of conservation measures in Europe's protected areas and how well biodiversity is protected there. The available outlook information is limited, so the assessment of outlook relies primarily on expert judgement.

FIGURE 3.3 Trends in conservation status of assessed non-bird species at EU level



Note: These are species from the Habitats Directive. The number of assessments is indicated in parenthesis. The total number of assessments is 2 665.

Source: EEA (2016e), based on conservation status of habitat types and species reporting (Article 17, Habitats Directive 92/43/EEC).

There are different patterns among countries and the differences in approaches reflect the diversity of historical, geographical, administrative, social, political and cultural circumstances (EEA, 2012).

In establishing Natura 2000, countries also have the flexibility to introduce new designation procedures, adapt existing ones or underpin the designation by other legislation. Some Natura 2000 sites nearly always overlap with national designations. This is particularly visible in Estonia, Latvia and the Netherlands and to a slightly lesser extent in Finland, Lithuania and Sweden. Countries that joined the EU most recently — Bulgaria, Croatia and Romania — have extended their protected areas very significantly by creating Natura 2000 sites, and in the past a similar process took place in Greece, Hungary, Ireland, Portugal and Slovakia. In other countries, there is moderate or little overlap, as in Denmark, France or Germany. Switzerland has a moderate overlap of Emerald sites with national designations, while in Norway the overlap is large.

Designation as a protected area is not a guarantee of effective biodiversity protection; hence the need for management plans and conservation measures.

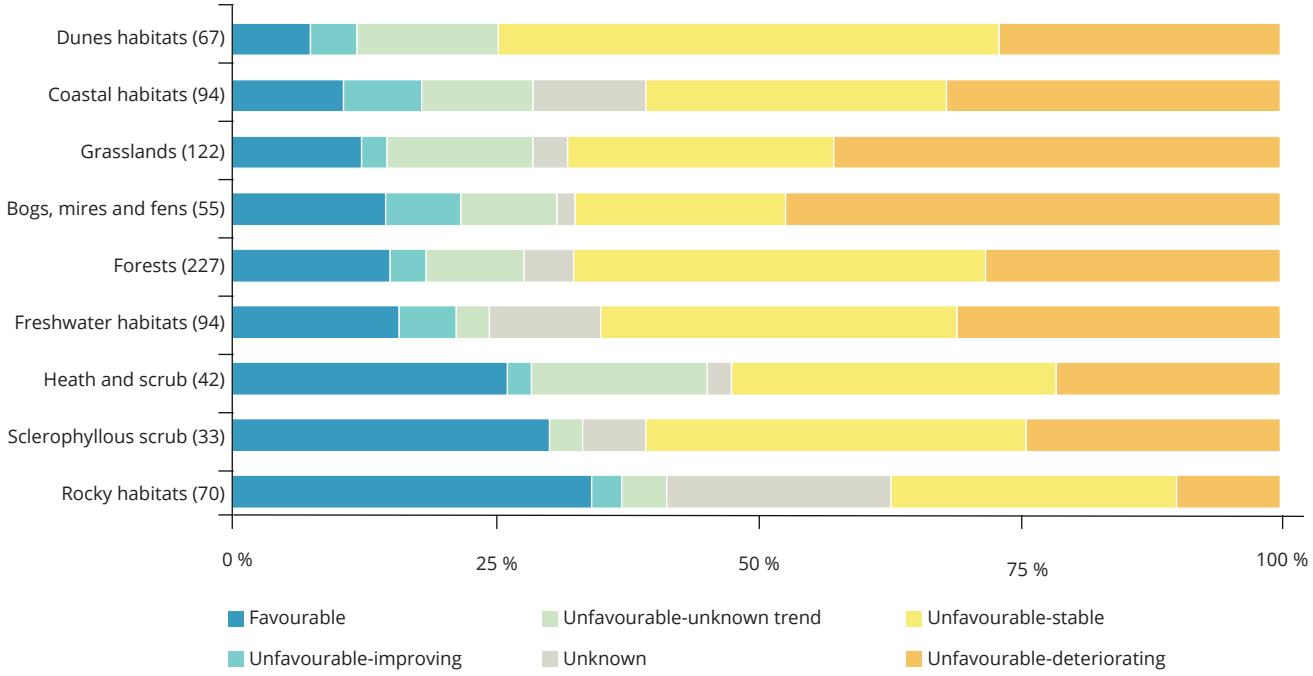
Independently of the scale and extent of the complementarity, it is clear, however, that the process of designing Natura 2000 sites, along with maintaining or extending nationally designated sites, benefits biodiversity and ecosystems and that Natura 2000 has very significantly increased the protected area coverage in Europe. The single designation of sites is not enough in itself to safeguard biodiversity and ecosystems, but it is a pre-condition to prevent species and habitats of European interest being lost forever.

3.3.2 EU protected species and habitats

▶ See Table 3.3

The EU Birds and Habitats Directives constitute the backbone of Europe's legislation on nature conservation. Member States are required to report on the status of species and habitats

FIGURE 3.4 Trends in conservation status of assessed habitats at EU level



Note: The number of assessments is indicated in parenthesis. The total number of assessments is 804.

