The European environment — state and outlook 2020

Knowledge for transition to a sustainable Europe

European Environment Agency

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Contents

Part 3
Sustainability prospects

Part 4
Conclusions

I.

Foreword

The European environment — state and outlook 2020 (SOER 2020) comes at a crucial time. We face urgent sustainability challenges that require urgent systemic solutions. This is the unambiguous message to policymakers in Europe and globally. The overarching challenge of this century is how we achieve development across the world that balances societal, economic and environmental considerations.

This is the 6th SOER published by the European Environment Agency (EEA), and this 2020 edition identifies serious gaps between the state of the environment and existing EU near- and long-term policy targets. Citizens' expectations for living in a healthy environment must be met, and this will require renewed focus on implementation as a cornerstone of EU and national policies.

That being said, we do not only have to do more; we also have to do things differently. Over the next decade, we are going to need very different answers to the world's environmental and climate challenges than the ones we have provided over the past 40 years. This report aims to inform discussions on Europe's 2030 policies, including trajectories to 2050 and beyond.

These future policies must build on existing responses to our environmental and climate challenges — the acquis b D Q G W K H \ P X V W D O V R respond to the most-up-to -date knowledge, which calls for fundamentally different approaches — both in terms of what we need to do, as well as how we need to do it.

The message of urgency cannot be overstated. In the last 18 months alone, major global scientific reports from the IPCC, IPBES, IRP and UN Environment ([1]) have been published, all carrying similar messages: current trajectories are fundamentally unsustainable; these trajectories are interconnected and linked to our main systems of production and consumption; and time is running out to come up with credible responses to bend the trend.

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R Q % L R G L Y H U V L W \ D Q G (F R V \ V W H P 6 H U Y L F H V – Q W H U Q D W L R Q D O 5 H V R X U F H 3 D Q H O – 5 3 * O R E D O 5 H V R X U F H V 2 X W O R R N 5 H S R U W
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The call for fundamental sustainability transitions in the core systems that shape the European economy and modern social life — especially the energy, mobility, housing and food systems — is not new. Indeed we made such a call in the 2010 and 2015 editions of SOER, and in recent years the EU has embedded this thinking in important policy initiatives such as the circular and bio-economy packages, the climate and energy policies for 2030 and 2050, and its future research and innovation programme. Furthermore, the EU's sustainable finance initiative is the first of its kind to ask serious questions about the role of the financial system in driving the necessary change.

However, it is one thing to change thinking and another to bring about actual change. The focus now must be on scaling up, speeding up, streamlining and implementing the many solutions and innovations — both technological and social — which already exist, while stimulating additional research and development, catalysing behavioural shifts and, vitally, listening to and engaging with citizens.

We cannot underestimate the social dimension. There are loud and understandable calls for a just transition, in which the potential losers from the low-carbon economy are given due care and attention. The unequal distribution of costs and benefits arising from systemic changes is now recognised by policymakers, but requires solid understanding, citizen engagement and effective responses.

Neither should we ignore the young people of Europe. They are increasingly making their voices heard to demand a more ambitious response to climate change and environmental degradation. Unless we manage to change current trends within the next decade, then their sense of fear for the future will prove to be well founded.

SOER 2020 does not provide all the answers to these complex challenges. Nonetheless, it is the EEA's most comprehensive integrated assessment to date, and the first to address rigorously our systemic challenges in the context of the sustainability transitions that we, as a society, must make. It builds on 25 years of experience with data, analysis and EU policy, drawing on the knowledge of our unique network of European member countries (Eionet).

We cannot predict the future, but we can create it. We are convinced that this report constitutes a solid, timely source of knowledge that can guide discussions on future EU environment and climate policies, and help shape European responses to the United Nations Agenda 2030 and Sustainable Development Goals (SDGs). Europe must lead the global transition to a healthy environment in a just and sustainable world. The idea of a European Green Deal — outlined as the number one priority in the Political Guidelines for the next European Commission 2019-2024 — has the potential to provide an excellent framework for action, allowing for the kind of systems-based thinking and innovation needed to achieve this transition and create a future we can all be proud of.

Hans Bruyninckx
Executive Director, European Environment Agency

II.
Executive summary

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In 2020, Europe faces environmental challenges of unprecedented scale and urgency. Although EU environment and climate policies have delivered substantial benefits over recent decades, Europe faces persistent problems in areas such as biodiversity loss, resource use, climate change impacts and environmental risks to health and well-being. Global megatrends such as demographic change are intensifying many environmental challenges, while rapid technological change brings new risks and uncertainties.

Recognising these challenges, the EU has committed to a range of long-term sustainability goals with the overall aim of 'living well, within the limits of our planet'. Achieving these goals will not be possible without a rapid and fundamental shift in the character and ambition of Europe's responses. Europe needs to find ways to transform the key societal systems that drive environment and climate pressures and health impacts — rethinking not just technologies and production processes but also consumption patterns and ways of living. This will require immediate and concerted action, engaging diverse policy areas and actors across society in enabling systemic change.

Europe stands at a critical juncture in 2020. Its leaders have opportunities to shape future developments that will not be available to their successors. The coming decade will therefore be of decisive importance in determining Europe's RSSRUWXQLWLHV LQ WKH VWbFHQWXU\

These, in short, are the overarching conclusions of The European environment — state and outlook 2020 (SOER b2020). The report provides a comprehensive assessment of Europe's environment to support governance and inform the public. Like all EEA reports, it is founded on the work of the European Environment Information and Observation Network (Eionet) — a partnership between the EEA and its bPHPEHU FRXQWULHV DQG VL[FRRSHUDWLQJ

Making sense of the European environment's state, trends and prospects requires an integrated approach that acknowledges the complex drivers and implications of environmental change. SOER b2020 provides just that, presenting the global context that shapes Europe's development (Part b1), European environmental and sectoral trends and RXWORRNVb 3DUWb DQG WKH IDFWRUV FRQV enabling transformative change (Part 3). It concludes in Part 4 with reflections on how Europe can shift its trajectory and achieve a sustainable future.

Europe continues to consume more resources and contribute more WR bHQYLURQPHQWDO GHJUDGDWLRQ than other world regions.

62(5b LGHQWLILHV PDQ\ FKDOOHQJHV DQG EDUULHUV but it also sees reasons for hope. European citizens are increasingly voicing their frustration with the shortfalls in environment and climate governance. Knowledge about systemic challenges and responses is growing and is increasingly reflected in EU policy frameworks. In parallel, innovations have emerged rapidly in recent years, including new technologies, business models and community initiatives. Some cities and regions are leading the way in terms of ambition and creativity, experimenting with different ways of living and working and sharing ideas DFURVVbQHWZRUNV

All of these developments are important because they create space for governments to bring a new scale of ambition to policies, investments and actions. They also help raise awareness, encouraging citizens to rethink behaviours and lifestyles. Europe must seize these opportunities, using every means available to deliver transformative change in the coming decade.

Europe's environment in a changing global context

The environmental and sustainability challenges that Europe faces today are rooted in global developments stretching back over decades. During this period, the 'Great Acceleration' of social and economic activity has transformed humanity's relationship with the environment. Since 1950, the global population has tripled to 7.5 billion; the number of people living in cities has quadrupled to more than 4 billion; economic output has expanded 12-fold, matched by a similar increase in the use of nitrogen, phosphate and potassium fertilisers; and primary energy use has increased five-fold. Looking ahead, these global developments look set to continue increasing pressures on the environment. The world's population is projected to grow by almost one third to 10 billion by 2050. Globally, resource use could double by 2060, with ZDWHU GHPDQG LQFUHDVLQJ b E\ DQG GHPDQG JURZLQJ b E\

The great acceleration has undoubtedly delivered major benefits, alleviating suffering and enhancing prosperity in many parts of the world. For example, the share of the global population living in extreme SRYHUW\ KDV GHFUHDVHG VKDUSO\ IURP WR OHVV WKDQ b LQ <HW WKH VDPH G have also caused widespread damage to ecosystems. *OREDOO\ DERXW b RI WKH WHUUHVWULDO DQG b RI WKH PDULQH HQYLURQPHQW DUH altered. The Earth is experiencing exceptionally rapid loss of biodiversity, and more species are threatened with extinction now than at any point in human history. Indeed, there is evidence that a sixth mass extinction of biodiversity is under way.

Many of the changes in the global climate system observed since the 1950s are similarly unprecedented over decades to millennia. They largely result from greenhouse gas emissions from human activities, such as burning fossil fuels, agriculture and deforestation.

Both directly and indirectly, these pressures are inflicting tremendous harm on human health and well-being. The global burden of disease and premature death related to environmental pollution is already three times greater than that from AIDS, tuberculosis and malaria combined. But the continuation of the great acceleration could create even more far-reaching threats if pressures trigger the collapse of ecosystems such as the Arctic, coral reefs and the Amazon forest. Sudden and irreversible shifts of this sort could severely disrupt nature's ability to deliver essential services such as supplying food and resources, maintaining clean water and fertile soils, and providing a buffer against natural disasters.

As a pioneer of industrialisation, Europe has played a pivotal role in shaping these global changes. Today, it continues to consume more resources and contribute more to environmental degradation than many other world regions. To meet these high consumption levels, Europe depends on resources extracted or used in other parts of the

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materials. As a result, many of the environmental
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consumption occur outside Europe.

Collectively, these realities add up to a profound challenge for Europe and other world regions. The current trajectories of social and economic development are destroying the ecosystems that ultimately sustain humanity. Shifting
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and large-scale reductions in environmental
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Europe's environment in 2020

As the character and scale of global
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become clearer, policy frameworks have evolved. Europe's environmental policy framework — the environmental acquis — is increasingly shaped by ambitious long-term visions and targets. The overarching vision for Europe's environment and
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We live well, within the planet's ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and
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Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and
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EU environmental policies are guided by three thematic policy priorities in the 7th EAP: (1) to protect, conserve and enhance the EU's natural capital; (2) to turn the EU into a resource-efficient, green and competitive low-carbon economy; and (3) to safeguard the EU's citizens from environment-related pressures and risks to their health and well-being. In recent years, the EU has also adopted a series of strategic framework policies that focus on transforming the EU economy and particular systems (e.g. energy, mobility) in ways that deliver prosperity and fairness, while also protecting ecosystems. The United Nations (UN) Sustainable Development Goals complement these frameworks, providing a logic for transformative change that acknowledges the interdependence of social, economic and environmental targets.

Viewed against Europe's long-term vision and complementary policy targets, it is clear that Europe is not making enough progress in addressing environmental challenges. The messages from
WKH 62(5b DVVHVVPHQW RI UHFHQW WUHQG
outlooks is clear: policies have been more effective in reducing environmental pressures than in protecting biodiversity and ecosystems, and human health and well-being. Despite the successes of European environmental governance, persistent problems remain and the outlook for Europe's environment in the coming decades is discouraging (Table ES.1).
It is clear that natural capital is not yet being protected, conserved and enhanced in accordance with the ambitions of the 7th EAP. Small proportions
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assessed are in favourable conservation status and Europe is not on track to meet its overall target of halting biodiversity loss by 2020. Europe has achieved its targets for designating terrestrial and marine protected areas and some species have recovered, but most other targets are likely to be missed.

Policy measures targeted at natural capital have delivered benefits in some areas, but many problems persist and some are getting worse. For example, reduced pollution has improved water quality, but the EU is far from achieving good ecological status for all water bodies by 2020. Land management has improved, but landscape fragmentation continues to increase, damaging habitats and biodiversity. Air pollution continues to impact biodiversity and
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is exposed to excessive nitrogen levels, causing

SOER 2020 shows that despite
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policies, the outlook for Europe's
environment is discouraging.

(8 SROLFLHV KDYH EHHQ PRUH H•HFWLYH in reducing environmental pressures than in protecting natural capital DQG KXPDQbKHDOWK

eutrophication. The impacts of climate change on biodiversity and ecosystems are expected to intensify, while activities such as agriculture, fisheries, transport, industry and energy production continue to cause biodiversity loss, resource extraction and harmful emissions.

Europe has made more progress in relation to resource efficiency and the circular economy. Material consumption has declined and resource efficiency improved as gross domestic product has increased. Greenhouse gas emissions declined E\ b EHWZHHQ DQG GXH WR policy measures and economic factors. The share of renewable energy sources in final energy FRQVXPSWLRQ LQFUHDVHG VWHDGLO\ DQG Energy efficiency has improved, and final energy consumption has declined to roughly the level in 1990. Emissions of pollutants to both air and water have been reduced, while total EU water abstraction GHFUHDVHG E\ b EHWZHHQ DQG

More recent trends are less positive, however. For example, final energy demand has actually increased since 2014 and, if that continues, the EU's 2020 target for energy efficiency may not be met. Harmful emissions from transport and agriculture have also risen, and production and consumption of hazardous chemicals have remained stable. The outlook to 2030 suggests that the current rate of progress will not be sufficient to meet 2030 and 2050 climate and energy targets. In addition, addressing environmental pressures from economic sectors through environmental integration has not been successful, as illustrated by agriculture's continued impacts on biodiversity and pollution of air, water and soil.

Europe has achieved some success in protecting Europeans from environmental risks to health and well-being. For example, drinking and bathing water are generally of high quality throughout Europe. But, again, there are persistent problems in some areas and the outlook is worrying. For example, some persistent and mobile chemicals resist even advanced drinking water treatment. Similarly, although emissions of air pollutants have declined, DOPRVW b RI WKH (8 V XUEDQ SRSXODWLRQ areas with concentrations of air pollutants above at least one EU air quality standard. Exposure to fine particulate matter is responsible for around b SUHPDWXUH GHDWKV LQ (XURSH HYHU\ and central and eastern European countries are disproportionately affected.

Human health and well-being are still affected by noise, hazardous chemicals and climate change. Accelerating climate change is likely to bring increased risks, particularly for vulnerable groups. Impacts can arise from heat waves, forest fires, flooding and changing patterns in the prevalence of infectious diseases. In addition, environmental risks to health do not affect everyone in the same way, and there are pronounced local and regional differences across Europe in terms of social vulnerability and exposure to environmental health hazards. In general, the outlook for reducing environmental risks to health and well-being is uncertain. Systemic risks to health are complex and there are important gaps and uncertainties in the knowledge base.

Understanding and responding to systemic challenges

The persistence of major environmental challenges can be explained by a variety of related factors. First, environmental pressures remain substantial despite progress in reducing them. The pace of progress has also slowed in some important areas, such as greenhouse gas emissions, industrial emissions, waste generation, energy efficiency and the share of renewable energy. This implies a need to go beyond incremental efficiency improvements and to strengthen the implementation of environmental policies to achieve their full benefits.

The complexity of environmental systems can also mean that there is a considerable time lag between reducing pressures and seeing improvements in natural capital, and human health and well-being. Environmental outcomes, such as biodiversity loss,

Societal systems of production and consumption (food, energy and mobility) must be transformed to achieve Europe's sustainable, low-carbon future.

are often determined by diverse factors, meaning that the effectiveness of policy measures and local management efforts can be offset by external factors. These include global developments such as growing populations, economic output and resource use, all of which influence the situation in Europe. Looking ahead, concerns are also emerging about drivers of change, such as technological and geopolitical developments that have unclear implications.

Perhaps the most important factor underlying Europe's persistent environmental and sustainability challenges is that they are inextricably linked to economic activities and lifestyles, in particular the societal systems that provide Europeans with necessities such as food, energy and mobility. As a result, society's resource use and pollution are tied in complex ways to jobs and earnings across the value chain; to major investments in infrastructure, machinery, skills and knowledge; to behaviours and ways of living; and to public policies and institutions.

The many interlinkages within and between societal systems mean that there are often major barriers to achieving the rapid and far-reaching change that is needed to achieve Europe's long-term sustainability objectives. For example:

- Production-consumption systems are characterised by lock-ins and path dependency, linked to the fact that system elements — technologies, infrastructures, knowledge and so on — have often developed together over decades. This means that radically altering these systems is likely to disrupt investments, jobs, behaviours and values, provoking resistance from affected industries, regions or consumers.
- Interlinkages and feedbacks within systems mean that change often produces unintended outcomes or surprises. For example, technology-driven gains may be undermined by lifestyle changes, partly because of 'rebound effects' when efficiency improvements result in cost savings that enable increased consumption.
- Production-consumption systems are also linked directly and indirectly, for example through their reliance on a shared natural capital base to provide resources and absorb wastes and emissions. This 'resource nexus' means that addressing problems in one area can produce unintended harm elsewhere, for example deforestation and increases in food prices due to biofuel production.

The systemic character of Europe's environmental challenges helps explain the limitations of established environmental governance approaches in delivering needed change. Although signs of progress have been observed across the food, energy and mobility systems, environmental impacts remain high and current trends are not in accordance with long-term environmental and sustainability goals.

A growing body of research and practice provides insights into how fundamental systemic change can be achieved. Such transitions are long-term processes that depend critically on the emergence and spread of diverse forms of innovation that trigger alternative ways of thinking and living — new social practices, technologies, business models, nature-based solutions, and so on. It is impossible to know in advance precisely what innovations will emerge, whether or how they will be integrated into lifestyles, and how they will affect sustainability outcomes. Transitions therefore involve numerous uncertainties, conflicts and trade-offs.

This understanding of systemic change has important implications for governance. First, the perceived role of government shifts from acting as a 'pilot', with the knowledge and tools to steer society towards sustainability, to a role as an enabler of society-wide innovation and transformation. Top-down planning still has a role in some contexts.

But governments also need to find ways to leverage the powers of citizens, communities and businesses.

Achieving this requires contributions across policy areas and levels of government towards common goals. Environmental policy tools remain essential. But enabling systemic change will require a much broader policy mix to promote innovation and experimentation, to enable new ideas and approaches to spread, and to ensure that structural economic change produces beneficial and fair outcomes. The complexity and uncertainty of transition processes means that governments will also need to find ways to coordinate and steer actions across society towards long-term sustainability goals and to manage the risks and unintended consequences that inevitably accompany systemic change.

Where does Europe go from here?

Taken together, the analysis in Parts 1-3 highlights the persistence, scale and urgency of the challenges facing Europe. Achieving the EU's 2050 sustainability vision is still possible, but it will require a shift in the character and ambition of actions. That means both strengthening established policy tools and building on them with innovative new approaches to governance. Drawing on the insights from across the report, Part 4 identifies a variety of important areas where action is needed to enable transitions.

Strengthening policy implementation, integration and coherence: Full implementation of existing policies would take Europe a long way to achieving its environmental goals up to 2030. Achieving full implementation will require increased engagement of business and citizens; better coordination of local, regional and national authorities; and a stronger knowledge base. Beyond implementation, Europe needs to address gaps and weaknesses in policy frameworks, for example in relation to land, soil and chemicals. Better integration of environmental goals into sectoral policy is also essential, as is improved resource efficiency

Developing more systemic, long-term policy frameworks and binding targets: The growing set of strategic policies addressing key systems (e.g. energy and mobility) and promoting the transformation to a low-carbon and circular economy are important tools for stimulating and guiding coherent action across society. But the coverage of long-term policy frameworks needs to be extended to other important systems and issues, such as food, chemicals and land use. Comparable cross-cutting strategies are also needed at other levels of governance — including countries, regions and cities. Engaging stakeholders in developing transformative visions and pathways is important to reflect the diverse realities across Europe and to maximise environmental, social and economic co-benefits.

Leading international action towards sustainability: Europe cannot achieve its sustainability goals in isolation. Global environmental and sustainability problems require global responses. The EU has significant diplomatic and economic influence, which it can use to promote the adoption of ambitious agreements in areas such as biodiversity and resource use. Full implementation of the UN's 2030 agenda for sustainable development in Europe and active support for implementation in other regions will be essential if Europe is to provide global leadership in achieving sustainability transitions. Using the Sustainable Development Goals as an overarching framework for policy development in the next 10 years could provide an important step towards realising Europe's 2050 vision.

Fostering innovation throughout society: Changing trajectory will depend critically on the emergence and spread of diverse forms of innovation that can trigger new ways of thinking and living. The seeds for this shift already exist. More and more citizens, businesses, entrepreneurs, researchers, city administrations and local communities are experimenting with different

Achieving the EU's 2050 sustainability vision is still possible, but it will require a shift in the character and scale of actions.


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Sustainability needs to become the guiding principle for ambitious and coherent policies and actions across society.

ways of producing and consuming. In practice, however, innovations often encounter major barriers. Public policies and institutions therefore have a vital role in enabling systemic change. Environmental policies remain essential, but system innovation requires coherent contributions from diverse policy areas, ranging from research, innovation, sectoral and industrial policies to education, welfare, trade and employment.