Source: EEA (2016b), based on conservation status of habitat types and species reporting (Article 17, Habitats Directive 92/43/EEC).

covered by the Birds and Habitats Directives. Comprehensive data sets are therefore available in relation to, among others, conservation status, trends, pressures and threats, and conservation measures. Member States report on those directives every 6 years. The most recent results cover the period 2006-2012, and the outcomes of the next round of reporting, 2013-2018, will be available in 2020. Detailed information on how countries assess the conservation status of species and habitats under the Habitats Directive and population status under the Birds Directive is available on the EEA's website (EEA, 2015a). A parallel mechanism for reporting on the conservation status of species and habitats has been developed under the Bern Convention — Resolution 8. The first results from this reporting will also be available in 2020, which will contribute to a full pan-European perspective on their conservation status.

60 %

of species assessments show unfavourable conservation status.

Assessments of species and habitats protected under the Habitats Directive show predominantly unfavourable conservation status (EEA, 2015b). At the EU level, only 23 % of the assessments of species indicate favourable conservation status, while 60 % of species assessments are unfavourable. There are still significant gaps in knowledge, especially for marine species. Fish, molluscs and amphibians have a particularly high proportion of species that exhibit a deteriorating trend (EEA, 2016e) (Figure 3.3).

The conservation status of species varies considerably from one biogeographic region to another. At Member State level, more unfavourable assessments are declining than improving (EEA, 2016e).

Only 16 % of the assessments of habitats protected under the Habitats Directive have a favourable conservation status at the EU level (EEA, 2015b). Bogs, mires and fens have the highest proportion of unfavourable assessments, followed closely by grasslands (EEA, 2016b) (Figure 3.4). Conservation status trends

TABLE 3.3 Summary assessment — EU protected species and habitats

Past trends and outlook		
Past trends (10-15 years)		A high proportion of protected species and habitats are in unfavourable condition, although there have been some limited improvements in the last 10 years.
Outlook to 2030		The underlying drivers of biodiversity loss are not changing favourably so, without significant conservation efforts, current trends will not be reversed and pressures will continue to increase.
Prospects of meeting policy objectives/targets		
2020	☒	The EU is not on track to meet the 2020 target of improving the conservation status of EU protected species and habitats and the cumulative pressures remain high.
Robustness		Despite the increasing quality of information delivered by the nature directives reporting, data gaps remain, as a proportion of the assessments report unknown conservation status of species and habitats, unknown population status of birds and unknown trends for species or habitats assessed as unfavourable. The available outlook information is limited so the assessment of the outlook relies primarily on expert judgement.

are quite variable across biogeographic regions; however, more habitats are stable than decreasing in the terrestrial regions. There are still significant gaps in knowledge of marine habitat types. At the EU Member State level, the majority of assessments indicate low numbers of habitats with a favourable conservation status (EEA, 2016b).

Over half of the bird species in the Birds Directive are considered to be 'secure', i.e. they show no foreseeable risk of extinction and have not declined or been depleted (EEA, 2015b). However, 17 % of the bird species are still threatened and another 15 % are declining or depleted (EEA, 2016e).

The short-term trends of breeding birds in Member States indicate a high degree of change in their populations. There is no clear geographic pattern discernible in these trends. For wintering bird populations, assessments show an increasing trend for a relatively high proportion of wintering populations (EEA, 2016e).

The pressures and threats for all terrestrial species, habitats and ecosystems most frequently reported by Member States are associated with agriculture (EEA, 2015b). For freshwater ecosystems, changes in hydrology, including overabstraction of water (Chapter 4) are most frequently reported as being important, although 'loss of habitat features or prey availability' is frequently reported for species, as is 'pollution to surface waters' for habitats.

The pressures on and threats to all terrestrial species, habitats and ecosystems most frequently reported by Member States are associated with agriculture.

The results of the nature directives' reporting are used to assess progress in implementing the EU biodiversity strategy to 2020, specifically, its Target 1, 'To halt the deterioration in the status of all species and habitats covered by EU nature legislation, and achieve a significant and measurable improvement in their status'. So far, progress towards the 2020 target of improving the conservation status of habitats covered by the EU Habitats Directive has not been substantial since 2010. Similarly, there has been little progress towards the target for bird populations under the Birds Directive in spite of some positive examples (Box 3.1). This indicates that significant additional conservation efforts need to be implemented to reverse current trends.

3.3.3 Common species (birds and butterflies) and interlinkages between the decline of birds and insects

► *Table 3.4*

Birds and butterflies are sensitive to environmental change and their population numbers can reflect changes in ecosystems as well as in other animal and plant populations. Trends in bird and butterfly populations can, therefore, be excellent barometers of the health of the environment.

The status of birds and butterflies has been the subject of long-term

BOX 3.1 The recovery of birds of prey in Europe

Historically many wildlife species in Europe have suffered dramatic declines in their numbers and distribution as a consequence of human activity. However, while Europe keeps losing biodiversity overall, there are also some positive examples of wildlife making a comeback (Deinet et al., 2013). These include birds of prey, e.g. red kite, white-tailed eagle, peregrine falcon or lesser kestrel. These success stories show that species can be brought back, even from the brink of extinction. This requires, however, well-designed conservation strategies, which are mainly a combination of factors: targeted species protection, reducing pressures (e.g. poaching or chemical pollution), specific site protection measures at the local level, such as Special Protection Areas in the Natura 2000 network, and targeted funding via LIFE projects. For example, with support from the LIFE programme, the Spanish imperial eagle population in the Iberian peninsula increased from 50 breeding pairs in 1995 to 520 pairs in 2017 (Ministerio para la Transición Ecológica, 2018; BirdLife International, 2019).

The success stories also work alongside social change and embracing the interactions between wildlife and people. The recovery of birds of prey and other wildlife is of great importance for ecosystem functioning and its resilience (Deinet et al., 2013). It also has implications for society and the economy: reconnecting people with nature increases their well-being and boosts local and regional economies. ■

monitoring in Europe, much of it via voluntary effort. The current data sets have good geographical and temporal coverage and are methodologically well founded, illustrating trends that can be linked to both policy and practice in terms of land use and management (EBCC, 2019; Eurostat, 2019). Both species groups resonate strongly with the interested public and are good examples of how the power of citizen science can be released through effective targeting (EEA, 2019a).

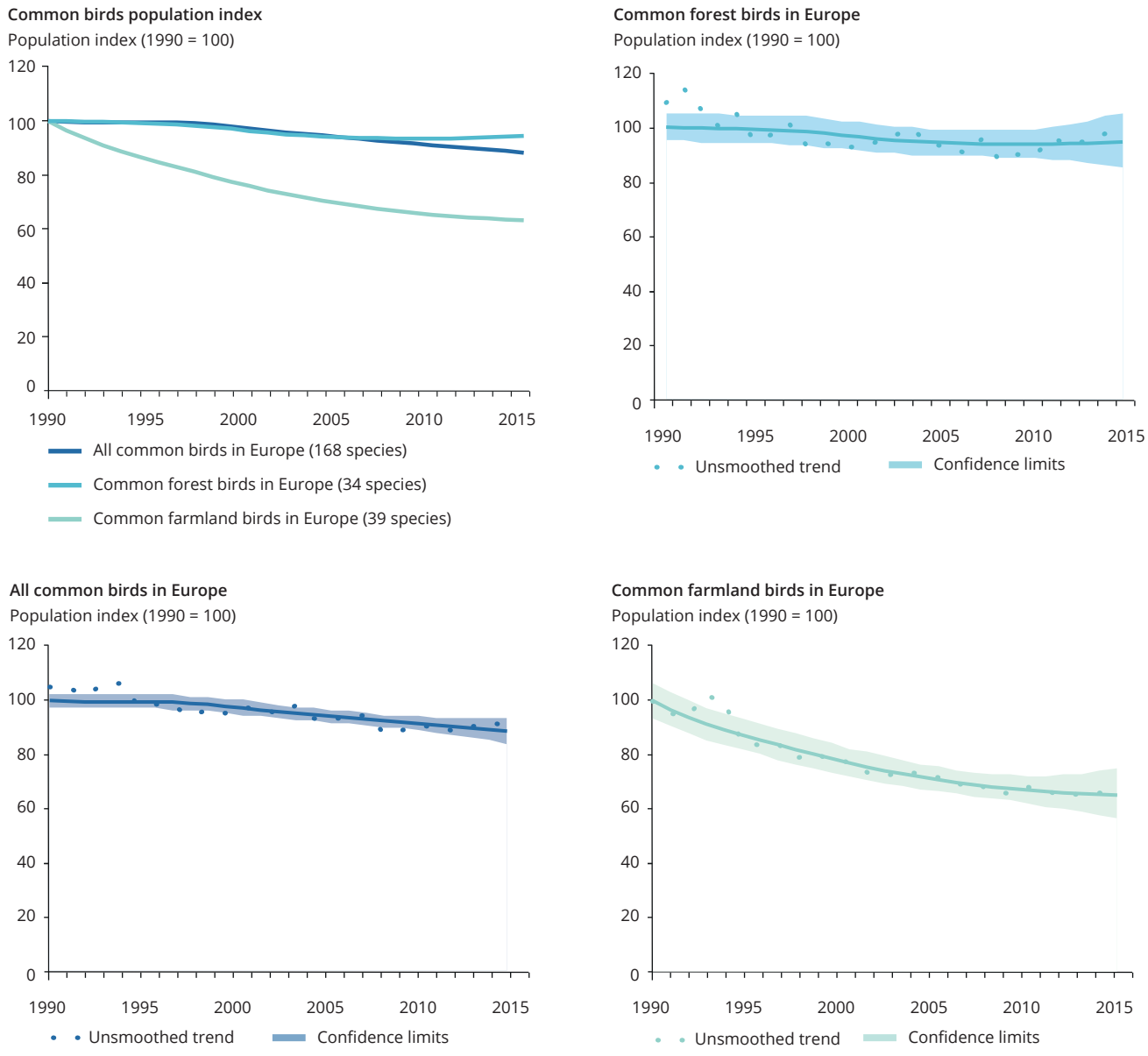
Long-term trends (over 25 years) from monitoring schemes of common birds (in particular farmland birds) and grassland butterflies show significant declines and no sign of recovery (EEA, 2019a). Figure 3.5 shows that, between 1990 and 2016, there was a decrease of 9 % in the index of common birds in the 26 EU Member States that have bird population monitoring schemes. This decrease is slightly greater (11 %) if figures for Norway and Switzerland are included. The decline in numbers of common farmland bird over the same period was much more pronounced, at 32 % (EU) and 35 % (EU plus Norway and Switzerland). The common forest bird index decreased by 3 % (EU) and 5 % (EU plus Norway and Switzerland) over the same period (EEA, 2019a). While this indicator takes 1990 as a starting point, it should be borne in mind that significant decreases had already occurred before that date.