Scaling up investments and reorienting finance: Although achieving sustainability transitions will require major investments, Europeans stand to gain hugely – both because of avoided harms to nature and society, and because of the economic and social opportunities that they create. Governments need to make full use of public resources to support experimentation, invest in innovations and nature-based solutions, procure sustainably, and support impacted sectors and regions. They also have an essential role in mobilising and directing private spending by shaping investment and consumption choices, and engaging the financial sector in sustainable investment by implementing and building on the EU's Sustainable Finance Action Plan.

Managing risks and ensuring a socially fair transition : Successful governance of sustainability transitions will require that societies acknowledge potential risks, opportunities and trade -offs, and devise ways to navigate them. Policies have an essential role in achieving 'just transitions', for example by supporting companies and workers in industries facing phase-out via retraining, subsidies, technical assistance or investments that help negatively affected regions. Early identification of emerging risks and opportunities related to technological and societal developments needs to be combined with adaptive approaches, based on experimentation, monitoring and learning.

Linking knowledge with action: Achieving sustainability transitions will require diverse new knowledge, drawing on multiple disciplines and types of knowledge production. This includes evidence about the systems driving environmental pressures, pathways to sustainability, promising initiatives and barriers to change. Foresight methods are an important way of engaging people in participatory processes to explore possible futures, outcomes and risks or opportunities. Generating, sharing and using relevant evidence to the full may require changes in the knowledge system linking science with policy and action, including developing new skills and institutional structures.

The next 10 years

Achieving the goals of the 2030 agenda for sustainable development and the Paris Agreement will require urgent action in each of these areas during the next 10 years. To be clear, Europe will not achieve its sustainability vision of 'living well, within the limits of our planet' simply by promoting economic growth and seeking to manage harmful side-effects with environmental and social policy tools. Instead, sustainability needs to become the guiding principle for ambitious and coherent policies and actions across society. Enabling transformative change will require that all areas and levels of government work together and harness the ambition, creativity and power of citizens, businesses and communities. In 2020, Europe has a unique window of opportunity to lead the global response to sustainability challenges. Now is the time to act.

PART 1

Setting the scene

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Reporting on the environment in Europe

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Reporting on the environment in Europe

A short history

For 25 years, the EEA has operated as a knowledge broker at the interface between science, policy and society in Europe. Today, there is widespread recognition that environmental issues touch on almost all aspects of society and have implications for the types of knowledge needed by policymakers and other stakeholders to underpin their actions. It is this backdrop that has guided the logic and contents of this report, the sixth in a series of European environment state and outlook reports (SOER) produced by the EEA since 1995, as mandated by its governing regulation (EU, 2009). The structure and focus of the six reports have reflected and informed the logic of the EU's environmental policy ( ). The reports have informed policy implementation by monitoring progress towards established targets, and identified opportunities for EU policy

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SOER 2020 marks 25 years of the EEA's reporting on the state of the environment

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to contribute to achieving long-term objectives, notably the 2050 vision of 'living well, within the limits of our planet', as set out in the EU's Seventh Environment Action Programme, or th (EU, 2013).

Like the previous reports, The European environment — state and outlook 2020 (SOER 2020) provides relevant, reliable and comparable knowledge to support European environmental governance and inform the European public. It draws on the knowledge base available to the EEA and the European Environment Information and Observation Network (Eionet), which is the partnership network between the EEA's member countries[1] and six cooperating countries[2]. EU policies do not necessarily directly apply to the EEA's non-EU member countries and six cooperating countries. Nevertheless, many of these countries follow the same or similar environmental and climate policy objectives, so they are included in the assessment as far as possible.

This report (SOER 2020) marks the 25th anniversary of state of the environment reporting at the EEA and more than 30 years of reporting at the European level (CEC, 1987) In parallel, state of the environment reporting at the national level has evolved rapidly, driven by the changing nature of environmental challenges and policy responses and the continuous drive for innovation in

(1) The 28 Member States of the EU together with Iceland, Liechtenstein, Norway, Switzerland and Turkey.
(2) Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia and Kosovo (under United Nations Security Council Resolution 1244/99 and in line with the International Court of Justice Opinion on the Kosovo Declaration of Independence).

TABLE 0.1 The focus and context of SOERs 1995 to 2020

SOER	Focus	Input to EU environmental policy
1995	Addressed the Fifth Environment Action Programme (EAP) targets, focusing on trends and sectoral integration, in the context of a pan-European assessment	Report for the mid-term review of the 5th EAP (1993-2000)
1999	Addressed trends, outlooks and interconnections	Input to the assessment of the 5th EAP (1993-2000)
2005	Addressed trends and outlooks, core indicators, country scorecard analyses and long-term, flexible policymaking	Input to the mid-term review of the 6th EAP (2002-2012)
2010	Addressed 6th EAP priorities, focusing on trends and outlooks, the global context, complex challenges and governance	Input to the final assessment of the 6th EAP (2002-2012)
2015	Addressed 7th EAP priorities, focusing on trends and outlooks, systemic challenges, the need for transitions and governance	Input to implementing the 7th EAP and a baseline for evaluating progress
2020	Addresses 7th EAP priorities and other broad frameworks (including the Sustainable Development Goals), trends and outlooks, systemic challenges and sustainability transitions	Support to established EU environment policies and framing of future policies and programmes

Source: EEA.

assessment methods. Furthermore, the 1998 United Nations Economic Commission for Europe Convention on Access to Information, known as the Aarhus Convention, provided a strong incentive to anchor regular state of the environment reporting in national legislation in many countries. As a result, almost all Eionet countries now publish national state of the environment reports on a regular basis, and more than half of the EEA member countries plan to publish a new edition of their national report in 2019 or 2020 (Box 0.1).

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62(5b EXLOWRQWKHFRQFOXVLRQV LWVSUHGHFHVVRUVDQGUHDFKHG Based on a detailed analysis of the European environment's state and WUHQGVWKH62(5b V\QWKHVLVUHSRUW (EEA, 2015c) presented a mixed picture of policy successes and challenges. It demonstrated that, although implementation of environment and climate policies has delivered substantial benefits for the functioning of Europe's ecosystems and human well-being, the outlook in the coming decades is worrying. Europe faces major challenges in addressing persistent environmental problems that are tied in complex ways to systems of production and consumption. At the same time, in an ever more interconnected world, Europe's ecological and societal resilience is increasingly affected by a variety of global megatrends ((\$ b . E

2QWKLVEDVLV62(5b FRQFOXGHG that achieving the EU's vision for 2050, as set out in the 7th EAP, requires fundamental transitions in the production-consumption systems driving environmental degradation, including the food, energy and mobility systems. It also stressed that neither environmental policies alone nor economic and technology-driven efficiency gains alone are likely to be sufficient. Such sustainability transitions will, by their character, entail profound changes in dominant institutions, practices, technologies, policies, lifestyles and thinking. They will inevitably involve uncertainties and disruption — impacting industries, investments, welfare systems and livelihoods. Yet they also present major opportunities to boost Europe's economy and employment and to put Europe at the frontier of science and innovation.

Improving the knowledge base for tackling sustainability transitions in Europe will require a greater use of anticipatory knowledge and understanding of the changing global context, in addition to interdisciplinary and participatory processes. Therefore, VLQFHWKHSXEOLFDWLRQRI62(5 the EEA and Eionet have collaborated in a range of knowledge co-creation activities to bring together evidence from experiences across Europe and to develop

transdisciplinary knowledge. Two of these EEA-Eionet cooperation processes are briefly introduced in Box 0.2.

6 2 (5 b D Q L Q W H J U D W H G assessment focused on sustainability

A plausible future requires a factual present (Snyder, 2018). Addressing trends across timescales is one of the key hallmarks of this report. Two other hallmarks are (1) bridging geographical dimensions in recognition that the environment has no borders and b S U R Y L G L Q J D Q D Q D O \ V L V the many environmental, economic, social and governance dimensions needed to achieve sustainability.

This report comes at a time when political initiatives are challenged by false information and fake news. The need for sound scientific knowledge becomes even more important in this context (ESPAS, 2019). Linked to this, more people in Europe are questioning the value of established institutions, public policy and expertise in ways that undermine confidence in such structures and the value of the knowledge supporting them (6 3 $ 6 b . This report makes every effort to acknowledge these realities by ensuring transparency through

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SOER 2020 responds to W K H b H Q Y L U R Q P H Q W D O F K D O O H Q J H V and the need to support fundamental transitions W R b V X V W D L Q D E L O L W \

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comprehensive referencing of scientific findings and an improved approach to appraisal and communication of aspects of quality and uncertainty, as well as of knowledge gaps. It also draws on stakeholders' knowledge and expertise (see also Section 0.2) and has been subject to extensive peer review H J L R Q H W b 6 F L H Q W L I L F & R P P L W W H H international experts). These steps are fundamental for ensuring the relevance, credibility and legitimacy of the report, particularly when the underpinning knowledge base and assessment characteristics are increasingly moving towards a systemic understanding of problems and possible pathways towards sustainability.

2 Y H U D O O b 6 2 (5 b U H V S R Q G V W R W K H challenges presented by an evolving policy landscape and the need to support fundamental transitions to sustainability in Europe. It builds on the D V V H V V P H Q W R I 6 2 (5 b and includes a range of assessments that support various stages of policy and decision-making. The report is structured into four parts (Figure 0.1).

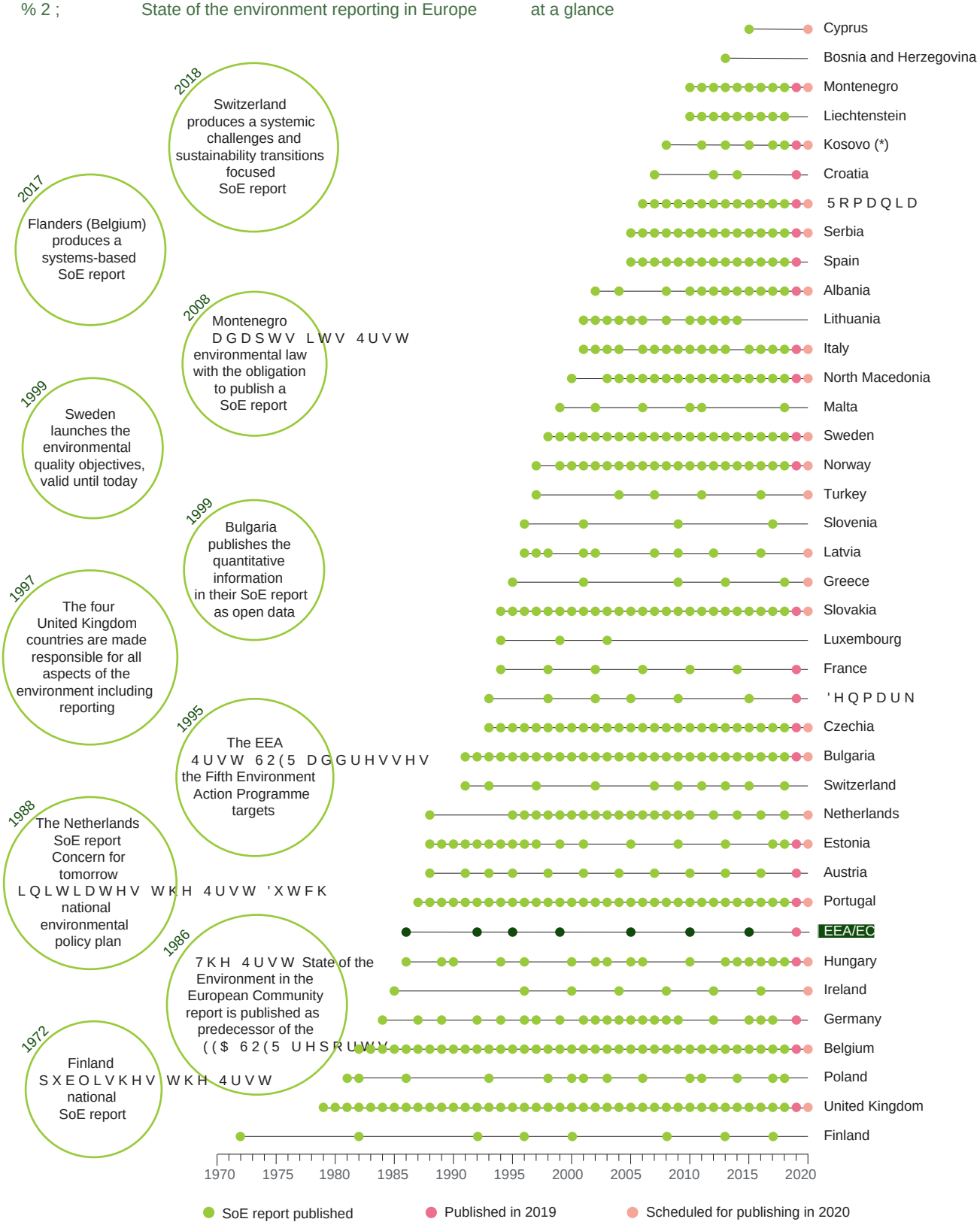
Part 1: 'Setting the scene' comprises two chapters. Chapter 1 assesses the global-European context and trends that will shape Europe's efforts to achieve sustainability in the coming decades. Therefore, it mostly relies on data and findings from international organisations and processes and includes an analysis of global megatrends, European-specific trends and emerging issues. Chapter 2 provides an overview of Europe's policies and long-term sustainability goals that are currently in place to address environmental and climate challenges.

Part 2: 'Environment and climate trends' comprises 12 chapters that assess European trends over the past 10 to 15 years and provide an outlook for the coming 10 to 15 years. It provides an assessment of progress towards established EU environmental and climate policy goals, focusing particularly on objectives and targets in the 2020 -2030 timeframe. Part 2 L Q F O X G H V b W K H P D W L F D V V H V V P H Q W V (Chapters 3 to 12): biodiversity and Q D W X U H b I U H V K Z D W H U b O D Q G b D Q G b V R L O P D U L Q H b H Q Y L U R Q P H Q W b F O L P D W H b F K D Q J H

FIGURE 0.1 6 W U X F W X U H R I W K H 6 2 (5 b U H S R U W

PART 1	PART 2	PART 3	PART 4
Setting the scene	Environment and climate trends	Sustainability prospects	Conclusions
2 chapters addressing: · Assessing the global-European context and trends · Europe's policies and sustainability goals	12 chapters addressing: · 10 thematic assessments · Environmental pressures and sectors · Summary assessment of progress to 7th EAP objectives	3 chapters addressing: · Sustainability through a systems lens · Understanding sustainability challenges · Responding to sustainability challenges	1 chapter addressing: · Overall assessment of R X W F R P H V D Q G U H 5 H F W L R Q V on implications

% 2 ; State of the environment reporting in Europe at a glance

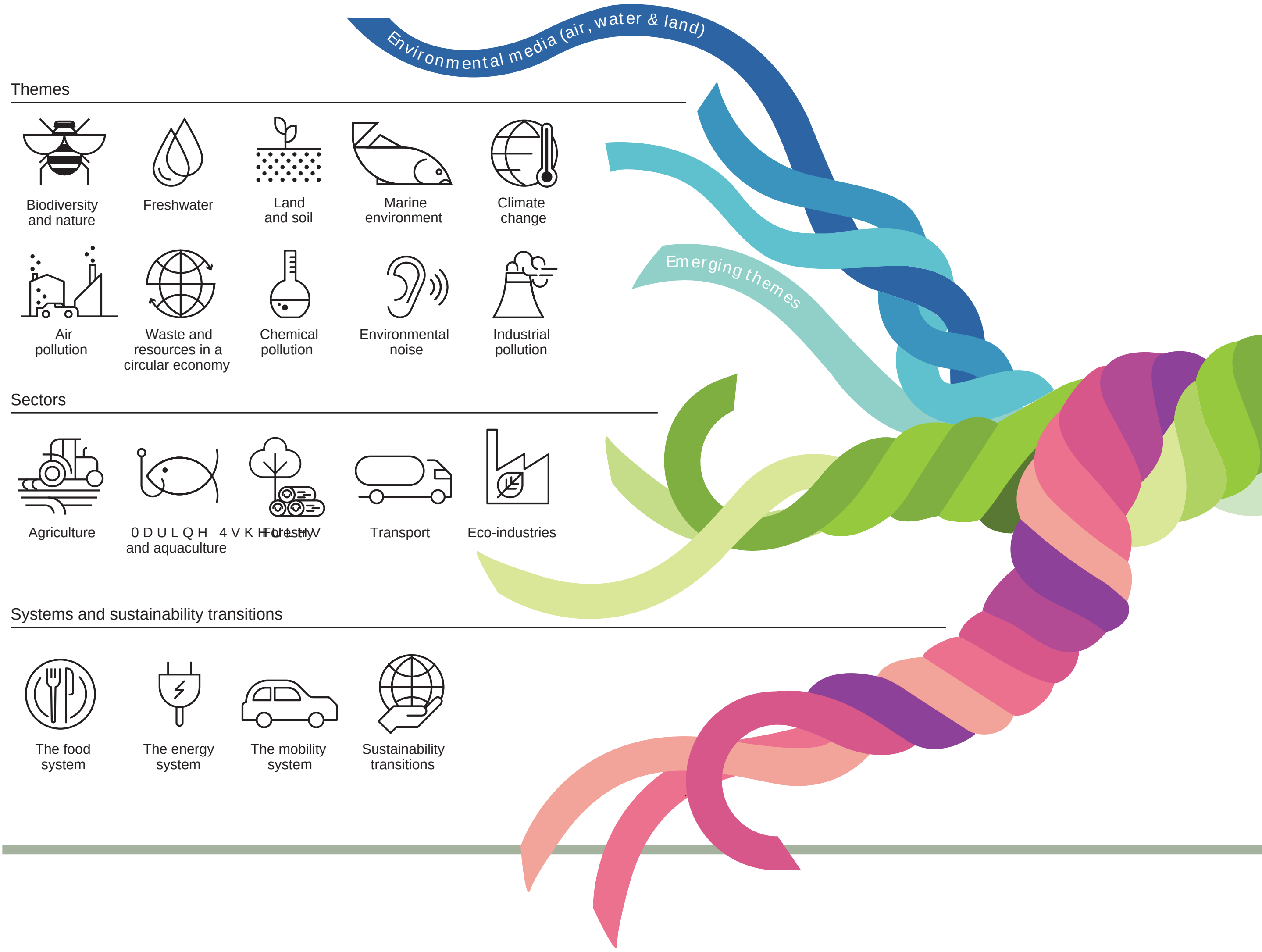


Notes: 6 R (V W D W H V W K H Y L U R Q P H Q W R Y R Q G H Q L W L D W L Y H V R O X W L R Q D Q G D L Q L H W K H International Court of Justice Opinion on the Kosovo Declaration of Independence).

Source: EEA and Eionet.


The European environment — state and outlook 2020 (SOER 2020) published
IPBES Global Assessment Report on Biodiversity and Ecosystem Services published
Global Resources Outlook 2019 published
UNEP 6th Global Environmental Outlook published
2019
European strategy for plastics in a circular economy
Action Plan on Sustainable Finance
2018
First Environmental Implementation Review
2017
Quito New Urban Agenda
2016
Sendai Framework for Disaster Risk Reduction
2030 Agenda for Sustainable Development
Paris Agreement on Climate Change
Action Plan for the Circular Economy
2015
7th Environment Action Programme
Adaptation strategy on climate change
2013
Millenium Declaration and Millenium Development Goals
2000
Cartagena Protocol on Biosafety
2003
Directive Public access to Environmental Information
2006
Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
2008
Marine Strategy Framework Directive
2009
2020 Climate & energy package
2010
Nagoya Strategic Plan for Biodiversity, including the Aichi Biodiversity targets
2011
Biodiversity strategy to 2020
Energy roadmap 2050
2012
Bioeconomy strategy
Rio+20 Conference on sustainable development
UNECE Aarhus Convention on Access to Environmental Information
1998
Kyoto Protocol
1997
UNEP First Global Environmental Outlook published
Europe's environment, the Dobris Assessment published
1995
First European Environment State and Outlook report published
EEA/Eionet Establishment
1994
Directive on the Conservation of Natural Habitats, Fauna and Flora (Natura 2000)
Rio Declaration on Environment and Development
Framework Convention on Climate Change
Convention on Biological Diversity
1992
Stockholm conference on the human environment
1972
First Environmental Action Programme
1975
Wastewater Framework Directive
1976
Bathing Water Directive
1979
Birds Directive
1986
State of the Environment in the European Community published
1987
Our Common Future published World Commission on Environment and Developments
Regulation initiating the EEA and the European environment information and observation network (Eionet)
1990
United Nations milestones
European Union milestones
EEA milestones

% 2 ; State of the environment reporting in Europe at a glance (cont.)