The long-term trends in many bird and butterfly populations demonstrate that Europe has experienced a major decline in biodiversity.

In spite of year-to-year fluctuations, which are typical of butterfly populations, the index of grassland butterflies has declined significantly in the 15 EU Member States where butterfly population monitoring schemes exist (Figure 3.6). In 2017, the index was 39 % below its 1990 value in those countries. As with bird indices, the reductions observed since 1990 are on top of decreases occurring before that year (EEA, 2019a).

The long-term trends in farmland, forest and all common bird and grassland butterfly populations demonstrate that Europe has experienced a major decline in biodiversity. This has been primarily due to the loss, fragmentation and degradation of natural and semi-natural ecosystems, mainly caused by agricultural intensification (Donald et al., 2001; Van Dyck et al., 2009; Jeliazkov et al., 2016), intensive forest management (Virkkala, 2016; Fraixedas et al., 2015), land abandonment and urban sprawl (Chapters 5 and 13). For example, through habitat simplification (e.g. removal of hedgerows and treelines to make fields larger), loss and fragmentation, birds lose their nesting sites and food sources, which adds to population decline (Guerrero et al., 2012). Urban sprawl increases anthropogenic light levels as well as noise levels, which affects the behaviour of singing birds and impairs acoustic communication in birds (Chapter 11).

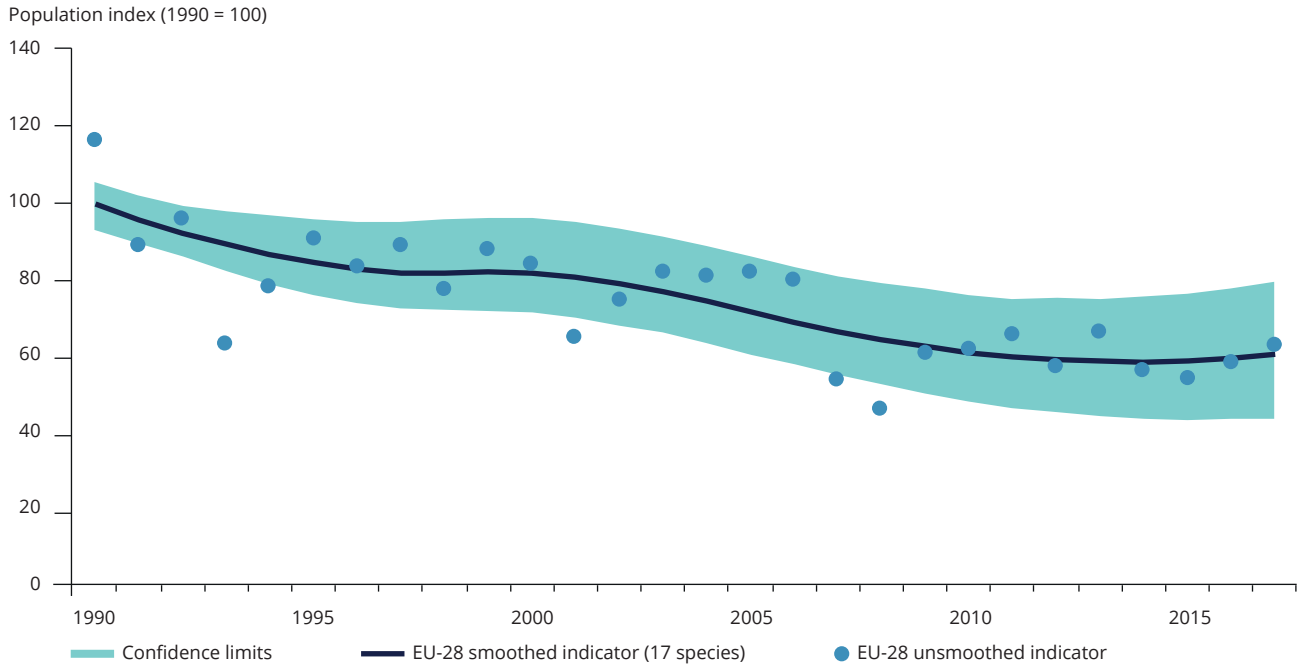
FIGURE 3.5 Common birds population index, 1990-2016



Note: The shaded areas represent the confidence limits. Geographical coverage: EU-28 Member States (except Croatia and Malta) and Norway and Switzerland.

Sources: EEA (2019a), European Bird Census Council, Royal Society for the Protection of Birds, BirdLife International and Czech Society for Ornithology.

FIGURE 3.6 Grassland butterflies population index, 1990-2017



Note: The shaded area represents the confidence limits. Geographical coverage: Belgium, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, the Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom.

Source: EEA (2019a), Butterfly Conservation Europe, European Butterfly Monitoring Scheme partnership, Assessing Butterflies in Europe (ABLE) project.

Agricultural intensification can entail high inputs of agrochemicals, including pesticides. Their environmental impacts on the environment are described in Chapter 10. Increased use of pesticides results in reduced insect populations and seed production by plants, thereby reducing food for birds (Vickery et al., 2009; Musitelli et al., 2016). Apart from being an important source of food for birds and other animals, insects play a key role in ecosystem processes and provide various ecosystem services (Schowalter et al., 2018). Their most widely recognised role is pollination (Section 3.4.4 and Box 3.2) but they are also instrumental in developing soil nutrient cycling and providing pests, diseases and invasive alien species regulation (Noriega et al., 2018).

Grassland butterfly populations declined by 39 % in 15 EU Member States since 1990.

Recently, reports of dramatic losses of insects have been widely discussed. Hallmann et al. (2017) reported a decline of more than 75 % over 27 years in total flying insect biomass in protected areas in Germany. Declines concern pollinators too, including butterflies, as discussed earlier, but also honey bees and wild bees (Potts et al., 2010; EC, 2018b). An exhaustive global review of 73 reports of insect species declines (Sánchez-Bayo and Wyckhuys, 2019) concluded that habitat loss by conversion to intensive agriculture, followed by urbanisation, pollution (mainly pesticides and fertilisers), invasive alien species and climate change (to the least extent in moderate climatic zones) are the main drivers of decline. Moreover, there is increasing evidence that the use of pesticides such as neonicotinoid insecticides has a much wider impact on biodiversity, not only affecting non-target invertebrate (insect)

TABLE 3.4 Summary assessment — common species (birds and butterflies)

Past trends and outlook		
Past trends (> 25 years)		Since 1990 there has been a continuing downward trend in populations of common birds. Although this has levelled off since 2000 for some species, no trend towards recovery has been observed. The most pronounced declines were observed in farmland birds and grassland butterflies.
Outlook to 2030		The underlying drivers of the decline in common species are not changing favourably. Full implementation of a range of policy measures, including sectoral policies, is required to deliver improvements.
Prospects of meeting policy objectives/targets		
2020	☒	Europe is not on track to meet the 2020 target of halting biodiversity loss.
Robustness		Data collection methods are scientifically sound and the methods used by skilled volunteers are harmonised. However, wide monitoring schemes currently exist for only two species groups. The available outlook information is limited, so the assessment of outlook relies primarily on expert judgement.

species but also causing declines in bird populations. Neonicotinoids are applied as seed dressings to arable crops (Goulson, 2014) but only a very small percentage of this dressing (approximately 5 %) is absorbed by the growing plant. The rest accumulates in soils and leaches into surface and ground waters. Hallmann et al. (2014) used the Dutch long-term monitoring bird data and measurements of surface water quality to check to what extent water contamination by the most popular neonicotinoid, imidacloprid, correlated with bird population trends. They found that higher concentrations of imidacloprid in surface waters were consistently associated with decreases in bird numbers. The authors concluded that the declines are predominantly linked to changes in the food chain, namely the depletion of insect food resources for birds. It cannot be excluded, however, that declines in bird populations are also linked to trophic accumulation through consuming contaminated invertebrates or ingesting coated seeds (Hallmann et al., 2014).

It is difficult to forecast how soon biodiversity, as illustrated by the abundance of bird and grassland butterfly populations, will recover, as their state is influenced by a complex combination of environmental factors and policy measures. Potential positive impacts of CAP reform and the measures anticipated under the multiannual financial framework 2014-2020 on common species associated with farmland may become apparent in the period 2020-2030, as long as these policies are implemented thoroughly and on a large scale throughout the EU (EEA, 2019a). On the other hand, other factors that could adversely impact the outlook beyond 2020 include the negative impact of climate change on biodiversity and ecosystems, particularly on those specialist species groups that are dependent on non-intensive agriculture and forest ecosystems (EEA, 2019a). The increased competition for land could also intensify agricultural production in the EU, through land take via urbanisation as well as for producing renewable energy and biofuels.

3.3.4 Ecosystem condition and services

► See Table 3.5

The ability of ecosystems to deliver ecosystem services is inherently linked to their condition and provides an important pivot between their constituent species and habitats, and their abiotic components. Species and ecosystems are generally characterised by a capacity to cope with exploitation and disturbance. Beyond certain limits, or a 'safe operating space', however, species can decline in numbers or diversity and disappear or become extinct, and ecosystems can lose their capacity to deliver services (Birkhofer et al., 2018; Landis, 2017). Most biodiversity loss is ultimately anthropogenic and is driven by human production and consumption.

The IPBES regional assessment for Europe and Central Asia concluded (for IPBES sub-regions western Europe and central Europe) that there are decreasing trends (2001-2017) in biodiversity

BOX 3.2 EU Pollinators initiative

Pollinators are an integral part of healthy ecosystems. In Europe, pollinators are mainly insects such as bees (domesticated and wild bees), hoverflies, butterflies, moths and beetles. Without them, many plant species would decline and eventually disappear along with the organisms that depend on them. They are also important from an economic perspective: in the EU, around 84 % of crops and 78 % of temperate wild flowers depend, at least in part, on animal pollination and an estimated EUR 15 billion of the EU's annual agricultural output is directly attributed to insect pollinators (EC, 2018b).

In recent decades pollinators have declined dramatically and many species are on the verge of extinction (EC, 2018c). Existing evidence suggests that the main drivers of pollinator decline are land use change, intensive agricultural management and pesticide use, environmental pollution, invasive alien species, diseases and climate change (IPBES, 2016). Mitigating the decline will require actions across sectors, particularly in land management.