SOER 2020 provides a range R I b D V V H V V P H Q W V W K D W V X S S R U W W K H G L • H U H Q W stages of policy and decision-making.

P L W L J D W L R Q D Q G D G D S W D W L R Q ... Z D V W H D Q G U H V R X U F H V ... H Q Y L U R Q P H Q W D Q G ... pollution. In addition, Chapter 13 addresses the role of sectors in meeting environmental policy goals.

As in 2015, the thematic and sectoral assessments retain a strong focus on L P S O H P H Q W D W L R Q ... provides a stronger analysis of the interlinkages across themes. In addition, country-level information is integrated to facilitate improved sharing of developments and approaches that offer wider potential. Part 2 also responds to the challenge of growing knowledge complexity by using summary assessments that take a consistent approach across the b W K H P D W L F V X P P D U \ assessments also include a new element on robustness to improve transparency regarding the quality of evidence, uncertainty and knowledge gaps. The I L Q D O F K D S W H U b draws on the thematic and sectoral assessments to provide a summary assessment of past trends, outlooks and progress towards policy objectives and targets structured by the objectives R I b W K H ($ 3

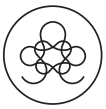
State of the environment: tools and building blocks

Data
from

- Environmental monitoring
- Key registers and databases
- Dedicated data sources and analysis

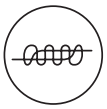
Indicators
showing environmental

- Driving forces
- Pressures
- States
- Impacts
- Responses



Scoreboards
giving insight into

- Environmental trends
- Policy progress



Assessments
providing knowledge on

- The state of the environment
- Trends and outlooks
- Systemic challenges and responses

Advances in national state of the environment reporting

(•HFWLYH LQGLFDWRUV DQG UREXVW [illegible]

that include the monitoring of emerging WKHPHV VXVWDLQDELOLW\ WUDQVLWLRQV DQG [illegible] term systemic challenges but also incorporate new data sources.

[illegible] with an emphasis on digital information [illegible] interactive data visualisation and storytelling and provision of open data and models.

Innovative sustainability assessments

[illegible] that address the challenges and prospects [illegible] barriers and levers for participatory solutions and links assessment knowledge to action.

Part 3 : 'Sustainability prospects' comprises three chapters and assesses long-term prospects (2030-2050), global interactions and opportunities for systemic transitions to achieve the EU's sustainability objectives. Chapter 15 introduces the shift to a broader sustainability and more systems-oriented perspective. Chapter 16 responds to the need for an increased focus on understanding and assessing the systemic character of today's environmental challenges, including key production-consumption systems such as energy, mobility and food. Finally, in response to the growing demand for knowledge on solutions and responses, Chapter 17 complements the analysis of environment, climate and sustainability challenges with a greater emphasis on how Europe can respond.

3DUW :KHUH GR ZH JR IURP KHUH [illegible] reflects on the implications of the findings of Parts 1, 2 and 3. This includes reflections on the current state of, trends in and outlook for Europe´s environment, opportunities for Europe's environmental governance, and broader enabling conditions to put Europe on a path to a prosperous and VXVWDLQDEOHbIXWXUH

Translating knowledge into action requires the involvement of a wide range of stakeholders. In response, the EEA has designed SOER 2020 as a process, extending over 2019 and [illegible] 7KHSURFHVVbUHSRUW represents the first component in this process and provides the foundation for subsequent stakeholder interactions aimed at exploring its conclusions and their implications. The second component will be a set RIbVWDNHKROGHU [illegible] the development of a 'knowledge for action' report that the EEA will SXEOLVKbLQ

% 2 ; EEA-Eionet cooperation in building anticipatory knowledge for sustainability transitions

E3I Sustainability transitions: now for the long term

Recognising the need to develop new knowledge to support environmental governance, the EEA and Eionet initiated the Eionet Improvement and Innovation Initiative (E3I) after the publication of SOER 2015. Focusing initially on the theme of sustainability transitions, E3I work combined two major functions. First, EEA and Eionet partners engaged in a shared learning process about sustainability transitions and related knowledge needs. Second, the work produced empirical evidence about transition activities across Europe, providing inputs to EEA work.

The E3I transitions activities were led by a working group of Eionet national focal points and EEA staff, who gathered case studies and inputs from 26 EEA member countries and five European topic centres. The work culminated in the publication of the first Eionet publication, Sustainability transitions: now for the long term (EEA and Eionet, 2016), which used case studies and interviews to explain and illustrate key concepts and to give a sense of the transformative activities already under way at local levels.

Mapping Europe's environmental future: understanding the impacts of J O R E D O P H J D W U H Q G V D W W K H L U D W L R Q D O O H Y H O

Drivers of change, including global megatrends, are likely to bring risks and opportunities, whose relative magnitude largely depends on the variability and specificity of local environmental, economic and social conditions. The EEA and the National Reference Centre for Forward-Looking Information and Services (NRC FLIS) have engaged in a joint activity to develop a methodological toolkit to facilitate analysis of the implications of global megatrends at the national level (EEA and Eionet, 2017).

Many countries or regions in Europe have now investigated how global megatrends and other drivers of change may affect their environment and society (Table 0.2). The majority of these studies were prompted by the EEA's reporting on global megatrends (EEA, 2010, 2015a, 2015b) as well as the publication of the methodological toolkit. While differences exist in the focus and scope of these studies, climate change has been analysed most frequently, followed by pollution loads, population and urbanisation trends, and economic trends (Table 0.2).

Several countries (or regions) have included the findings of these studies in their national state of the environment reports. The global megatrends analysis for Switzerland (FOEN, 2016) is an example of clear articulation of these efforts. The study mainly followed the logic of the methodological toolkit (($ D Q G L R Q H W l 2 Q H R I W K H key findings used to inform the Swiss national state of the environment report (Swiss Federal Council, 2018) is that Switzerland's environmental challenges are all influenced by global megatrends. For example, the Swiss food production system is expected to be significantly affected by climate change, leading to both opportunities and risks. Additional in-depth studies confirmed that a longer growing season could be beneficial for agricultural production, but it might also lead to water resource conflicts. Heat waves, new diseases and water scarcity could also exert stress on dairy farming and meat production, both being very important economic activities. As only b R I 6 Z L V V R R G V X P S W L R Q accounted for by domestic production, the country will be vulnerable to future price fluctuations in global food commodities triggered by climate change. Developing adaptation strategies will therefore be crucial to ensure ecological and societal U H V L O L H Q F H W] H U O D Q G

TABLE 0.2 Studies on implications of global megatrends at the national/regional scale and their thematic focus

		Focus of national/regional study										
		Environment						Resources		Environment and society		
EEA global megatrends		Switzerland (FOEN, 2016)	Hungary (MA, 2017)	Slovenia (SEA, 2018)	Flanders (BE) (Flemish Environment Agency, 2014)	Slovakia (Slovak Environment Agency et al., 2016)	Sweden (Naturvårdsverket, 2014)	[illegible] (ETC/ICM, 2018)	Northern Europe [a] (Naturvårdsverket, 2014)	Finland (Valtioneuvoston kanslia, 2017)	United Kingdom (DEFRA, 2017)	Netherlands (PBL, 2013)	[illegible]
Social	Diverging global population trends	×	×		×	×	×		×	×	×	×	82
	Towards a more urban world	×	×		×	×	×		×	×	×	×	82
	Changing disease burdens and risks of pandemics		×		×	×	×		×		×		55
Technological	Accelerating technological change				×	×	×		×	×	×	×	64
Economic	Continued economic growth?	×	×		×	×	×		×	×	×	×	82
	An increasingly multipolar world				×	×	×		×	×	×		55
	Intensified global competition for resources			×	×	×	×	×	×		×		64
Environmental	Growing pressures on ecosystems	×	×		×	×	×	×	×		×		73
	Increasingly severe consequences of climate change	×	×	×	×	×	×	×	×	×	×	×	100
	Increasing environmental pollution	×	×		×	×	×	×	×	×	×		82
Political	Diversifying approaches to governance				×	×	×		×	×	x		55

Note: [a] 'Northern Europe' refers to a case study run for Germany and Sweden.

Source: EEA, based on NRC FLIS inputs.

01.

Assessing the global-European context and trends

Summary

- The period after the 1950s marks a unique period in human history in terms of human-induced global change and economic activity. This ‘Great Acceleration’ has delivered enormous improvements in living standards and well-being for millions of people.

- In turn, this has caused dramatic degradation of ecosystems and exceptionally rapid loss of biodiversity, including in Europe. Many of the changes observed in the global climate system since the 1950s are unprecedented over decades to millennia and largely caused by human activities. In addition, many known pollution problems persist, while new ones, such as certain types of chemical pollution, are emerging.

- In an increasingly interconnected world, Europe is influenced by multiple drivers of change. These can be characterised as global megatrends, more European-specific trends or emerging trends with potentially significant impacts. They include an ageing population in Europe, changing migration patterns, increasing inequalities, global competition for resources, the implications of accelerating digitalisation and other technological changes, and changing lifestyles. Many of these drivers have important influences on Europe’s long -term environmental outlook.

- Through trade, European production and consumption patterns contribute significantly to environmental pressures and degradation in other parts of the world. Depending on the type of resource, the associated total environmental footprint of European consumption that occurs outside Europe is estimated to be in the range of 30-60 %.

- In conclusion, Europe, in common with other advanced economies, has achieved high levels of human development (‘living well’) but at the expense of being not environmentally sustainable. Europe currently does not live up to its 2050 vision of ‘living within the limits of our planet’. This calls for fundamental changes in lifestyles, production and consumption, knowledge and education.

01.

Assessing the global-European context and trends

1.1
The Great Acceleration

Many key human achievements — culture, farming, cities, industrialisation, medical advances — have happened during a period in which the Earth's natural regulatory systems, such as the climate, have been remarkably stable. This period spanning the last DOPRVW \HDUV LV UHIHUUHG the Holocene. However, the onset of the Industrial Revolution around 1760 was accompanied by an increasing pace of change in human development and associated environmental degradation and destruction.

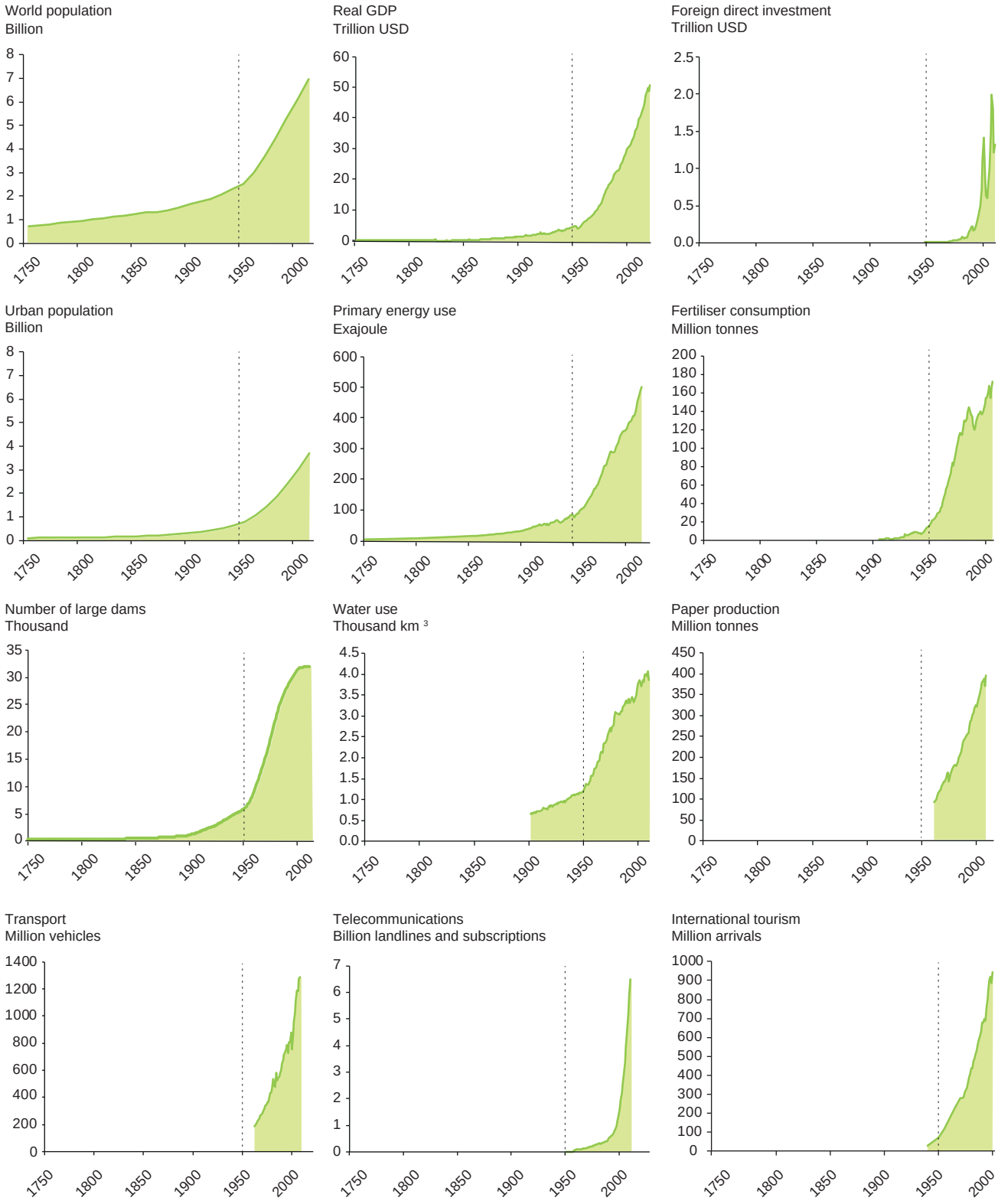
In particular, the period after the 1950s marks a unique period in human history with unprecedented and accelerating human-induced global change, which has become known as 'the Great Acceleration' (Steffen et al., 2011, 2015b) (Figure 1.1). The global human population has tripled (from around 2.5 billion to some 7.5 billion WRGD\ 81'(6$ F WKH QXPEHU of people living in cities has more than quadrupled (from less than 1 billion to

> Since the 1950s there has been unprecedented and accelerating human-induced global change, causing tremendous pressures RQ (DUWK

PRUH WKDQ ELOOLRQ 81 (6$ D\ HFRQRPLF SURVSHULW\ WHUPV gross domestic product (GDP) expanded 12-fold between 1950 and 2016 %ORWWHW DO IHUWLOLVHU FRQVXPSWLRQ of nitrogen, phosphate and potassium increased 12-fold between 1950 and 2010 (from 14.5 to 171.5 million tonnes LQ DQG SULPDU\ HQHUJ\ XVH increased by almost a factor of five from 1950 to 2008 (from 112 to 533 exajoules) (Steffen et al., 2011, 2015b). In addition, as a result of increased welfare and prosperity, international tourism is now one of the largest and fastest growing economic sectors globally with a total of ELOOLRQ LQWHUQDWLRQDO WRXULVW DUULYDOV in 2015 (UNWTO, 2017).

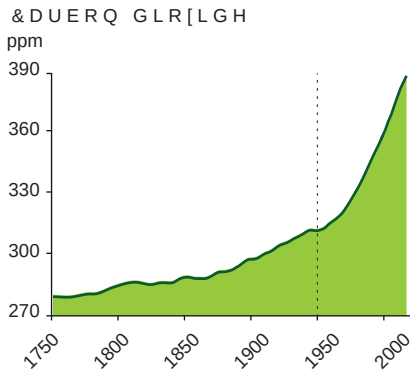
This exponential trajectory of human activity and economic growth has delivered enormous improvements in living standards and well-being for hundreds of millions of people, especially in Europe and other highly industrialised world regions. Other world regions have also benefited from this growth. For example, the percentage of the world's population living in extreme poverty LH OLYLQJ RQ OHVV WKDQ 86' D GD\ EDVHG on the US dollar exchange rate of 2011) KDV GURSSHG IURP LQ WR DERXW LQ :RUOG %DQN E 7KH prevalence of stunting among children under 5 years old due to malnutrition KDV GURSSHG IURP DOPRVW LQ WR LQ :RUOG %DQN F However, at the same time the sheer size of the global population and the intensity of human activities has caused tremendous pressures on the Earth's life support systems through climate change, biodiversity loss and changes in the chemical composition of the atmosphere, oceans and soil, etc. Change is occurring

FIGURE 1.1 Indicators for global socio-economic development and the structure and functioning of the Earth system



Note: GDP, gross domestic product.

Source: Steffen et al. (2015b).


&DUERQ GLR[LGH
ppm
390
360
330
300
270
1750
1800
1850
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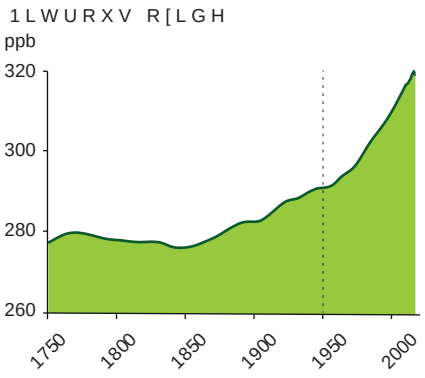
1950
2000


1LWURXV R[LGH
ppb
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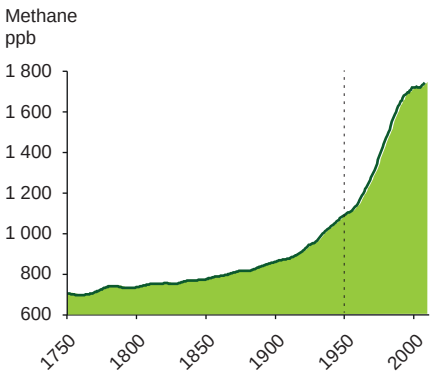
Methane
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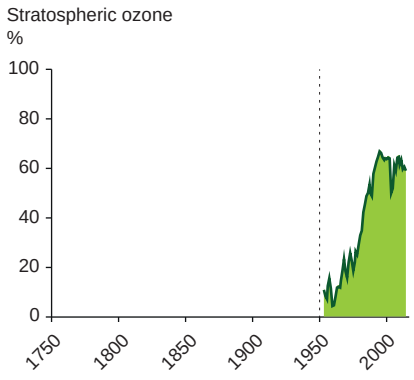
Stratospheric ozone
%
100
80
60
40
20
0
1750
1800
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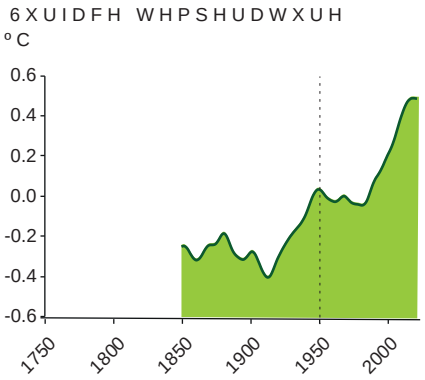
1900
1950
2000


6XUIDFH WHPSHUDWXUH
º C
0.6
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0.2
0.0
-0.2
-0.4
-0.6
1750
1800
1850
1900
1950
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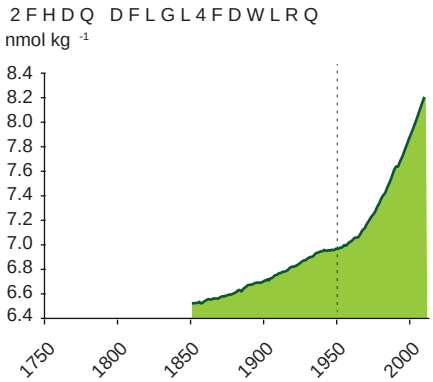
2FHDQ DFLGL4FDWLRQ
nmol kg -1
8.4
8.2
8.0
7.8
7.6
7.4
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7.0
6.8
6.6
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1750
1800
1850
1900
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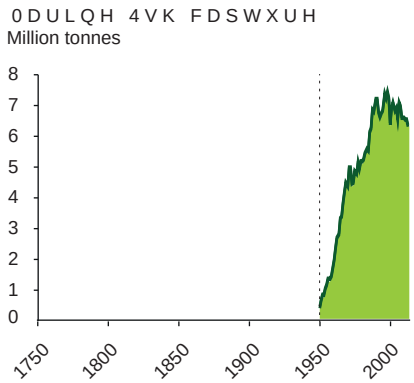
0DULQH 4VK FDSWXUH
Million tonnes
8
7
6
5
4
3
2
1
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1750
1800
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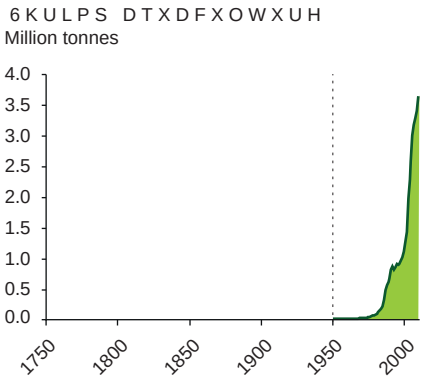
1900
1950
2000


6KULPS DTXDFXOWXUH
Million tonnes
4.0
3.5
3.0
2.5
2.0
1.5
1.0
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1750
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1850
1900
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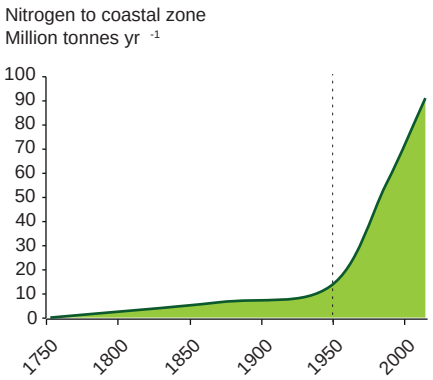
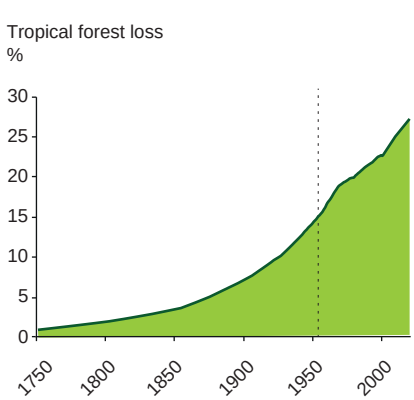
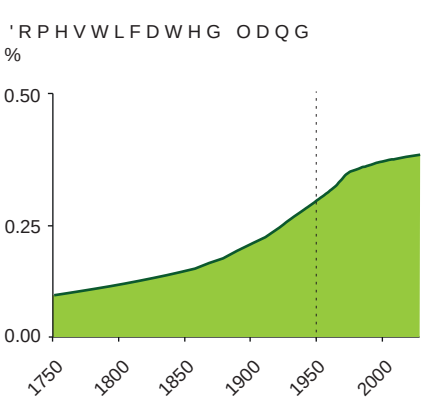
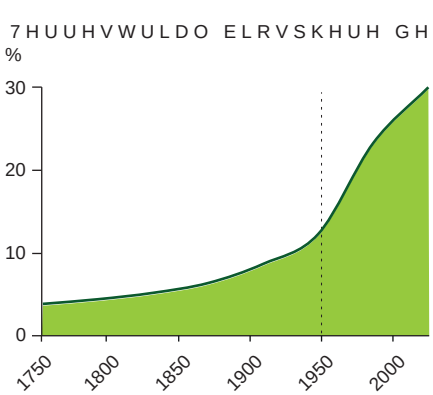
2000


Nitrogen to coastal zone
Million tonnes yr -1
100
90
80
70
60
50
40
30
20
10
0
1750
1800
1850
1900
1950
2000


Tropical forest loss
%
30
25
20
15
10
5
0
1750
1800
1850
1900
1950
2000


'RPHVWLFDWHG ODQG
%
0.50
0.25
0.00
1750
1800
1850
1900
1950
2000


7HUUHVWULDO ELRVSKHUH GHJUDGDWLR
%
30
20
10
0
1750
1800
1850
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1950
2000

The loss and degradation of our natural capital is detrimental to human development.

at a scale at which human activities have now significantly altered the Earth system from the stable Holocene to a new human-dominated epoch referred to as the Anthropocene (Waters H W b D O b

Twenty-five years after the first 'world scientists warning to humanity', 15 b b V F L H Q W L V W V Z D U Q H G second warning, stating that:

Humanity has failed to make sufficient progress in generally solving these foreseen environmental challenges, and alarmingly, most of them are getting far worse. Especially troubling is the current trajectory of potentially catastrophic climate change due to rising greenhouse gas (GHG) emissions from burning fossil fuels, deforestation, and agricultural production — particularly from farming ruminants for meat consumption. Moreover, we have unleashed a mass extinction event, the sixth in roughly 540 million years, wherein many current life forms could be annihilated or at least committed to extinction by the end of this century 5 L S S O H H W D O .

In the most recent Global risks report 2019 by the World Economic Forum, environmental risks accounted for three of the top five risks by likelihood and four of the top five by impact : ( ) b .

1.2 Unprecedented pressures R Q b S O D Q H W (D U W K

Human activities have caused consistent widespread reductions in species populations and the extent and integrity of ecosystems – 3 % (6 b 8 1 (Q Y L U R Q P H Q W The Intergovernmental Platform for Biodiversity and Ecosystem Services – 3 % (6 6 W L P D W H V W K D W R I W K H W H U U H V W U L D O D Q G F R D V W D O marine environment are now severely altered globally (IPBES, 2019). The Earth has experienced exceptionally rapid loss of biodiversity and more species are threatened with extinction now than at any other point in human history (IPBES, 2019). The abundance of wild species has declined drastically, E R W K R E D Q G D Q G Q X U R S & H K D S W H U — a phenomenon referred to as the 'Anthropocene defaunation' (Dirzo H W b D O 0 F & D X O H \ O . The mass of humans today is an order of magnitude higher than that of all wild mammals combined (Bar-On et al., 2018). Overall, evidence suggests that the sixth mass extinction of Earth's biota is already under way / H D N H Q G H Z L Q & H E D O O R V D Q G Q X U S - H Q b L W W H Q Y L V D J H et al., 2015). Across the oceans, the cumulative impacts of resource extraction and pollution have increased causing a decline in the health of marine ecosystems (IPBES, 2019). At S U H V H Q W R I J O R E D O W K W F N V are overfished (FAO, 2016), and plastic pollution is increasing, with an H V W L P D W H G b P L O O L R Q W R Q Q H V of plastic waste entering the ocean annually - D P E H H W b D O .

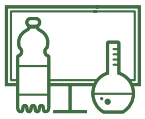
In addition to its intrinsic value, this unprecedented loss and degradation of (D U W K ' X U D E L O L W \ is detrimental to human development. Biodiversity and ecosystems and their services — the benefits people derive from nature — are fundamental for the existence of human life on Earth, through providing food and feed, fibre, H Q H U J \ - G L F L Q H Q V H U Y L F H V regulating the quality of air, fresh water and soils, regulating climate, pollination, pest control and reducing W K H S D U F H Q W X U D O D U G providing inspiration and learning, and physical and psychological experiences – 3 % (6 b & X U U H Q W W J D U G E W L Q the Earth's land surface through human activities is negatively impacting the well-being of at least 3.2 billion people (IPBES, 2018). The increasing demand for more food, energy and materials comes at the expense of nature's ability to provide such services in the future and frequently undermines many of the services that underpin almost every aspect of human well- E H L Q - 3 % (6 b 7 K D W H D Q W K D W humanity is running up an ecological debt that threatens the Earth system's ability to meet the needs of future generations and thereby jeopardises sustainable development, globally D Q G Q X U S - H Q b L W W H Q Y L V D J H G that an ambitious post-2020 global biodiversity framework will be adopted in the context of the Convention on Biological Diversity to deal with these challenges.

Likewise, many of the observed changes in the global climate system since the 1950s are unprecedented over decades to millennia and largely caused by human activities such as GHG emissions from fossil fuel burning, agriculture and deforestation (IPCC, 2013a). For example, atmospheric concentrations

([1]) In this report, natural capital is used in line with the definition in the 7th EAP, i.e. it represents 'biodiversity, including ecosystems that provide essential goods and services, from fertile soil and multi-functional forests to productive land and seas, from good quality fresh water and clean air to pollination and climate regulation and protection against natural disasters'. A structured and complete definition of natural capital was developed under the EU MAES process. This distinguishes more explicitly abiotic natural capital and biotic natural capital (i.e. natural capital in the 7th EAP) and their respective components (see also Figure 1.1 in EEA (2018)).

of carbon dioxide (CO_2) and methane (CH_4) have increased, and are projected to rise further (IPCC, 2013a). The Intergovernmental Panel on Climate Change (IPCC) confirmed that it is extremely likely that these increases in greenhouse gas concentrations due to human activities have caused most of the observed changes in the climate system (IPCC, 2013a). The global average annual near-surface temperature in the period 2006–2015 was about 0.87 °C higher than the pre-industrial average (IPCC, 2018). The minimum extent of Arctic sea ice has decreased since 1979. In many world regions, including Europe, increases in the frequency and intensity of extreme climate events such as droughts and heavy precipitation have been observed (IPCC, 2013b). Europe is also vulnerable to climate change impacts occurring outside Europe. In the coming decades, the economic effect on Europe of such impacts could potentially be very high, and Europe can expect to face challenges from increased climate-induced human migration and increased geopolitical and security risks in neighbouring regions (see EEA (2016) and Chapter 7).

Without drastic emission abatement measures in the coming two to three decades, continued global warming will increase the likelihood of severe, pervasive and irreversible consequences such as the collapse of natural ecosystems (the Arctic, coral reefs, the Amazon rainforest) and the erosion of global food security or displacement of people (IPCC, 2018). Pathways reflecting the full implementation of current mitigation ambitions, as submitted by all countries under the Paris Agreement, imply a global warming of around 3 °C by 2100 (UNEP, 2017). If this 'emissions gap' is not closed by 2030 through strong reductions in emissions, the goal of achieving a global temperature increase well below 2 °C (UNEP, 2018). In this context, the recent EU strategy for a climate-neutral economy by 2050 in Europe (EC, 2018b) is an important contribution and a step forward.



Many known pollution issues persist, while new ones are emerging.

Apart from continuing ecosystem destruction and the increasingly severe consequences of climate change, many known pollution issues persist while new ones are emerging. Pollution from plastic, electronic waste (e-waste) and chemicals are of increasing concern globally and in Europe (Chapters 9 and 10). By 2050, there could be as much plastic (by weight) as fish in the world's oceans (WEF et al., 2016), and the impact of microplastics on the food chain is expected to be substantial. E-waste, containing numerous hazardous toxins, has a current annual global growth rate of 3–4 % (Europe is the largest generator of e-waste per person (Baldé et al., 2017). The negative effects of persistent, bioaccumulative and toxic substances are increasingly recognised, but their effects on humans and ecosystems are still not well understood (Chapter 10).

A clean environment is essential for human health and well-being. Current levels of pollution are detrimental to human health, and approximately 400 000 premature deaths are estimated to occur annually as a result of pollution of air, soil, water and food globally (UNEP, 2017b). In Europe, strong reductions in air emissions or peak exposure to ozone have been achieved, but background concentrations of ozone, mercury and some persistent organic pollutants are not declining (UNECE, 2016). These concentrations are highly influenced by air pollution in other parts of the world through long-range transport and can be reduced only through internationally coordinated action (UNECE, 2016). While air quality has slowly improved in many of Europe's cities, many cities and regions still experience exceedances of the regulated limits (Chapter 8). In addition, noise is an emerging human health issue (Chapter 8). Other human pressures, such as depletion of stratospheric ozone, loss of biodiversity, etc., also adversely affect human health.

Moreover, human activities have substantially altered biogeochemical cycles. For example, the modification of the nitrogen cycle, mainly due to fertiliser use in agriculture, is far greater in magnitude than the modification of the global carbon cycle as a result of GHG emissions (OECD, 2018a). The release of excessive nitrogen into the environment contributes to eutrophication in freshwater bodies and coastal areas, and atmospheric emissions of nitrogen pose considerable human health risks (OECD, 2018a).

Ecosystem degradation and biodiversity loss, climate change, pollution loads and other global environmental challenges are intrinsically interlinked through numerous feedback loops at multiple scales. For example, increasing levels of global warming will exacerbate biodiversity loss and further erode the resilience of ecosystems. At the same time, global warming will increase the likelihood of extreme climatic events such as droughts and floods, which in turn amplify pressures on freshwater systems. These changes in turn put pressure on land resources through

When will human-induced pressures exceed environmental limits or W L S S L Q J b S R L Q W V "

aridification or increased loss of forest cover, which further contributes to accelerating climate change. These multiple interdependencies between environmental systems are intertwined with societal needs such as food production, energy security, and freshwater supply, adding an additional layer of complexity. For example, the food system is a major driver of biodiversity loss, land and soil degradation and GHG emissions and a polluter of air, freshwater and oceans through eutrophication 8 1 b (Q Y L U R Q P H Q W The systemic character of environmental challenges and their links to systems of production and consumption such as the food system will be explored further L Q b 3 D U W b

The continuation of the Great Acceleration due to rising consumption levels by a growing population raises the critical questions of whether and at what point human-induced pressures exceed environmental limits or tipping points (Box 1.1). Are there certain critical limits — for example related to global resource use, levels of pollutants and emissions, or ecosystem degradation — beyond which resilience is eroded and abrupt changes in the Earth system can no longer be excluded? In this context, the planetary boundary framework examines the tolerance levels of the Earth's life support systems and has identified climate change and biodiversity loss D V L V V X H W H U L R X F H % R [b Climate change and biodiversity loss are intrinsically linked, as they are influenced by many of the same indirect and direct socio-economic drivers. In turn, certain systemic responses such as ecosystem -based approaches are important for both climate change mitigation and adaptation as well as increasing ecosystem resilience (Chapter 17).

1.3 Drivers of change

Europe has played a pivotal role in shaping global changes over the last 50 to 70 years (Section 1.1) and is today intertwined with the rest of the world in numerous ways, for example through trade, financial flows or geopolitical processes. This means that Europe and its environment are influenced by multiple drivers of change at various scales. These can be characterised as global megatrends — large-scale and high-impact trends — (EEA, 2015) more European-specific trends or emerging trends with potentially significant impacts.

Some of the multiple and highly interconnected drivers of change are environmental and climate related, others are social, economic, technological or political. Many of the non-environmental drivers of change have strong impacts on the environment and climate and are of key importance in determining Europe's long-term environmental outlook. Therefore, drivers of change are an important part of the context for European environmental policymaking aimed at developing responses to today's systemic environmental challenges.

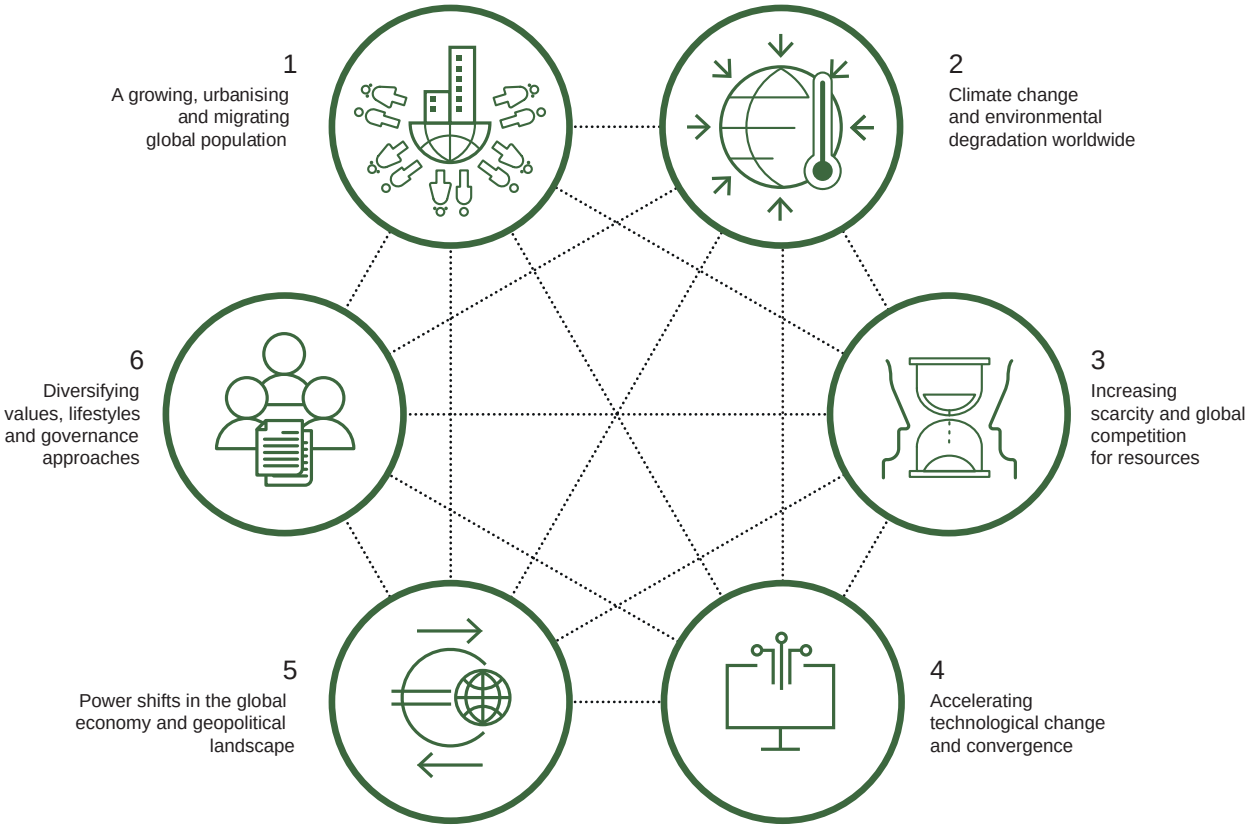
There are multiple options for identifying and grouping drivers of change into overarching thematic clusters, depending on the purpose and thematic emphasis. Possible foci can be technology (OECD/DASTI, 2016), economic aspects (WEF, 2017) or geopolitics (ESPAS, 2017). This report draws upon a synthesis of drivers of change from the perspective of Europe and its environment (EEA, forthcoming), which goes beyond previous EEA work on global megatrends (EEA, 2010, 2015) to include more European -specific trends and emerging trends. Six broad clusters of drivers of change have been distinguished (Figure 1.2). While aspects related to climate and global environmental degradation F O X V W H U V G U L Y H U V F U R V V F O X W L Q J the non-environmental clusters are briefly described below. A more detailed assessment, including potential implications on Europe's environment and society, be will provided in a forthcoming EEA report (($ b I R U W K F R P L Q J

1.3.1 Cluster 1: A growing, urbanising and migrating global population

The world population exceeded b E L O O L R Q S H R S O H D Q G L V projected to reach 9.8 billion by 2050 with most of the projected growth in developing countries (UNDESA, 2017c). In Africa, the population is projected to double from currently 1.3 billion to 2.5 billion by 2050 (Figure 1.5). On the contrary, Europe is confronted with ageing populations, albeit with differences in the projected trends among EU countries (EC, 2017b). In the 28 EU member States (EU-28), almost 35 b of the population is expected to be 60 or older in 2050 (UNDESA, 2017c). This raises questions about a shortfall in working-age adults and poses challenges for social stability, (environmental) taxation and public health systems.

Urbanisation and urban sprawl are expected to further increase globally, Z L W K S U R M H F W H G W R V K H U O G V population living in cities by 2050 F R P S D U H G W R b W R G D \ ' (6 $

FIGURE 1.2 Clusters of drivers of change



Source: EEA.

2018). Africa and Asia together are S U R M H W F W H G R X U Q D O P R V W of the estimated 2.5 billion increase in global urban population by 2050 (UNDESA, 2018). In Europe, urban growth is projected to be slower than in Asia and Africa, and the share of Europeans living in cities is estimated to U L V H U P X U H Q W U D W H U X Q G in 2050. Most European capital cities are expected to see noticeable urban growth, while other cities might contract E \ X S W R b (U R V W D W

Besides, international migration is on the rise and increasingly affects Europe. The number of international migrants increased from 170 million in 2000 to 260 million in 2017 (UNDESA, 2017a). Most international migration is voluntary and driven by economic opportunities and personal motives, but forced displacement due to armed conflicts or natural disasters is increasing. In 2017, Europe hosted about 2.6 million refugees and forced migrants (UNHCR, 2017). In the coming decades, environmental degradation and climate change are expected to become increasingly important drivers of migration (Missirian and Schlenker, 2017), However, because of the complex social, economic and environmental factors underlying migration, estimates of future migration volumes remain highly uncertain (IPCC, 2018).