Acknowledging the urgent need to address pollinator decline, on 1 June 2018, the European Commission adopted a Communication on the first-ever EU initiative on pollinators. The initiative sets strategic objectives and a set of actions to be taken by the EU and its Member States to address the decline in pollinators in the EU and contribute to global conservation efforts. It sets the framework for an integrated approach to the problem and a more effective use of existing tools and policies now and in the following years under three priorities: (1) improving knowledge of pollinator decline, its causes and consequences; (2) tackling the causes of pollinator decline; and (3) raising awareness, engaging society at large and promoting collaboration (EC, 2018a, 2018b). ■

status for almost all terrestrial ecosystem types and that the majority of non-provisioning ecosystem services such as regulation of freshwater quality or pollination (Box 3.2) show declining trends (1960-2017) (IPBES, 2018).

Although reporting on ecosystem condition and services is a relatively new area and the coverage and availability of data and information is not comprehensive, it offers the potential for applying new technologies and innovation as well as providing an important benchmark with high policy relevance.

The EU biodiversity strategy to 2020, the global strategic plan for biodiversity 2011-2020 and many of the Sustainable Development Goals put ecosystems at the core of agreed objectives and targets. Target 2 of the EU biodiversity strategy explicitly aims to maintain and restore ecosystems and their services by including green infrastructure in spatial planning and restoring at least 15 % of degraded ecosystems

Biodiversity targets will not be met without wider and more effective implementation of existing policies and stronger societal responses to biodiversity loss.

by 2020. Action 5 in Target 2 of the EU biodiversity strategy to 2020 calls on Member States to map and assess ecosystems and their services in their national territory. This mapping and assessment of ecosystems and their services (MAES) process developed a common analytical framework to carry out the relevant assessment (Maes et al., 2013, 2018). Work at national level is complemented by an EU-wide assessment performed by the EEA and the JRC, which aims to provide the knowledge base for the other actions and targets of the strategy, e.g. green infrastructure, sustainable agriculture and forestry.

The final outcomes of the EU-wide assessment will be available by the end of 2019. The work done so far has looked at trends in five main categories of pressures (Section 3.1) in eight broad MAES ecosystem types in Europe (urban, cropland, grassland, heathland and shrub, woodland and forest, wetlands, freshwater and marine). Habitat change, including loss and fragmentation, as well as pollution, have had the greatest overall impact and they seem to be on the increase in more than 60 % of ecosystems assessed (EEA, 2016c). The effects of climate change on ecosystems are wide ranging and are considered one of the key risk factors for biodiversity decline and are projected to increase significantly across all ecosystems. A warming climate is leading to changes in species distribution and causing shifts in their ranges (EEA, 2017) as well as phenological changes, which may lead to decreased food availability and increased

TABLE 3.5 Summary assessment — ecosystem condition and services

Past trends and outlook		
Past trends (10-15 years)		Deteriorating trends have dominated with continued loss of valuable ecosystems and habitats as a result of land use change, particularly grasslands and wetlands, which has a severe impact on biodiversity and ecosystem services. Agricultural practices continue to have negative impacts on biodiversity and ecosystem services such as pollination.
Outlook to 2030		The underlying drivers of biodiversity loss are not changing favourably and increasing pressures from land use change, pollution, extraction of natural resources, climate change and invasive alien species are expected to further impact habitat quality and ecosystem condition. Ongoing initiatives triggered by policies, e.g. green infrastructure investments, the Pollinators initiative and restoration projects, are expected to deliver improvements.
Prospects of meeting policy objectives/targets		
2020	☒	Europe is not on track to meet the 2020 target of maintaining and enhancing ecosystems and their services by establishing green infrastructure and restoring at least 15 % of degraded ecosystems. While Natura 2000 areas have a positive effect on ecosystem condition and biodiversity in surrounding areas, pressures remain high and the conservation measures undertaken are still insufficient.
Robustness		Monitoring systems, models for assessing ecosystem services and data collection methods are scientifically sound but still improving in terms of completeness and appropriate spatial and temporal resolution. Significant improvements in data availability are expected, but the interconnection between ecosystem condition and service capacity still requires more research. Important data and information sources are natural capital accounting, the Copernicus programme and research initiatives. The available outlook information is limited, so the assessment of outlook relies primarily on expert judgement.

competition, and changes in species interlinkages and relationships. Climate change increases the importance of migration corridors between ecosystems and between protected areas. However, there are many barriers to movement, and not all species are able to move fast enough to keep up with the pace of climate change (EEA, 2017).

Another key pressure on biodiversity and ecosystems is invasive alien species IAS): animals and plants that are introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences (Walther et al., 2009; Simberloff et al., 2013; Rabitsch et al., 2016). They spread through different pathways (Rabitsch et al., 2016), have a negative impact on ecosystem services and can increase the incidence of livestock diseases. Overall, they represent a major threat to native plants and animals as well as ecosystems in Europe, causing damage worth billions of euros to the European economy and to the health and well-being of Europeans every year. The EU Regulation on invasive alien species (EU, 2014) provides a set of measures to combat such species, ranging from prevention, early detection and rapid eradication to management of invasive alien species.