1.3.2 Cluster 3: Increasing scarcity and global competition for resources

Global use of material resources increased 10-fold between 1900 and 2009 (Krausmann et al., 2009) . It has continued to rise in recent years (Figure 1.6) with projections suggesting a doubling of demand by 2060 – 5 3 b 7 K L V D L Y H U Q F H D E R X W access to key primary and secondary raw materials and poses a challenge to

% 2 ; Tipping points, critical thresholds and resilience

A tipping point is when a system reaches a critical threshold at which a small change in conditions can lead to large, abrupt changes in the function and structure of a system, shifting it from one state to another. The existence of tipping points increases the risk of such shifts given ongoing environmental degradation. These shifts are difficult to reverse and can have drastic negative impacts on society.

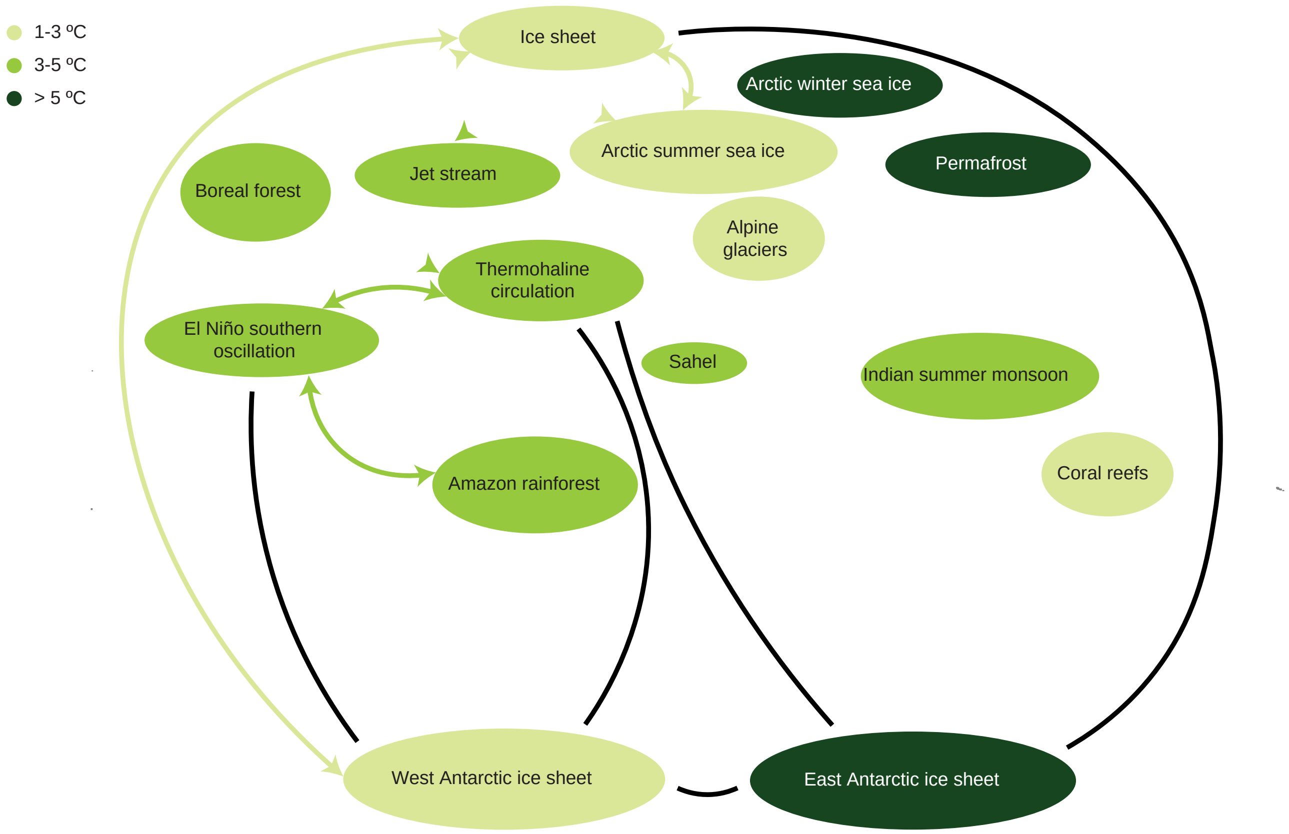
Resilience refers to the capacity of a system to absorb disturbance and reorganise while undergoing change so that it retains essentially the same function, structure, identity and feedbacks (Walker et al., 2004).

If a system has been degraded, H J bHFRVGHWUHPG DWKURXJK multiple pressures, its resilience is reduced, making the system more prone to shifting states.

The phenomenon of tipping points, critical thresholds and resilience can be found in many different systems, including natural, socio-ecological, and societal systems. An example is the collapse of the cod fishery in Newfoundland in the early 1990s, caused by a combination of overfishing and regional climatic variability 3 D W H O b H W b D O

In relation to climate change, several so-called 'tipping elements' have been identified (Figure 1.3), which are large -scale components of the Earth system, such as the Greenland ice sheet or the jet stream (Lenton H WD O / H Y H U P H QW Q + D Q V H QW O 6 W H I I H Q O 2018). The transgression of certain tipping points for these elements could trigger self -reinforcing feedback loops resulting in continued global warming even if human emissions were reduced to almost zero. It has been estimated that several of these tipping elements risk collapsing at temperature increases E H W Z H H Q G b r & D O W K R X J K uncertainties remain (Schellnhuber H W b D O 6 W H I I H Q O „

FIGURE 1.3 Potential tipping elements and cascades according to estimated thresholds in global average surface temperature



Source: Steffen et al. (2018).

% 2 ; The planetary boundary framework

The planetary boundary framework identified nine processes that regulate the stability and resilience of the Earth system — 'planetary life support V \ V W H P R F N V W U ¸ P 6 W H I I H Q et al., 2015a). The framework proposes precautionary quantitative planetary boundaries within which humanity can continue to develop and thrive, also referred to as a 'safe operating space'. It suggests that crossing these boundaries increases the risk of generating large -scale abrupt or irreversible environmental changes that could turn the Earth system into states detrimental or catastrophic for human development.

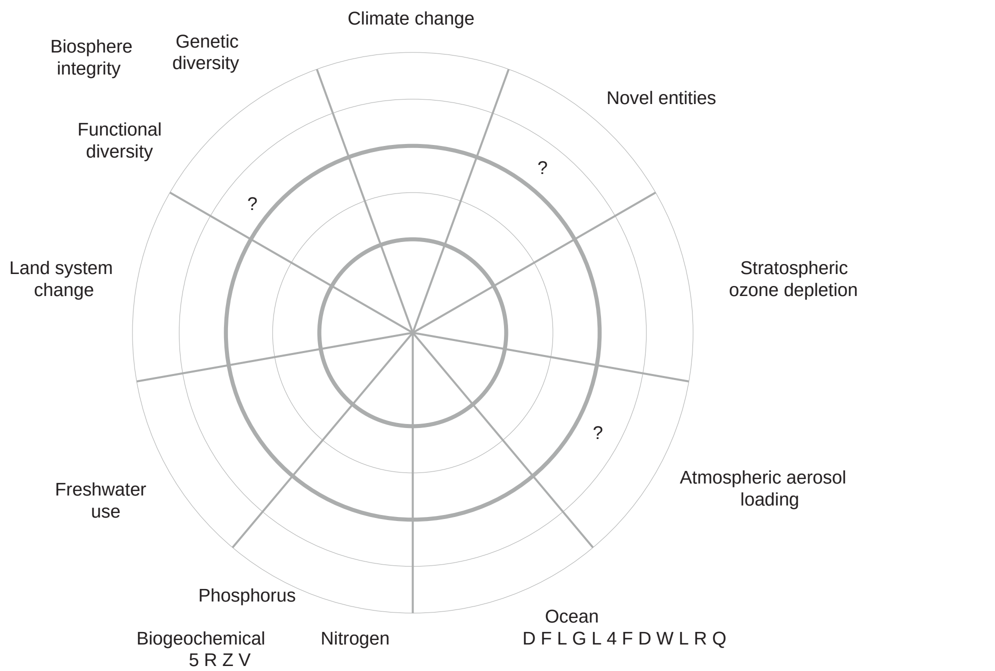
The nine planetary boundaries are: b F O L P D W H F K D Q J H b E L R V S K H U H L Q W H J U L W \ b V W U D W R V S K H U L F R] R Q H G H S O H W L R Q b R F H D Q D F L G L I L F D W L R Q b biogeochemical flows — interference with S K R V S K R U X V D Q G Q L W U R J H Q F \ F O H V O D Q G V \ V W H P F K D Q J H b I U H V K Z D W H U X V H D W P R V S K H U L F D H U R V R O O R D G L Q J (9) introduction of novel entities such as new substances or modified life forms (Figure 1.4). Loss of biosphere integrity relates to the widespread degradation of biodiversity and ecosystems with associated loss of ecosystem function, as described in Section 1.2. Two boundaries — climate change and biosphere integrity — have been identified as core boundaries, meaning that each of these has the potential on its own to drive the Earth system into a new state should they be substantially and persistently overshot and that the other boundaries operate through their influence on these two core boundaries (Steffen et al., 2015a).

Seven of the nine planetary boundaries have been quantified at the global scale by identifying control variables (e.g. atmospheric CO_2 concentration for climate change) and estimating specific limits that humanity should stay within. It is estimated that humanity has already overshot the limits that define a safe operating space for four planetary boundaries, namely those for biosphere integrity, climate change, land system change and biogeochemical flows (Steffen et al., 2015a).

Much uncertainty remains regarding some of the control variables, and the limits of the planetary boundaries represent estimates based on currently available scientific knowledge. These are likely to be further refined as scientific understanding evolves. For example, efforts to further define and quantify biosphere integrity D U H R Q J R L Q J 0 D F H H W D O 1 H Z E R O G H W b D O 7 K H S O D Q H W D U \ E R X Q G D U \ I U D P H Z R U N has been disputed by some scientists H J b 0 R Q W R \ D H W D O D Q G 5 R F N V W U ¸ P et al.'s (2018) responses). „

FIGURE1.4 The status of the nine planetary boundaries

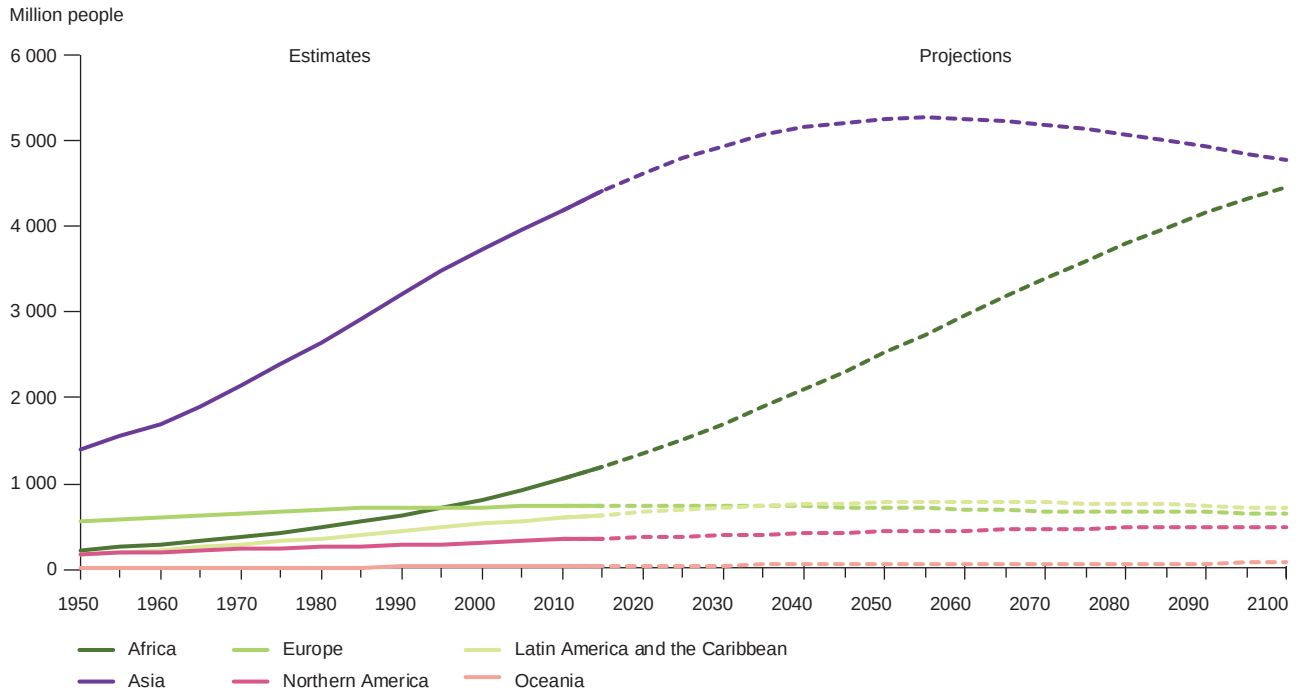
- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not \ H W T X D Q W L 4 H G



Note: % – E – L R G L Y H U V L W \ L Q W D F W Q H V V L Q G H [V 6 < H [W L Q F W L R Q V S H U P L O O L R Q V S H F L H V \ H D U V

Source: Steffen et al. (2015a).

FIGURE 1.5 Trends in total population by world region, 1950-2100



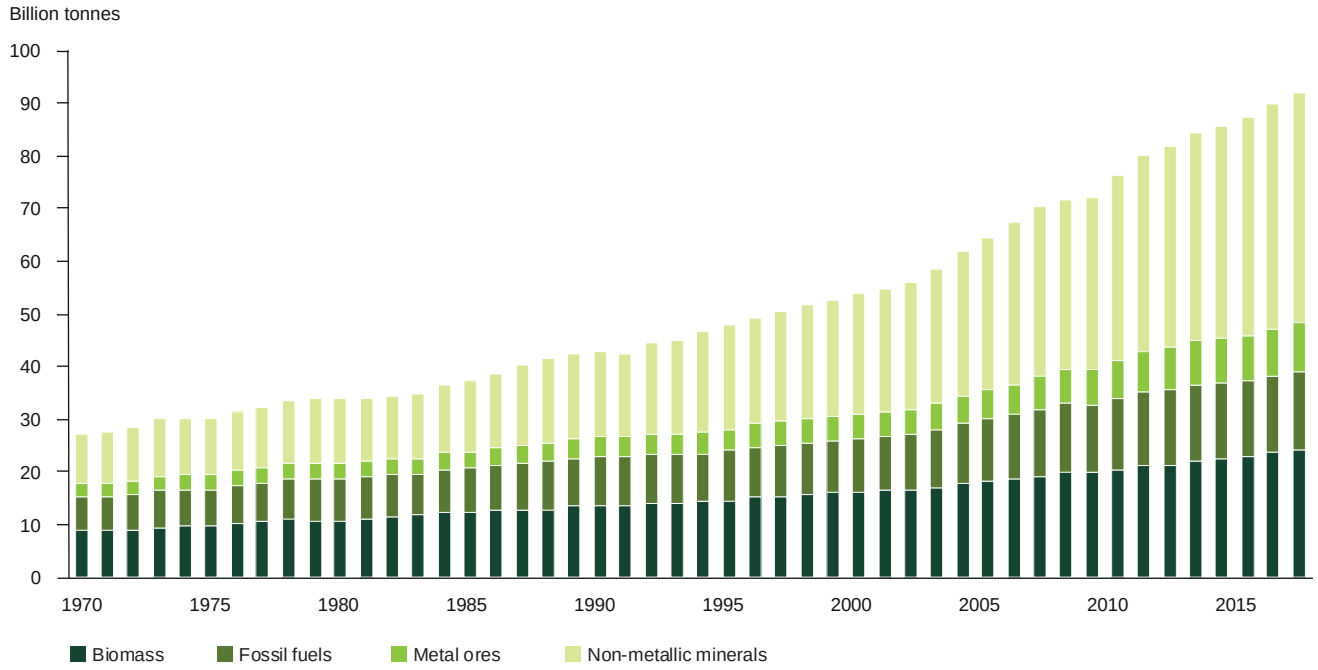
Source: UNDESA (2017b).

economies that are highly dependent on materials from international markets, such as Europe (Alessandrini et al., 2017). A list of 27 'critical raw materials' crucial for European industry — in particular green technologies — but with particular risks in terms of security of supply has been drawn up by the EU (EC, 2017a)(Chapter 9).

Likewise, global demand for land is projected to continue, in particular since 25-100 b more food would be required globally by 2050, depending on socio-economic and technical D V V X P S W L R Q W H U b H W b D O Demand for biofuels is also expected to rise (OECD/FAO, 2018), and agriculture is projected to be increasingly compromised by the combined effects of climate change and soil G H J U D G D W L R Q b 6 L Q F H b the growing global competition for arable land is reflected in a sharp increase in large -scale transnational land acquisitions, primarily in Africa, by foreign investors from Europe, 1 R U W K b $ P H U L F D V K H Middle East. As a result, large -scale P R Q R F X O W X U H V R O L O production) often replace local access to land and water 8 1 & ' – 3 % (b6 b

Similarly, global demand for water is projected to rise by 55 b until 2050, assuming a continuation of current policies and socio-economic trends (OECD, 2012). Today 1.9 billion people live in severely water-scarce regions, and this number could increase to b E L O O L R Q (UN Water, 2018). Water scarcity could impact southern Europe in particular (Veldkamp H W b D O . Likewise, global energy demand could increase by 30 b up to 2040, assuming an annual global economic J U R Z W K b and increasing energy efficiency – ($ b (X U R S H U H Q H U J \ b 54 b of all energy it consumes — and it is particularly dependent on imports of crude oil and natural gas (X U R V W D W b E

FIGURE 1.6 Trends in global domestic extraction of materials, 1970-2017



Source: WU Vienna (2018).

1.3.3 Cluster 4: Accelerating technological change and convergence

The global landscape of technological innovation is undergoing rapid transformation. Developed economies are not alone in investing in research and development (R&D). For example, China is expected to reach the same R&D intensity (i.e. R&D as a percentage of GDP) as an average Organisation for Economic Co-operation and Development (OECD) member country by 2020 (OECD, 2018c). In Europe, meanwhile, the stage between the basic discovery research and the actual commercialisation — known as the 'Valley of Death' — remains a particular challenge for fully exploiting the potential benefits of key enabling technologies (EC, 2018a).

Accelerating technological innovation is fuelled by the widespread digitalisation of economies and societies worldwide. While this can increase productivity and energy efficiency, it is not yet clear whether the energy and materials savings are enough to outweigh the negative sustainability impacts of information and communications technology (ICT) (UN Environment, 2019), such as its huge demand for critical U D Z D W H U E D V H G V W R U D J H P ICT, other technologies are increasingly penetrating societies and economies, such as artificial intelligence (AI) — the ability of machines and systems to acquire and apply knowledge and to simulate intelligent behaviour), the internet of things (IoT) — the connection over time of almost any device to the internet's network of networks — and big data and analytics. These technologies provide numerous applications and potential benefits, but they also pose risks and raise ethical concerns, for example in relation to privacy and cybersecurity.

Widespread digitalisation is also the key enabler of the 'Fourth Industrial Revolution', which fuses digital technologies with nanotechnologies, biotechnologies and cognitive sciences — a trend referred to as 'technology convergence' (OECD, E 6 F K Z D E b 7 K L L W [S H F W H G to provide opportunities for more integrated and efficient industrial processes, personalised production, new M R E Q H F R Q R P L F Z W K OECD, 2018d). However, it has been suggested that about 14 b of workers are at a high risk of having most of their existing tasks automated over the next

b \ H D U V b 2 (&G & R Q F H D Q W R exist over the implications for human health (especially from nanotechnologies and synthetic biology), and the implications for the environment are largely unknown (UNEP, 2017a).

1.3.4 Cluster 5: Power shifts in the global economy and geopolitical landscape

Global economic output increased about 12-fold in the period from 1950 to 2016 (Bolt et al., 2018). Since the 1990s, much of this global growth has been driven by emerging economies, such as Brazil, China or India, reflecting a shift in economic power. China's economy grew on average 9.5 b annually between 1990 and 2017 compared with 1.7 b in the euro area (World Bank, 2018d). Measured in purchasing power parity (PPP), which corrects for price differences between countries, China's GDP had already surpassed the United States' GDP in 2013 (OECD, 2018b). In contrast, the EU's share of the global economy (in PPP terms) could be halved between 2000 and 2050, dropping from 28 b W R lb (OECD, 2018b).

Emerging economies have also been the main driver of a fast-growing global P L G GFOOHDZ/KL FUKH D F K H GE L O O LibeQ S H R SLOQH . K D U D V b– Q contrast, Europe's middle class has contracted in most EU countries as a result of the 2008 financial crisis and structural changes in the labour market (ILO, 2016). At the same time, inequalities within countries have been rising in Europe and emerging economies (OECD, 2015). Therefore, the prospects for the global middle class are highly uncertain, and some studies suggest that their share of global wealth might decline in the coming decades, whereas the wealth of the top 1 b of the global population, which captured 27 b of total income growth in the period 1980-2016, might increase further (WIL, 2017).

In addition, geopolitical uncertainties and tensions in the global multilateral V \ V W HP PLQ F U H D (V6L3QJ b This is seen in the waning of the consensus on the benefits of globalisation and trade liberalisation, resulting in countries turning away from multilateral agreements and increasing protectionist measures (EPSC, 2018). For Europe, where exports represented more than 50 b of its GDP in 2018, this is of great concern (EPSC, 2018). At the same time, other non-state actors such as non-governmental organisations (NGOs) and multinational businesses, are increasingly challenging traditional S R Z HUUH O D W5LXRJQJV H b

1.3.5 Cluster 6: Diversifying values, lifestyles and governance approaches

In the last few decades , identities, values and cultures have changed as a consequence of globalisation, trade liberalisation (cluster 5) and digitalisation (cluster 4). In emerging economies, this has led to increasing consumption (cluster 5) and the adoption of Western lifestyles. In contrast, in developed economies such as Europe, ageing populations (cluster 1) in combination with weak economic growth F O X V WDQUBL V QQJW LRE EWV in the aftermath of the 2008 financial crisis (Eurostat, 2018a) have posed unprecedented challenges for welfare systems (EPRS, 2018), and the effects are already apparent in a shrinking middle class (cluster 5). This may lead to growing social discontent and inequality, which in turn is one of the highest obstacles to environmental sustainability (UN Environment, 2019) .

In parallel, new work patterns and lifestyles are emerging. With rapid and pervasive technological change, more jobs are likely to be automated (cluster 4) and the demand for highly skilled qualifications is expected to rise (IPPR, 2015) Although this creates new opportunities, it poses challenges for individuals, such as increasing mobility needs, and for governments to prevent mass unemployment and job insecurity. Life-long learning is becoming the norm and is increasingly supported by a diversification of educational opportunities (OECD, 2017a) At the same time, numerous forms of social innovation, such as the sharing economy, community-oriented forms of living or slow food movements, are emerging. Yet, major lifestyle-related human health challenges remain, such as cardiovascular diseases, obesity and cancer. For example, more than half of the EU's population in 2014 was estimated to be overweight (Eurostat, 2018c). These trends are now J O R EZDLOWKb R ID GGHD WLQV due to non-communicable diseases : + 2 b .

1.4 Europe's production and consumption

Global drivers of change have impacts on Europe, but, in turn , European production and consumption patterns also have implications for environmental pressures and degradation in other parts of the world. Key production-consumption systems — for example energy, mobility and food — operate across and beyond European borders. They contribute to meeting our fundamental needs, but at the same

time they are the root causes of environmental and climate pressures both in Europe and abroad.

The European economy has gone through a series of major industrial transformations during the past two and a half centuries. Since the 1950s, the structure of the European economy has shifted from an industry-intensive towards a service-oriented economy. Alongside this, consumption patterns have also changed, with proportionally decreasing spending on basic needs — for example food — and relatively more on ITCs, recreation and health & K D S W H 2 U Y L G H U E X U R S H D Q consumption levels are high compared with many other world regions . For example, the average EU-28 citizen spends 3.4 times more on goods and services than the global average (World Bank, 2018a). In that context, imports are an important component in meeting final European demand for goods and services, and trade is fundamentally important for the European economy.

The environmental consequences of European production and consumption systems can be assessed from complementary perspectives b ([2]). The territorial perspective includes environmental pressures exerted by human activities within the European territory. The production perspective expands this to include pressures arising from production by European residents (companies and households), irrespective of where geographically these activities take place, and is the methodology used in compiling European environmental -economic accounts. The F R Q V X P S W L R Q S H U V S H F W L Y H [3] complements these by relating environmental pressures to final demand for goods and services. It includes the

Europe's production and consumption patterns create environmental degradation in other parts of the world.

total environmental pressures resulting from consumption, irrespective of where geographically the production of these goods and services has resulted in environmental pressures. Therefore, the consumption perspective also includes the environmental pressures created around the world by European domestic consumption.

Reducing environmental pressures from the territorial perspective is the primary focus of most EU and national environmental and climate policies . At present, the territorial perspective is the only method accepted by international environmental law to account for a country's emissions and mitigation efforts. For example, commitments to limit or reduce GHG emissions under the Paris Agreement are implemented through 'nationally determined contributions' (NDCs). In the EU, these NDCs have to account for emissions on the territory of each Member State, thereby contributing to the collective effort to achieve the EU NDC. Similarly, such a territorial approach is also the basis for the regulation of pollution or the protection of ecosystems and biodiversity. Consequently, the territorial and production perspectives of Europe's environmental performance are captured in a large body of environmental indicators, accounts and assessments, providing an indispensable knowledge base to inform EU climate and environmental policymaking. The thematic chapters in Part 2 (Chapters 3 to 13) primarily take a territorial perspective, as they assess the environment's state, trends and prospects on the European territory.

Overall European environmental performance also has an influence beyond the borders of the EU. In an increasingly globalised world characterised by feedbacks, interdependencies and lock-ins in environmental and socio-economic systems, this is of continually increasing importance (Section 1.4). Over the last decade or so, substantial scientific progress has been made in quantifying the environmental footprints embodied in internationally traded products through approaches such as multiregional input-output databases H J H Q] H Q W V O 7 L P P H H W D O R U L F H F O H assessment approaches (Frischknecht H W b D O 6 D O H D W V O b forthcoming) Therefore, improved estimations of the environmental impacts of consumption in Europe are now available, providing a more comprehensive picture of environmental performance.

The pressures associated with final European consumption are higher than the world average, and recent research suggests that the EU is indeed a net importer of environmental impacts 6 D O O D O H W : R R G H W V O Beylot et al., 2019) . Many internationally traded goods are produced in world regions with low production costs and weak environmental regulation. The prices of internationally traded goods rarely incorporate the costs of environmental externalities, i.e. the embodied impact of the land and

([2] 7 K H D U H K U H F R Q V W L Q V S H F W W Y H U L W S U R G X F W Q R Q V X P S W L R Q S H U V S H F W L Y H methodologies behind these different perspectives can be found in an EEA report (EEA, 2013).

([3]) In this report, the term 'environmental footprint' indicates environmental p ressures or impacts directly and indirectly associated with consumption of goods and services. It should not be confused with the 'product environmental footprint' or the 'organisation environmental footprint', which are specific assessment methodologies (EC, 2013).

water used, the GHGs emitted or the biodiversity affected. Decision -makers and consumers in importing countries are often not fully aware of these displacement effects. Focusing solely on the environmental impacts within Europe without considering the additional environmental impacts abroad can result in an overly positive perception of Europe's sustainability.

The volumes of water required for the production of a commodity traded for consumption in another region is often referred to as 'virtual water'. Estimates suggest that, for example, PRUHWKDQ RIWKHZDWHUQHHGHGWR produce products consumed in Europe is used outside the EU territory (Tukker HWbDO (XURSHZLWKRQO\ERXW of the global population, was responsible IRUoYHUb RIWKHLPSRUWVLUWXDO water flows globally in 2009 (Serrano HWbDO. Likewise, the EU countries rely heavily on 'virtual land' to meet their own consumption needs related to bioenergy and food production. Recent estimates suggest that more than half of the EU's land needs (arable land, pastures, forests) are based on land use abroad <XHWbDO b 7XNNHUbHW.bDO b

Europe's impact on ecosystems outside its territory can also be illustrated by analysing the origin of biomass products consumed in Europe, such as food, fibre or bioenergy . One way to quantify the share of products from agriculture and forestry with non-EU origins is the 'embodied human appropriation of net primary production' (eHANPP) approach (Haberl et al., 2012) . (Kastner et al., 2015) found that the share of biomass products with non-EU origins that are consumed in WK(8 LQFUHDVHGIURPDERXW LQ WRb LQ 0RUHRYHUWKHLQGLFDWH

> Depending on the type of resource, the associated total environmental footprint of European consumption that occurs outside Europe is estimated to be in the range RIb

the EU's increasing dependence on Latin America as a main supplier. While the extent of associated environmental pressures at the places of origin has not yet been quantified, there is strong scientific consensus that international trade chains contribute to accelerating habitat degradation and that EU consumption exerts considerable pressure on many biodiversity KRWVSRWVJOREDOO\bMRUDQDQG Kanemoto, 2017).

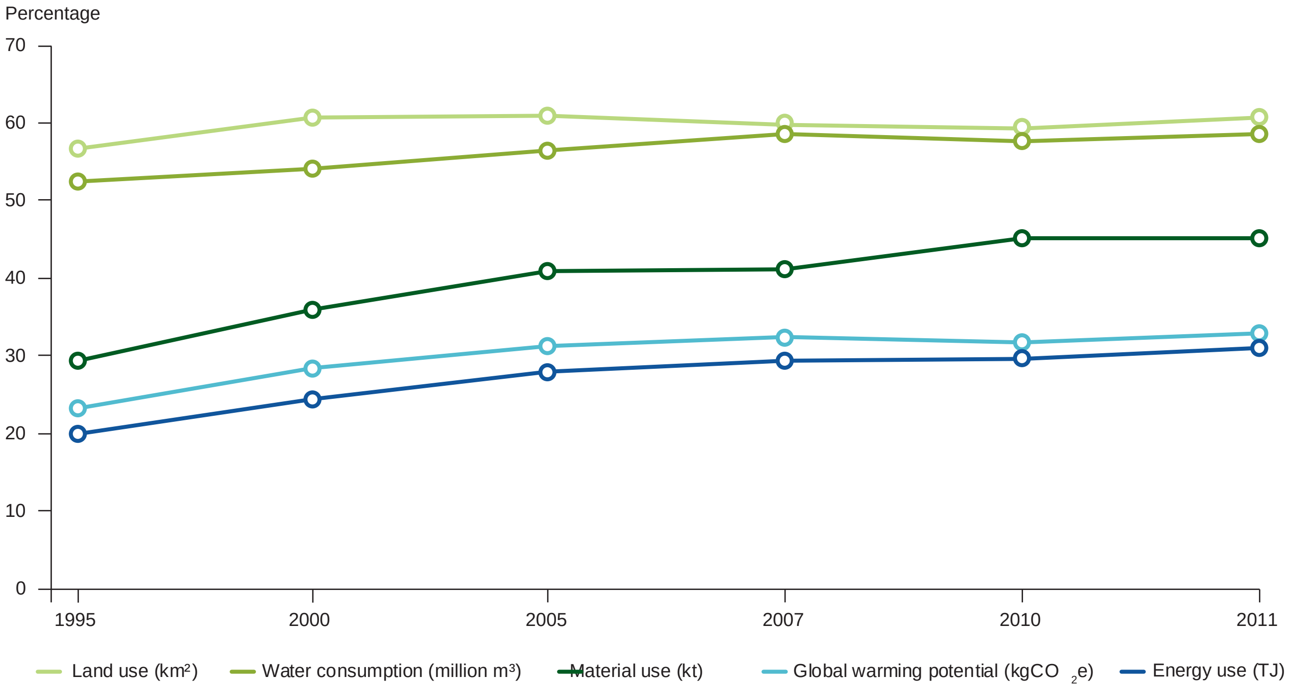
To summarise, it can be concluded that Europe is highly dependent on resources extracted or used outside Europe, such as water, land use products, biomass or other materials, to meet its high consumption levels. This means that a large part of the environmental impacts associated with European consumption is exerted in other parts of the world. In 2011, this ranged from b HQHUJ\XVHWRb ODQGXVH (Figure 1.7). Between 1995 and 2011, Europe's footprint increased across all resource or impact categories, with the largest increases being for energy use and material use (Figure 1.7). Assessing Europe's environmental performance using different but complementary perspectives provides a more in-depth understanding of Europe's sustainability challenges and opportunities. The characteristics of these challenges and the opportunities to respond to them are explored further in Part 3.

1.5 Is Europe living within the limits of the planet?

The EU's Seventh Environment Action Programme (7th EAP) sets out the 2050 vision of 'Living well, within the limits of our planet' (Chapter 2), recognising that Europe's economic development and human well-being are intrinsically linked to a resilient and healthy natural environment. In general, advanced economies in Europe and elsewhere have achieved high levels of human development (living well) but at the expense of not being environmentally sustainable (i.e. living ZLWKLQHQYLURQPHQWDOOLPLWV) (Figure 1.8).)LJXUH8 uses the ecological footprint as a proxy for environmental limits, but there are other approaches. For example, a recent analysis of seven indicators of national environmental pressures and bLQGLFDWRUVRIVRFLDORXWFRPHVRYHU 150 countries found that no country meets the basic needs of its citizens at globally sustainable levels of resource use (O'Neill et al., 2018).

Regardless of which proxies and perspectives are used, assessing whether a region lives 'within the limits of our planet' is challenging. Several studies have explored this by applying the planetary boundaries framework to examine the environmentally safe operating space at sub-global scales: one study each for Sweden (Nykvist HWbDO, South Africa (Cole, 2015) and Switzerland 'DRHWbDO and three studies for the EU +RIIbHWbDO b

FIGURE 1.7 Share of Europe's final demand footprint exerted outside European borders



Note: Geographical coverage = EU-28 plus Norway, Switzerland and Turkey.

Source: (($ D Q G (X U R S H 7 R Q & H Q W U R Q H V W H W H U L D * U V H (Q R Q R P R Z Q F D O F X O D W L R Q E D V H G R Q [L R E D V H W D G H W D O H U

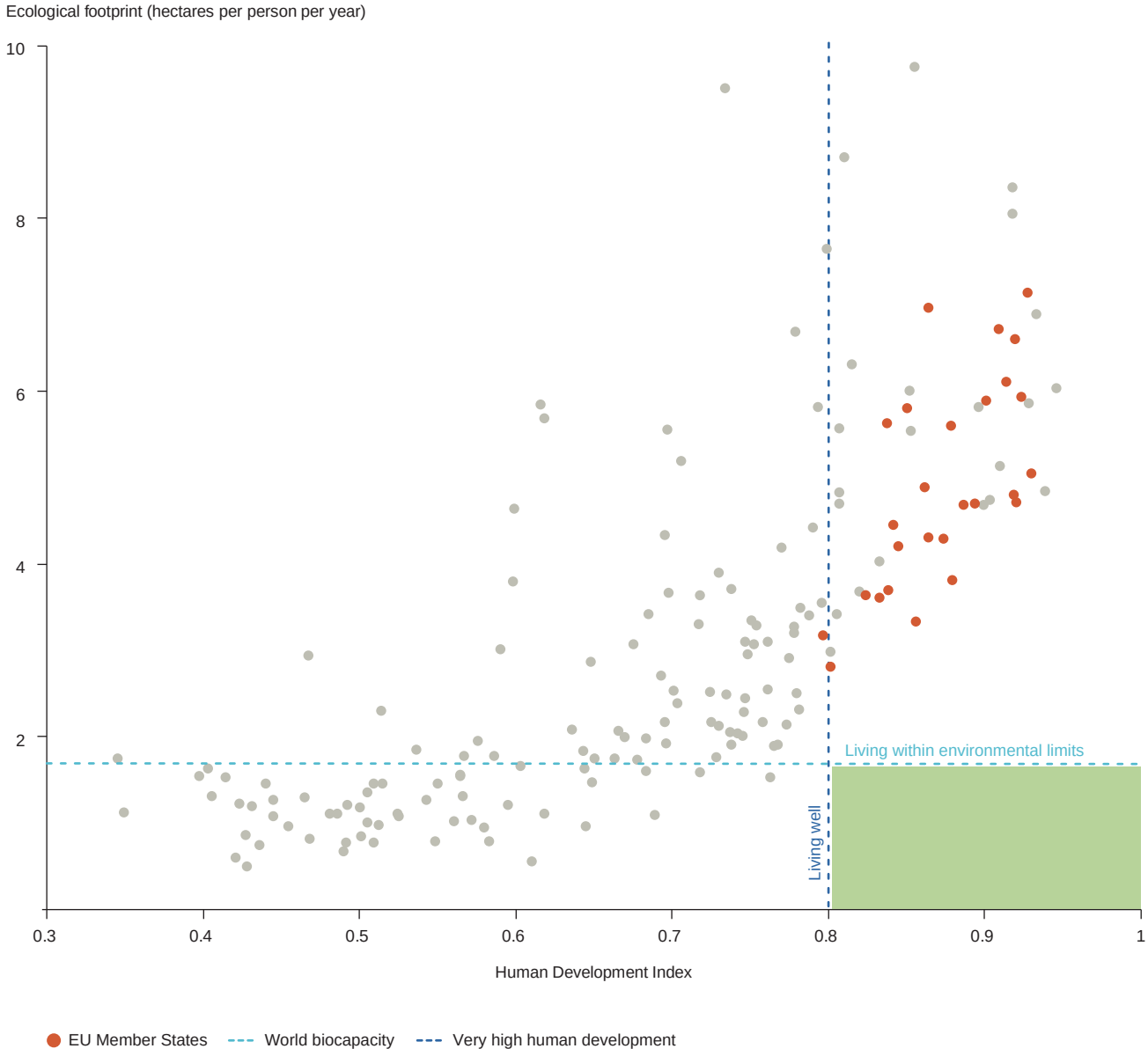
% R [H V D Q G b 7 K H L U W W H Q such an exercise is to disaggregate and allocate the globally defined limits of the planetary boundaries to specific national or European 'allowances', or 'shares', and then to measure the actual national or European performance against such 'down-scaled' allowances from a production- and/or consumption -based perspective.

Allocation of globally defined limits for planetary boundaries to national or European allowances is inevitably a normative process about responsibility for responding to and mitigating environmental degradation and about fair allocations of the global safe operating space. Most existing studies have applied a simple 'equal per capita' approach — which assumes the basic idea of equal rights for everyone — and have found large overshoots of the safe operating space for several planetary boundaries. However, there are alternative ways to define a safe operating space for a region depending on ethical and normative choices regarding aspects of fairness, (historical) responsibility, capacity to act, international burden sharing, or the right to economic development. As experiences with climate negotiations have shown, agreeing on allocations can be problematic and contentious.

Only a few attempts have been made to understand how multiple allocation principles will affect estimates of the safe operating space. A study from the Netherlands showed that, despite the large range resulting from multiple allocation approaches, most allocation results are lower than the current environmental footprints. Thus, the authors concluded that the Netherlands is not living within its safe operating space (Lucas and Wilting, 2018). Similar results have been found at the EU level based on an assessment of Europe's environmental I R R W S U L Q W b % R [

The three studies that have applied planetary boundaries to the European scale (Hoff et al., 2014) % R [H V D Q G b also concluded that Europe currently does not live 'within the limits of our planet'. Instead Europe overshoots its share of the global 'safe operating space' for several planetary boundaries, even under generous assumptions of what Europe's share of these global boundaries might be. The studies also suggest that

FIGURE 1.8 Correlation between ecological footprint and h uman development index



Note: The human development index (HDI) is calculated based on indicators of education, life expectancy at birth and wealth. It is expressed as a value between 0 and 1, from least to most developed countries. HDI scores between 0.8 and 1.0 are categorised as 'very high human development'. The ecological footprint measures how much land and water area a population requires to produce the resources it consumes and to absorb its waste. The world biocapacity is the global productive area available to produce resources and absorb waste. The HDI and ecological footprint data are from 2014.