The core of the Regulation is the list of invasive alien species of Union concern, which is updated regularly and currently includes 49 species (EU, 2019). Information on their spatial distribution is now available for each of the species on the list (JRC, 2019a). This will serve as a baseline supporting the implementation of the Regulation and monitoring the evolution of IAS distribution in Europe. The initial findings indicate that several species are already quite widespread across the EU (e.g. *Impatiens glandulifera, Heracleum mantegazzianum, Ondatra zibethicus*) (JRC, 2019a), while others are not yet established in the European environment (e.g. *Microstegium vimineum, Parthenium hysterophorus, Sciurus niger)*. More information on invasive alien species is available through the European Alien Species Information Network (EASIN) (JRC, 2019c).

The outlook for ecosystem condition and services are difficult to assess mainly because of the complexity of the interactions and interdependencies between them, for example land use change affects the quantitative as well as the qualitative aspects of ecosystem services. Overall, various European initiatives and policies aim to counteract the deterioration in ecosystem condition and services. These are, among others, green infrastructure investments, the Pollinators initiative, LIFE projects, including rewetting of wetlands, renaturation of rivers and lakes, improving the Natura 2000 and Emerald networks and relevant activities in rural development programmes. However, the

effects of many of those initiatives will be visible only in the medium or long term. Time lags in ecosystems' responses to environmental changes due to their buffering capacities may explain the lack of observed improvements in condition, but they are ambivalent, as they can also hide negative impacts due to ongoing high pressures.

The condition of ecosystems in Europe is increasingly under pressure from land use change, extraction of natural resources, pollution, climate change and invasive alien species.

3.3.5 Genetic diversity and soil biodiversity

Genetic diversity is crucial for food security, human health and the adaptation of species and ecosystems to environmental changes.

Apart from diversity of species and ecosystems, genetic diversity is the third key level of biodiversity; it describes the variability within a species, thus characterising the genetic pool, which enables organisms to better use, modify and adapt to changing environmental conditions. Plant and animal genetic resources for food and agriculture are an essential part of the biological basis for world food security (Martinez and Amri, 2008; FAO, 2015) and they contribute to human health and dietary diversity (Mouillé, et al., 2010). In addition to improving the quality of agricultural products, genetic diversity supports ecosystem-specific regulation processes, such as the suppression of pests and diseases.

While Europe is home to a large proportion of the world's crop varieties and domestic livestock breeds, it is also the region with the highest proportion of breeds classified as 'at risk'. At least 130 previously known cattle breeds are already classified as 'extinct' (Hiemstra et al., 2010; FAO, 2018). Modern plant breeding towards higher yields and minimal crop failure have reduced crop genetic diversity (Fu, 2015), and many traditional crop varieties and wild crop relatives are at risk too or have become extinct already.

The reasons for what is known as genetic erosion are similar to the pressures on biodiversity described earlier in this chapter and include in particular the intensification and industrialisation of animal and plant production, urbanisation, environmental degradation and land use change (e.g. loss of grazing land).

With climate change, the conservation and sustainable use of genetic diversity has become more critical than ever. For example, plants and animals that are genetically tolerant of high temperatures or droughts, or resistant to pests and diseases, are of great importance in climate change adaptation, which requires a diverse genetic basis (FAO, 2018). Preserving plant varieties and rearing endangered breeds is crucial for that purpose (FAO, 2019).

In order to properly address the critical value of genetic diversity, the European Commission, following an initiative by the European Parliament in 2013, commissioned a preparatory action on EU plant and animal genetic resources (EC, 2016b), that aimed to identify the actions needed to conserve and sustainably use genetic resources and to valorise the use of neglected breeds and varieties in an economically viable way .

Soil biodiversity maintains key ecosystem processes related to carbon and nutrient cycling and soil water balance.

Ecosystem services and functions rely on decomposition, which is the transformation of plant and animal residues into nutrients available to plants. This is possible only through burying, mixing, digesting and transforming of residues by soil animals including worms, mites, collembolans and bacteria. Soil organisms not only provide stability in the face of stress and disturbance, they also provide protection against soil-borne diseases (Brussaard et al., 2007).

One hectare of agricultural soil contains about 3 000 kg of soil organisms (Bloem et al., 2005), involving between 10 000 and 50 000 species (Jeffery et al., 2015). According to size and weight, earthworms dominate, whereas in terms of species richness, bacteria and fungi dominate (of which only 0.2-6 % are detected) (Orgiazzi et al., 2016).

Although soil biodiversity is difficult to investigate, there is evidence that pollution from metal and nanomaterials significantly reduces diversity (Gans et al., 2005), and species-diverse systems decompose more organic matter and produce more nitrogen compounds in the soil than species-poor soils (Setälä and McLean, 2004).

Soil biodiversity is increasingly under pressure, as a result of erosion, contamination and soil sealing, which may limit its capacity to deliver ecosystem services (Gardi et al., 2013; Orgiazzi et al., 2016) (Chapter 5).

3.4 Responses and prospects of meeting agreed targets and objectives

The recent fitness check of the EU nature legislation (EC, 2016a) concluded that, within the framework of broader EU biodiversity policy, the legislation remains highly relevant and is fit for purpose. However, full achievement

of the objectives of the nature directives will depend on substantial improvement in their implementation in close partnership with local authorities and various stakeholders in the Member States to deliver practical results on the ground for nature, people and the economy in the EU. In response to the fitness check, the Commission produced an action plan for nature, people and the economy in 2017, including 15 actions to be carried out before 2020 that aim to rapidly improve the implementation of the nature directives (EC, 2017).