% 2 ; Operationalising the concept of a safe operating space at the EU level — first steps and explorations

As a first step, the scientific evidence base for Europe for the following six planetary boundaries K D H H D Q Q D O \ V H F O L P D W H F K D Q J H E L R V S K H U W H J U L W \ Q G V \ V W H P F K D Q J H I U H V K Z D W H U b E L R J H R F K H P Z F O D W U R Q L F Q S K R V S K R U X V Q R Y H O W L H V (chemical pollution). Subsequently, a simple 'equal per capita' disaggregation and allocation approach was followed for those planetary boundaries for which the global limits are available and can be quantified at the European scale (climate change, land system change, freshwater use, nitrogen flows and phosphorus flow). 'Equal per capita' assumes the basic idea of equal rights for everyone and means that the European critical limits were calculated simply as a function of Europe's share of the global population D S S U R [L P D W H O \ V W H P D W L F compilation of Europe's current production- and consumption-based performance from scientific studies in relation to these planetary boundaries was used to assess whether the EU appears to be 'living within the limits of our planet'.

The study concluded that:

The EU does not appear to be 'living within the limits of our planet' for the majority of the boundaries analysed (based on equal per capita allocation approach).

Transgressions of the limits of planetary boundaries are generally higher in Europe than the global average.

Transgressions of the limits of planetary boundaries are generally higher for the consumption-based (footprint) perspective, reflecting that the EU is contributing to environmental pressures beyond its own territory due to goods imported into and consumed in the EU.

Trends over time show that decreases in Europe's territorial pressures are mostly outweighed by increasing environmental pressures in other world regions, thereby externalising the EU's environmental footprint. As a result, Europe's total consumption -based environmental performance does not show an improving trend for most planetary boundaries. „

Source: Häyhä et al. (2018).

Fundamental changes in lifestyles, production and consumption, knowledge and education are needed for Europe to transition towards sustainability.

the European overshoots of the limits are greater than the global average for most planetary boundaries.

Other studies have looked at the EU's consumption from a life cycle perspective in a planetary boundary context and similarly conclude that EU consumption is environmentally unsustainable and not within limits of the planet (Sala H W b D O . While there is considerable uncertainty on the limits of the planetary boundaries, numerous other studies employing input-output analysis largely confirm the findings that EU environmental footprints are above sustainable levels (Tukker et al., : R R G H W O .

Overall, this suggests that Europe still consumes more resources and contributes more to ecosystem degradation, both within and beyond its territory, than many other world regions. In addition, from a consumption-based perspective, Europe is more unsustainable than it is from a production-based perspective. In other words, Europe is, to an increasing degree, externalising its pressures on key environmental issues. This suggests that there is still a substantial gap between the EU's 2050 sustainability vision and current overall EU environmental performance, which will be examined in much more detail in Part 2.

This calls for fundamental and deep changes in relation to the functioning of Europe's socio -economic systems, lifestyles, education systems and institutions and to how knowledge is produced and used. Such sustainability transitions are inevitably complex and long term in character, but they require action now. Given Europe's embeddedness in globalised socio-economic structures and trade flows, new approaches and innovation will be needed. Part 3 assesses in more detail the challenges and opportunities to enable long-term transitions towards sustainability, as envisaged by the EU's 7th EAP and the Sustainable Development Goals.

% 2 ; Assessment of Europe's environmental footprint based on planetary boundaries

The study assessed whether Europe's environmental footprints are within the 'safe operating space' defined by the planetary boundaries framework by using a 'basket' of allocation approaches. It explored the implications of using four allocation principles proposed in the context of climate negotiations H J b + ¸ K K W H equality principle:

Needs: people's different resource needs due to age, household size, location of residence.

Rights to development: resource needs proportional to development level (more resources to less developed countries to enable them to meet their development objectives).

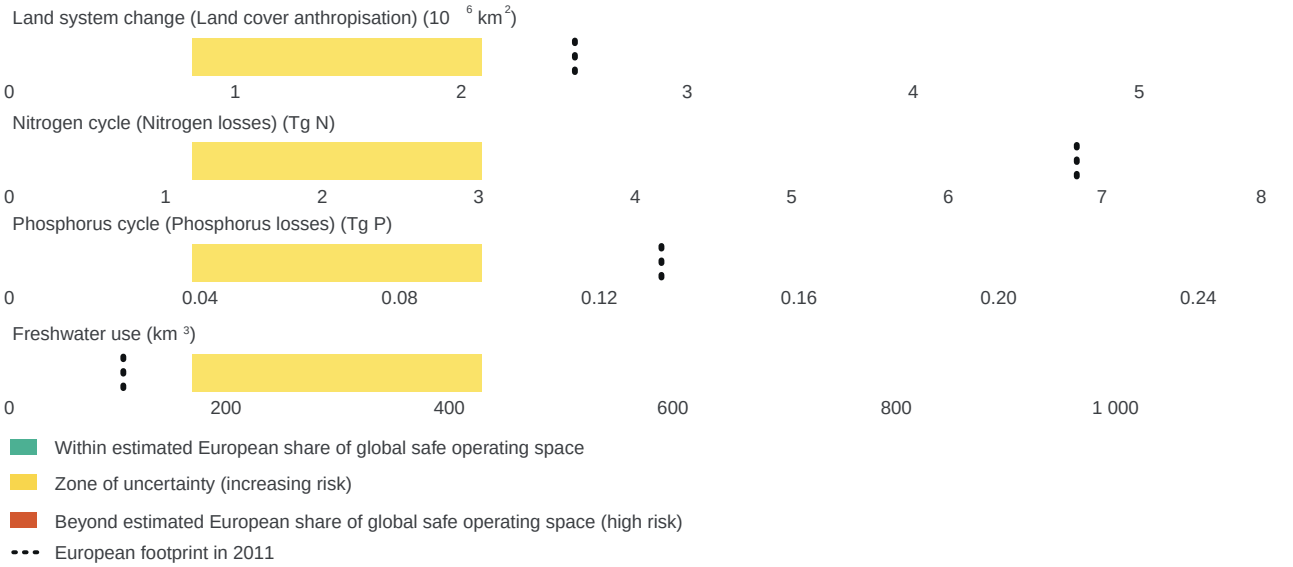
Sovereignty: resource needs as a function of economic throughput, biocapacity and land availability.

Capability: resource needs according to wealth and financial capability.

The principle of sovereignty results in the highest European share of the global safe R S H U D W L QI H G L Rthe principle of rights to development results in the lowest share (median of b 7 K H O C U R D Z Q L Figure 1.9 represents the average range across the five allocation principles, with a median R I b 7 K L V H O C U R D Z Q L the 'zone of uncertainty' to reflect the normative process of defining a European safe operating space.

This basket of allocation approach has been tested at the European scale with consumption-based footprint data (Exiobase, version 3) for three planetary boundaries: (1) land system F K D Q J H E L R J H R F K H P L R (phosphorus, nitrogen, addressed V H S D U D W H G L U H V K Z H U The results largely confirm the findings I U R P ¦ \ K ¦ H W b D O (X U R S H D Q transgressions are substantial for phosphorus and nitrogen, regardless of which allocation principle is used. The land boundary is transgressed when applying the equality, needs, rights to development and capability principles but not when using the economically determined sovereignty principle (not seen in the averaged yellow range in) L J X U H The freshwater boundary is not transgressed in Europe as a whole, regardless of which allocation principle is applied. However, this does not mean that there are not severe regional water issues, especially in southern Europe. „

FIGURE 1.9 European consumption-based performance for selected planetary boundaries



Notes: The yellow zone of uncertainty represents the average range across the six principles to allocate a European share of the global safe operating space.

The study takes a conservative approach, as it calculates the European share based on the lower end values of the global zone of X Q F H U W D L Q) R U [D P S O H K J O R E D Q X Q F H U W D L Q V b N P in Steffen et al. (2015). This study uses 4 000 km 3 as the basis for calculating the European share. In some cases (indicated in brackets) slightly different control variables have been used than in Steffen et al. (2015).

Source: EEA and FOEN (forthcoming).

02.

Europe's policies and sustainability goals

Summary

- Recognising persistent environmental and climate challenges at European and global scales, European environmental and climate policymaking is increasingly driven by long-term sustainability goals, as embedded in the EU's Seventh Environment Action Programme W K b ($ 3 Y L V L R Q W K H for sustainable development and the Paris Agreement on climate change.

- The current European environmental and climate policy landscape reflects a diversity of approaches and instruments adopted since the 1970s. European policies have evolved from targeted regulatory interventions on specific issues to a stronger focus on integrating the environmental dimension into sectoral policies and, more recently, to macro -integrated policy packages with a broader sustainability perspective.

- EU environmental policies are P D L Q O \ I U D P H G D U R X Q G W K U H H policy priorities: (1) to protect, conserve and enhance the EU's natural capital; (2) to turn the EU into a resource-efficient, green and competitive low -carbon economy; and (3) to safeguard the EU's citizens from environment-related pressures and risks to their health and well-being.

- Since The European environment — state and outlook 2015 (SOER 2015) report was published, significant policy developments have occurred around the low-carbon economy and the circular economy frameworks, in particular with the adoption of the 2030 climate and energy framework and the 2018 circular economy package, and have been complemented by an update of the bioeconomy strategy.

- Environmental and climate action is also pursued through broader institutional arrangements, such as the climate-related expenditure accounting for at least 20 % of the EU's budget for 2014-2020 and the sustainable finance initiative.

- European citizens are highly supportive of environmental protection and climate action, while cities and other local actors are increasingly proactive in launching environmental and climate initiatives that support the achievement of the EU's objectives and targets.

02.

Europe’s policies and sustainability goals

2.1 Europe’s long -term sustainability goals

2.1.1 The 2050 vision of the Seventh Environment Action Programme

Europe has increasingly recognised in its policies the unprecedented pressures caused by human activities on planet Earth and the role played by the European economy in that regard (Chapter 1). In particular, European environmental policy is aimed at ‘living well, within the limits of our planet’ . In 2013, with the adoption of the Seventh Environment Action Programme W K b (8 H Q G R U W K (8 long -term sustainability goal and turned it into a vision with a horizon of 2050 to guide its environmental action:

In 2050, we live well, within the planet’s ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society’s resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society. (8 b D

EU environment policy aims for a Europe that lives well, within the limits of our planet.

The vision reflects a greater recognition that the prosperity, health and well-being of European citizens are intrinsically linked to a resilient and healthy natural environment in Europe and also at a planetary scale, as environmental degradation elsewhere can have negative effects in Europe in many ways (Chapter 1 and Part 3). It builds on the understanding that how we live, exchange, consume or produce is deeply interconnected with our environment through a complex web of interrelationships, related to what we extract from it (e.g. natural resources, energy), what we release into it (e.g. pollutants, chemicals) or what we disrupt in its I X Q F W L R Q L Q J F O L P D W H V \ V W H P V nutrient cycles). Addressing persistent environmental and climate challenges, such as the loss of biodiversity, climate change, the degradation of ecosystems, the unsustainable management of natural resources or the adverse effects of pollution on human health, will require fundamental changes in our society and economy (EEA, 2015a) By setting a distant time horizon, the vision recognises that important and sustained efforts will be required over several decades.

The 7th EAP 2050 vision is a true sustainability vision, which goes beyond environmental issues per se. It echoes the founding principles of the international Brundtland Commission

European environmental policies increasingly driven by long-term sustainability goals.

on sustainable development (WCED, 1987), reiterated by former United Nations (UN) Secretary-General Ban Ki-moon: 'At its essence, sustainability means ensuring prosperity and environmental protection without compromising the ability of future generations to meet their needs.' (Ban Ki-moon, 2014). Those principles have long since been at the heart of the European project, with sustainable development included in the Treaty of Amsterdam as an overarching objective of EU policies (EU, 1997). Article 3 of the Treaty on European Union currently in force states that, '[The Union] shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment' (EU, 2007). The 7th EAP is one of the key policy frameworks to achieve this overall goal for the EU. Beyond setting its 2050 vision, it provides a more concrete overarching framework for shorter term objectives and targets the time horizon 2020/2030 (Section 2.3 and Part 2).

Besides, the 7th EAP vision is fully aligned with global objectives, such as the global recognition of the importance of protecting biodiversity and ensuring the provision of the ecosystem services on which human societies depend, as reflected in the 2020 Aichi biodiversity targets of the UN Convention on Biological Diversity. Since The European environment — state and outlook 2015 (SOER 2015) was published, two significant, long-term, global sustainability frameworks have been endorsed by the EU and complement the 7th EAP vision: the 2030 agenda for sustainable development and the Paris Agreement on climate change.

2.1.2 The 2030 agenda and the Sustainable Development Goals

In 2015, world leaders adopted the 2030 agenda for sustainable development, along with a set of 17 Sustainable Development Goals (SDGs) and 169 associated targets (UN, 2015b). Universal in scope, it applies to all countries at all levels of development, taking into account their 'different capacities and circumstances'. The setting of these goals built on the experience of the Millennium Development Goals (MDGs), which made an 'enormous contribution in raising public awareness, increasing political will and mobilising resources for the fight to end poverty' (EU, 2018g). Following up on the Rio+20 conference in 2012, the 2030 agenda expands the scope of the MDGs to address poverty eradication along with the economic, social and environmental dimensions of sustainability, as well as underlying issues related to institutions, governance, the rule of law, peace and international collaboration. In particular, the UN has stressed that the agenda should be viewed as an indivisible whole, in which all targets — be they of an economic, social or environmental nature — are equally important (Chapter 5).

Many SDGs embed a strong environmental dimension and have dedicated targets to progress on core environmental issues. In particular, SDG 6 (on water), SDG 14 (on oceans, seas and marine resources) and SDG 15 (on terrestrial ecosystems) advance the conservation of marine and terrestrial ecosystems and the sustainable use of their resources. Environmental sustainability is also addressed in SDG 2 (on hunger and sustainable agriculture), SDG 3 (on health and well-being), SDG 11 (on cities), SDG 12 (on sustainable consumption and production patterns) and SDG 13 (on climate change). Overall, 49 of the 169 targets address the quality of the physical environment either directly or indirectly.

Instrumental in shaping the 2030 agenda, the EU has expressed its ambition to play, together with its Member States, a leading role in its implementation (EU, 2018g). In 2016, the European Commission outlined its strategic approach and committed itself to integrating the SDGs in both its internal and its external policies (EC, 2016a). The first steps included the mapping of EU policies and actions for each SDG (EC, 2016a), the publication of an annual monitoring report on the EU's progress towards SDGs on the basis of 100 indicators (Eurostat, 2018), and the setting-up of a multi-stakeholder platform to support and advise the European Commission (EC, 2018h). In January 2019, the European Commission adopted the reflection paper 'Towards a sustainable Europe by 2030' to launch a forward-looking debate among EU citizens, Member States and other stakeholders on how to best progress on the SDGs (EC, 2019a).

Apart from the 2030 agenda, the year 2015 gave rise to several other international agreements in the field of sustainability, including the Addis Ababa Action Agenda of the Third International Conference on Financing for Development (UN, 2015c), which provides a global framework for mobilising public and private resources and investments for sustainable development, the Sendai Framework for Disaster Risk Reduction (UN, 2015a), which sets a new global approach to disaster risk management policy and operations, and, above all, the

FIGURE 2.1 The Sustainable Development Goals

Source : UN.

Paris Agreement on climate change
8 1) & & & b . E

2.1.3 The Paris Agreement

Only a few months after the adoption of the 2030 agenda, the 21st Conference R IW K3HD U W & 2 1 Vb R IW K3HQ L W H G Nations Framework Convention on Climate Change (UNFCCC) was held in 3 D UR LQ b ' H F H P E H U – QW R W D O 196 countries adopted the first-ever universal, legally binding global climate agreement, commonly referred to as the Paris Agreement, with the aim of strengthening the global response to the 'urgent and potentially irreversible threat [of climate change] to human societies and the planet' (UNFCCC, 2015a). This responds in particular to the scientific evidence compiled and reviewed by the Intergovernmental Panel on Climate Change (IPCC) (Chapter 1).

> The 2030 Agenda for Sustainable Development and the Paris Agreement are two examples of ambitious, international agreements on sustainability.

The Paris Agreement sets the ambitious goal to '[hold] the increase in the global D Y H U D J H P S H U D W X U H W R well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase W R b r R E E R Y H U H L Q G X V W U L D O Parties also agreed to '[increase] the ability to adapt to the adverse impacts of climate change' (UNFCCC, 2015b). To accomplish these goals, the Parties aim to reach a global peak in greenhouse gas (GHG) emissions as soon as possible and to achieve net zero emissions in the second half of this century.

In contrast to the previous international treaty, the 1997 Kyoto Protocol, Z K L F K R Y H U H G O H V V W K D Q I global emissions (UNFCCC, 1997), all major emitters have adopted the legally binding obligations of the Paris Agreement. However, in 2017, the

United States announced its withdrawal from the Paris Agreement, which, in practice, may become effective in late 2021 (UNFCCC, 2017). In Europe, as required by the Agreement, the EU and its Member States have submitted their joint 'intended nationally determined contributions', which will be renewed and upgraded every 5 years. In addition to existing policies (Section W K(H8 b V X S S R U W H V efforts through its European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy (EC, 2018c). The EU played an instrumental role in making the Paris $ J U H H P H Q W D W G L S O R P D W L F (EC, 2018k).

The 2030 agenda and the Paris Agreement have considerably raised the ambition of international cooperation on sustainable development. The world, not just Europe, has recognised the importance and urgency of addressing a range of persistent environmental and climate challenges in a much more proactive and coordinated way. Although recognising and agreeing on long-term V X V W D L Q D E L O L W \ W H Q G H Q F L H V and 3 will highlight the challenges faced by Europe in delivering on these commitments, as well as the potential opportunities were its responses to the challenges to evolve more fundamentally.

2.2 Europe's environmental and climate policy

2.2.1 The evolution of European environmental and climate policy

While the 7th EAP 2050 vision, the 2030 agenda and the Paris Agreement are today increasingly driving European environmental and climate policymaking, the last dates back far before these long-term sustainability goals and frameworks were set up. At first, as reflected in the first W Z R $ 3 V b (X U R S H D Q environmental policy consisted mainly of regulatory interventions focusing on specific issues such as water quality, air quality, waste disposal or species protection. The adoption of the Waste Framework Directive ((& b , the Bathing Water Directive (EEC, 1976) or the Birds Directive (EEC, 1979) represents this approach, based on the premise that targeted environmental legislation could lead to significant improvements in a range of environmental issues with relatively direct, well-identified cause -effect relationships. Since the 1970s, the replication of this intervention model led to a body of some 500 directives, regulations and decisions, which today forms the most comprehensive set of environmental standards in the world, commonly known as the environmental acquis. As a result, today European environmental policy rests on solid foundations (Box 2.1).

European environmental and climate policy rests on solid foundations.

As documented by the five previous SOERs from 1995 to 2015, this has led over the years to a measurable and substantial improvement in the level of environmental protection in most parts of Europe (EEA, 2015a). Notable achievements include a significant reduction in emissions of pollutants to air, water and soil, the establishment of the world's largest network of protected areas under Natura 2000 (EEC, 1992), the recovery of many species previously on the brink of extinction, the provision of safe drinking water, and the reduction of exposure to hazardous chemicals.

However, by the 1980s, it had become increasingly clear that such targeted policies would be insufficient to address environmental problems that result from diffuse pressures from various sources, such as the unsustainable use of natural resources, environmental impacts on human health through pollution or chemical contamination or the loss of biodiversity. At a time when Europe had set itself the goal of creating a single market (EEC, 1987) and when the sustainable development concept began to be influential (UNCED, 1992), integrating environmental concerns into other EU sectoral policies, also known as environmental integration, became increasingly sought after (Table 2.1). A key mechanism for implementation in the 5th EAP (1993-2000), environmental integration was formally established as a requirement under the Treaty of Amsterdam (EU, 1997) following a European Council initiative (known as the Cardiff process). The first five target sectors were those contributing the most to environmental deterioration: L Q G X V W U \ W U D Q V S R U W D J U L F X O W X U H R U W R X U L V P shift in approach was accompanied by an increasing use of non-legislative instruments, such as financial instruments (e.g. investment funds), economic instruments (i.e. market-based instruments to 'get the prices right'), horizontal approaches (e.g. information, education, research), and more coordination with stakeholders.