Other new policy instruments and initiatives, such as the National Emission Ceilings Directive, updated bioeconomy strategy, the Regulation on invasive alien species or the EU Pollinators initiative aim to help combat pressures and drivers of biodiversity loss.

Overall, however, policy responses, although successful in some areas, have been insufficient to halt biodiversity loss and the degradation of ecosystem services. Achieving significant progress towards biodiversity targets requires wider and more effective implementation of existing policies (EFSA, 2016). Improving coherence between different environmental policies, such as the EU biodiversity strategy, the Water Framework Directive, the Floods Directive and the Marine Strategy Framework Directive would make a positive contribution. For example, assessments of conservation status and pressures on freshwater habitat types under the Habitats Directive and assessments of the ecological status of water bodies under the Water Framework Directive run in parallel and there are not enough synergies between the two processes. A coordinated approach would result in co-benefits for both processes and improved management plans or programmes of measures (EEA, 2016a, 2018a).

Pressures on biodiversity and drivers of loss are mainly linked to a range of economic sectors and sectoral policies.

Financing mechanisms and other instruments included in sectoral and territorial policies have both direct and indirect impacts on biodiversity and ecosystem services to a very significant extent. While some of them may contribute to biodiversity conservation, many others affect it negatively through lack of coherence and conflicting objectives. For example, measures introduced in the CAP through agri-environmental schemes to reduce the environmental impact of agriculture have brought some positive outcomes. Overall, however, these have not been sufficient to halt biodiversity loss. The 2013 CAP reform introduced a payment for a compulsory set of 'greening measures', accounting for 30 % of the direct payments budget (EC, 2016c). These measures are intended to enable the CAP to be more effective in delivering its environmental and climate objectives, including those for biodiversity, soil quality and carbon sequestration, and at the same time to ensure the long-term sustainability of agriculture in the EU. However, a recent special report from the European Court of Auditors (2017) found the CAP greening measures ineffective, leading to positive changes in farming practices on only 5 % of EU farmland. Moreover, the report concluded that biodiversity and soil quality continue to be under increasing threat.

Another example is the production of renewable energy and biofuels, which may be of concern when it results in the conversion of natural or semi-natural ecosystems either for producing biofuels themselves or for producing other crops that have been displaced by biofuels.

While biodiversity in Europe is subject to many pressures and threats, the economic activities of Europe's nations have the potential to cause widespread depletion of natural capital and direct and specific damage to habitats and species well beyond Europe's regional boundaries. Europe's ecological deficit is considerable; its total demand for ecological goods and services exceeds what its own ecosystems supply (EEA, 2019b; Chapter 1). The implementation of Target 6 of the EU 2020 biodiversity strategy, aiming to help stop the loss of global biodiversity, continues to be of utmost importance.

Pressures on biodiversity and drivers of loss are mainly linked to a range of economic sectors and sectoral policies. Economic growth is generally not decoupled from environmental degradation and such decoupling would require a transformation in policies and tax reforms in the region (IPBES, 2018). Mainstreaming biodiversity concerns, in both the public and private sectors, and including them in sectoral policies is therefore crucial, especially for the post-2020 biodiversity agenda. These include trade, agriculture, forestry, fisheries, spatial planning, energy, transport, health, tourism and the financial sector, including insurance.

A more integrated approach across sectors and administrative boundaries would entail a wider application of ecosystem-based management and nature-based solutions. Green infrastructure, a strategically planned network of natural and semi-natural areas with other environmental features, is an example of such

ecosystem-based management. Although biodiversity remains at the core of green infrastructure, it is much more than a biodiversity conservation instrument. Using a green infrastructure approach can improve the connectivity between and within protected areas and surrounding non-protected parts of the landscape, between urban and rural areas, and provide many other benefits such as increasing resilience to climate change, improving human health and well-being and flood regulation. The Natura 2000 network, which is a central part of European green infrastructure, is an excellent example of existing natural features (Section 3.4.1). There is a need, however, to ensure better protection and management of the sites (including their connectivity) and the condition of areas outside Natura 2000. National and regional frameworks to promote restoration and green infrastructure need to be further developed and implemented. Chapter 17 provides more information on the role of green infrastructure in the transition towards a sustainable society and economy.

In addition to policy, societal responses to biodiversity loss and the need for its conservation also play an important role; these include changes in the patterns of food consumption and consumption of other goods (Marquardt et al., 2019; Crenna et al., 2019). The results of the 2019 Eurobarometer survey show that Europeans' familiarity with the term 'biodiversity' has increased and that an overwhelming majority of the people interviewed are concerned about biodiversity loss and the state of the natural world (EEA, 2016d; EC, 2019).

Faced with the unprecedented and catastrophic loss of biodiversity and degradation of the Earth's ecosystems (IPBES, 2019), further efforts are needed to increase public awareness of the importance of biodiversity and ecosystem services for the livelihoods and well-being of Europeans, so that they may be more prepared to make personal efforts. This includes influencing decision-making with the aims of redefining priorities, achieving more coherent development of policies and stronger policy implementation, to contribute to sustainability transitions accepted by society.