Environmental integration has been pursued to some extent through policy frameworks such as the common agricultural policy (CAP), the common fisheries policy (CFP), the cohesion policy or the EU's official development assistance, for example. Despite the soundness of this approach, and although some progress has been made (e.g. in the field of energy policy with the 2020 climate and energy package),

% 2 ; 1 Fundamentals of European environmental policy

Environmental policy is an area of shared competence between the EU and the Member States, with the principle of subsidiarity determining the most effective level of action.
The Treaties of the European Union established that EU environment policy should contribute to pursuing the objectives of 'preserving, protecting and improving the quality of the environment, protecting human health, [promoting] prudent and rational utilisation of natural resources, [and] promoting measures at international level […] and […] combating climate change' (EU, 2007).

EU environmental policy rests on four principles, as enshrined in the Treaties (EU, 2007):

- the precautionary principle, which is a risk management approach, 'whereby if there is the possibility that a given policy or action might cause harm to the public or the environment, and if there is still no scientific consensus on the issue, the policy or action in question should not E H S X U V X H G F

- the principle that preventive action should be taken, which means that environmental legislation should be adopted to prevent environmental harm and not as a reaction to environmental harm that has already R F F X U U H G

- the principle that environmental damage should as a priority be rectified at source, meaning that pollution, for instance, should be addressed where it occurs, e.g. E \V H W W H P Q V V Q R R Y L D O X H V

- the polluter pays principle, stating that a company causing environmental damage is to be held financially liable for it and must take the necessary S U H Y H Q W L - Y P H - G L F D W O L W R Q L V applies to operators of certain activities, such as transporting dangerous substances or managing extractive waste (EU, 2004).

EU environmental regulation also ensures that certain projects likely to have significant effects on the environment, e.g. the construction of a motorway or an airport, are subject to an environmental impact assessment (EIA). Equally, a range of public plans and programmes are subject to a similar process called strategic environmental assessment (SEA).

In addition, environmental policy in the EU is required to respect the Aarhus Convention (UNECE, 1998), which guarantees the right of all European citizens to access public environmental information and to participate in environmental decision-making as well giving them access to justice within the scope of environmental law.

In May 2016, the Commission launched the Environmental Implementation Review, a 2-year cycle of analysis and dialogue with Member States to improve the implementation of existing EU environmental policy and legislation (& b D D

While EU policy frameworks do not necessarily directly apply to the non-EU member countries of the European Environment Agency (Iceland, Liechtenstein, Norway, Switzerland, Turkey) or the cooperating countries (Albania, Bosnia and Herzegovina, Kosovo under United Nations Security Council Resolution 1244/99, Montenegro, North Macedonia, and Serbia), many of these countries have the same or similar environmental and climate policy objectives, and they are included in the assessment as far as possible. „

TABLE 2.1 The changing understanding of environmenta l challenges and the evolution of approaches to policy and assessment

Characterisation of key challenges	Key features	In policy since	Policy approaches (examples)	Assessment approaches and tools (examples)
Specific	Linear cause-effect, point source, local	1970s	Targeted policies and single-use instruments	Data sets, indicators
Diffuse	Cumulative causes	1990s	Policy integration, market-based instruments, raising public awareness	Data sets, indicators, environmental accounts, outlooks
Systemic	Systemic causes	2010s	Policy coherence, systemic focus (e.g. mobility system), long-term and multidimensional goals (e.g. SDGs)	Indicators, accounts, practice-based knowledge, systems assessment, stakeholder participation, foresight

Source : EEA.

% 2 ; The EU's Seventh Environment Action Program me

Since 1973, the European Commission has issued multiannual environment action programmes (EAPs) setting out forthcoming legislative proposals and goals for EU environment policy. In 2013, the Council and the European Parliament adopted the 7th EAP for the period X SW R X Q G HWUWL WLOHL Q Jb Z HQO O within the limits of our planet'. Building on a number of strategic initiatives, the programme identified three key thematic objectives:

1. to protect, conserve and H Q K D Q F HWQ OHW X FUDSO W D O

2. to turn the EU into a resource -efficient, green and F R P S H WLWLYH ORZ FDUERQ R P \

3. to safeguard the EU's citizens from environment-related pressures and risks to their health and well-being.

Four priority objectives create an enabling framework to help Europe deliver on these goals:

4. better implementation of O H J L V O D W L R Q

5. better information by improving the N Q R Z O HGJH

6. more and wiser investment in H Q Y L U R Q PHQWDO DQG VRFLDO F \

7. full integration of environmental requirements and considerations into other policies.

Two further priority objectives focus on meeting local, regional and global challenges:

8. to make the EU's cities more V X V WDL Q D E O H

9. to help the EU address international environmental and climate challenges more effectively. „

Source: Seventh Environment Action Programme (EU, 2013a).

this report indicates that this has led to mixed results, as have previous SOERs. Either environmental considerations have been insufficiently integrated into sectoral policies (e.g. for lack of incentives) or policy instruments have failed to deliver significant effects up to the scale and urgency of the challenges (Chapter 13).

Since the late 1990s, increased attention has been paid to better understanding the systemic interlinkages between the environment, society and the economy and understanding how policies could respond to them. This was reflected in the increasing orientation of the 6th and 7th EAPs (2002-2020) towards sustainability and in the search for more coherence among EU policies. This need has been reinforced with the recognition of the importance of climate change, which became the subject of a specific goal of the EU with the Treaty of Lisbon (EU, 2007).

Environmental integration into EU policy has had mixed results.

2.2.2 The current and developing EU environmental and climate policy landscape

Today, the 7th EAP (2014-2020) plays a central role and offers a coherent framework for EU environmental policies. The programme specifies an D P E LWLR XV YLVLRQ 6 H F WLR Q b sets out nine priority objectives to move towards this vision (Box 2.2) and defines a number of specific targets to be achieved by 2020 (as discussed in the chapters in Part 2). This framework builds on a number of strategic initiatives, directives and funding instruments covering almost all environmental thematic areas.

Among them, the EU biodiversity strategy to 2020 aims, through a set of six targets and 20 actions, to '[halt] the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and [restore] them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss' (EC, 2011b). The targets are aligned with the internationally agreed Aichi biodiversity targets of the Convention on Biological Diversity (CBD, 2013). For the marine environment, the ecosystem-b ased approach to management is further applied through the integrated maritime policy, the CFP and the Marine Strategy Framework Directive. A recent development in the field of nature and biodiversity is the adoption

of the EU's first-ever initiative on pollinators to address their decline in Europe and worldwide.

As regards environment and health, one of the purposes of the REACH Regulation is to ensure a high level of protection of human health and the environment, in particular through better and earlier identification of the intrinsic properties of chemical substances (EU, 2013e). This is done through the registration, evaluation, authorisation and restriction of chemicals (REACH), and the Regulation's provisions, which are underpinned by the precautionary principle.

Environmental integration is still being pursued. For example in the agricultural sector, which is responsible for many environmental pressures (Chapter 13), environmental and climate considerations have been increasingly embedded within the CAP. For the period 2014-2020, this is being implemented through cross-compliance conditions for obtaining full direct payments, greening measures to make farmers deliver environmental and climate benefits beyond cross-compliance and voluntary commitments by farmers to get additional payments under agri-environment schemes (EU, 2013d, 2013e). CAP payments for agricultural development constitute b R I W K H (8 R Y H U D O O E X G J H W the multiannual financial framework for 2014-2020 (& b . Under its Pillar 2, supporting rural development programmes, Member States have W R S H Q G D W O H D V W b R I W K H L U U H O D W H G budget on measures related to the environment and climate change P L W L J D W L R Q D Q G U H S U H V H Q W V D E R X W R I W K H (8 E X G J H W (8 5 b E L O O L R Q I R U the period 2014-2020, making it a very important funding instrument, which may potentially influence the trends in environmental pressures from agriculture (Chapter 13).

The 7th EAP establishes a coherent policy framework for EU environmental policies.

Other funding instruments support the implementation of European environmental and climate policy. The LIFE programme is the EU's financial instrument supporting environmental, nature conservation and climate action projects throughout the EU (8 b . Since 1992, the LIFE programme has co-financed D O P R V W b V P D O O S U R M H F W V developing innovative approaches for environment and climate action. For the period 2014-2020, the LIFE programme contributes approximately (8 5 b E L O O L R Q . EU funding instruments V X F K D V W K H (X U R S H D Q Regional Development Fund (ERDF) and the Cohesion Fund provide funding for the protection of the environment, although these instruments are primarily focused on other policy priorities. The European Maritime and Fisheries Fund has a strong focus on sustainable fish stocks, fuel-efficient fishing and reduced environmental impacts, among other priorities.

More recently, the ambition of the W K b ($ 3 K D V V X S S R U W H G D F K D Q J H of policy packages, which are more integrated at the macro-economic level and attempt to better address the long-term, systemic interlinkages between the environment, society and the economy. In particular, since the publication of the previous SOER, significant policy developments have arisen around three frameworks highly relevant for the environment and F O L P D W H W K H O R Z F D U E R Q H F R Q R P \ W K H F L U F X O D U H F R Q R P \ D Q G W K H bioeconomy.

In line with the Paris Agreement, the EU has set for itself ambitious climate- and energy-related targets in order to move towards a low-carbon economy by 2050. The long-term objective proposed by the European Commission is to achieve a U H G X F W L R Q L Q * + * H P L V V L R Q V b by 2050 compared with 1990 levels (EC, 2011a). In 2018, the European Commission raised its ambition with the publication of the European strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy for 2050, which shows how Europe could lead the way to climate neutrality while ensuring a socially just transition (EC, 2018c). Building on the '20-20-20 targets' set for 2020, the EU has committed, through its 2030 climate and energy framework, to reduce * + * H P L V V L R Q V W R D W O H D V W b E H O R Z 1990 levels by 2030, while improving H Q H U J \ H I I L F L H Q F \ W R D W O H D V W b D Q G increasing the share of energy from U H Q H Z D E O H V R X U F H V W R D W O H D V W b R I final consumption (European Council, (8 D E.

EU action relies on the EU Emissions Trading System (ETS), a 'cap and trade' mechanism for GHG emissions from Q H D U O \ L Q V W D O O D W L R Q V power stations, etc.) across the EU, on the Effort Sharing Regulation (8 b , H which sets binding annual targets for reducing GHG emissions for 2030 for each Member State in sectors not F R Y H U H G E \ W K H (7 6 H J b W U D Q V S R U W waste, agriculture and buildings), and on the LULUCF Regulation (EU, 2018d) committing Member States to ensure that GHG emissions from land use, land use change and forestry (LULUCF) are offset by at least an equivalent removal of CO_2 from the atmosphere in the period 2021-2030. These commitments are to be considered within the broader perspective of the Energy Union Strategy (EC, 2015b), which addresses


k %RMDQ %HQFHF :DWHU

environmental and climate dimensions along with issues of security, affordability, market integration, and research, innovation and competitiveness.

7 K H bRegulation on the Governance of the Energy Union and Climate Action establishes a unique framework for cooperation between Member States and the EU, building on integrated national energy and climate plans, EU and national long-term strategies, and integrated reporting, monitoring and data publication (EU, 2018f). In addition, these mitigation efforts are complemented by the EU adaptation strategy on climate change (EC, 2013), which aims to make Europe more climate resilient by enhancing the preparedness and capacity to respond to the impacts of climate change (Chapter 7) and which has recently been evaluated positively (EC, 2018i). The online European Climate Adaptation Platform, Climate-ADAPT, plays a central role in improving informed decision-making for climate change adaptation across Europe (($ b D (Q&G .

The concept of a circular economy has recently gained traction in European policymaking as a solutions-oriented perspective for achieving economic development within increasing environmental constraints (EEA, 2016). A circular economy aims to maximise the value and use of all materials and products, reducing the dependency on primary raw GHG emissions, thus contributing to moving towards a low-carbon economy. In 2015, the European Commission adopted its circular economy package, which includes an EU action plan for the circular economy (EC, 2015a), setting out a number of initiatives aiming at closing the loop of product life cycles, primarily through greater recycling. The package also led to the revision of six waste directives with new waste management targets regarding recycling and preparing for reuse and landfilling (Chapter 9). In 2018, the European Commission adopted complementary

Major policy developments have occurred around the frameworks of the low-carbon economy, the circular economy and the bioeconomy.

measures in its 2018 circular economy package, including a strategy for plastics that sets the goal that 'by 2030, all plastics packaging will have to be reusable or recyclable in an economically viable manner', and sets up a monitoring framework to record progress towards the circular economy at EU and national O H Y H (& Vb D b E

While not being an environmental policy per se, a third framework of particular relevance to the environment and climate has gained momentum during the last decade. The EC (2012) defines the bioeconomy as 'the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy' and states that it aims to optimise the use of biological resources for ensuring food security, managing natural resources sustainably, reducing dependence on non-renewable resources, mitigating and adapting to climate change, and creating jobs and maintaining European competitiveness. The EU launched its bioeconomy strategy in 2012 to stimulate knowledge development, research and innovation, bring together stakeholders, create markets, and streamline existing policy approaches in this area (e.g. the CAP, the CFP, Horizon 2020, the Blue Growth initiative). Building on the conclusions of the 2017 review (EC, 2017b), the 2018 update of the bioeconomy strategy aims to accelerate the development of a sustainable circular bioeconomy, through strengthening, scaling up and spreading bio-based innovations across Europe, while paying more attention to ecological limitations (EC, 2018b).

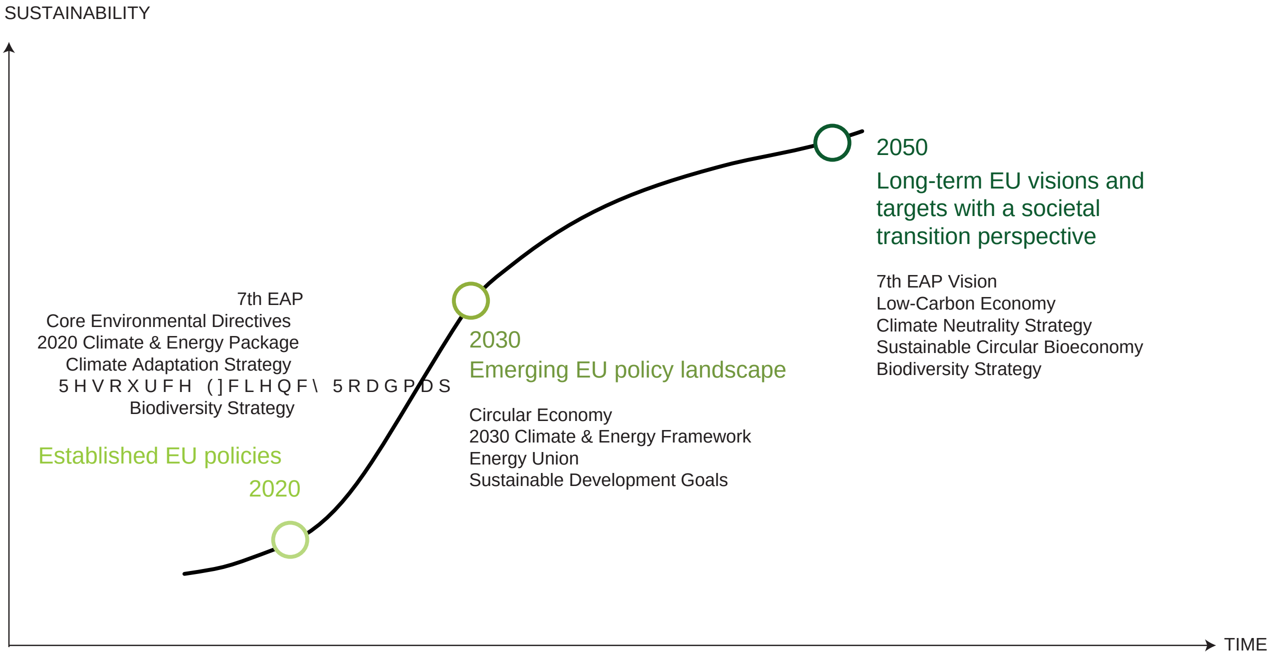
Overall, the EU environmental and climate policy landscape aims to address the short-, medium- and long-term time horizons through a range of policies, strategies and instruments that increasingly connect the environmental, social and economic dimensions of V X V W D L Q D E L O L W \ R Z H Y H U the ambition of the 7th EAP vision and frameworks such as the low-carbon economy, the circular economy and the bioeconomy is such that it implies fundamental societal transitions to transform key production-consumption systems (Part 3). While policy interventions can trigger the change needed, such ambition will ineluctably question our collective ways of living and thinking. One positive sign is the increasing awareness and concern around environmental and climate challenges across society.

2.3 The context of Europe's governance

2.3.1 Environmental and climate mainstreaming in EU institutions

In addition to adopting policies, the EU institutions have started to embed environmental and climate dimensions in a number of ways, which reflects an increasing recognition of sustainability challenges. For instance, the multiannual financial framework, the EU's budget for 2014-2020, had the objective of ensuring W K D W D Vb W R W K (8 V E X G J H W allocated to climate-related expenditure (EU and Euratom, 2013). Based on the current trend, climate-related spending L V U M H W D F H G X Q R 8 5 b billion or 19.3 b R I W K (8 V S H U D W L R Q D O spending commitments (& b M and climate change adaptation and mitigation have been integrated into all major EU spending programmes.

FIGURE 2.2 The emerging EU environmental and climate policy landscape



Source: EEA.

It remains difficult to monitor the EU's budget contribution to other environmental areas due to its degree of dispersion. It is, however, estimated that, for example, 8 b ZLOO EH DOORFDWHG to protect biodiversity over the period 2014-2020 (EC, 2018j).

EU regional policy, which is the EU's main investment policy with a budget RI (85 b ELOOLRQ IRU WKH SHULRG 2014-2020, contributes to improving the environment and moving towards a low-carbon economy in Europe.)RU LQVWDQFH (85 b ELOOLRQ RI WKH ERDF and the Cohesion Fund are to be invested in the transition to a low-carbon economy in the period 2014-2020, twice the amount spent in the period 2007-2013. From a research and innovation perspective, +RUL]RQ UHVHDUFK VHUYHV LQ IXQGLQJ DQ RI (85 b ELOOLRQ DYDLODEOH for the 2014-2020 period to tackle a number of societal challenges highly related to the environment (8 b E It has also established climate action and sustainable development as cross-cutting objectives and set expected H[SHQGLWXUH WDUJHWV IRU FOLPDWH DFWLRQ WDUJHWV IRU sustainable development.

> The ambitious EU vision requires fundamental societal transitions.

Besides, the European Commission is increasingly looking at how to integrate sustainability considerations into its financial policy framework, in particular within the context of the Capital Markets Union. Indeed, it estimated that an LQYHVWPHQW JDS RI (85 b ELOOLRQ SHU year needs to be filled to achieve the EU's 2030 targets set out in the Paris Agreement (EC, 2017d). Following the recommendations of a high-level expert group, the Commission adopted an action plan on sustainable finance in March 2018, which was followed by the first set of measures to facilitate sustainable investments (EC, 2018d).

An initiative is also ongoing to 'green' the European semester. The European semester is a mechanism to improve the coordination of economic and budgetary policies in EU Member States. While it was created with the aim of monitoring the implementation of the Europe 2020 strategy (EC, 2010), which includes economic, social and

environmental targets, the semester has mainly focused on macro-economic aspects, relying in particular on the GDP (gross domestic product) indicator. Following the integration of key social and employment indicators in the semester scoreboard, the ambition is now to embed environmental indicators to assess the sustainability of the progress made.

The EU has also set in motion Copernicus, its Earth observation programme (EC, 2017d). With seven dedicated satellites in orbit (so far), complemented by contributing missions, in situ sensors, numerical models and related services, it aims to provide full, free and open data daily to public and private users to allow a better understanding of and response to environmental and climate challenges. This includes monitoring of the atmosphere, the marine environment, land use and climate change.

2.3.2 Environmental and climate action across scales of governance

Environmental and climate action in the EU is not limited to the interventions of EU institutions and Member States. The scale of environmental and climate challenges calls for a whole-of-society approach in which all citizens and scales of governance across the EU have a role to play (EEA and Eionet, 2016). As annual Eurobarometer surveys show, support for environmental protection from European citizens has remained high across all Member States over the years, despite the socio-economic impacts of the 2008 financial crisis, and nearly 9 out of 10 Europeans b D J U HH WK DW WKH\ DOVR SOD\ role in protecting the environment (EC, 2017c) This allows more proactive environmental and climate interventions by EU institutions and Member States and closer engagement

> European citizens are highly supportive of environmental protection and climate action.

of citizens and local stakeholders in supporting their actions.

It is increasingly recognised that ‘ cities are key players in implementing the EU’s goals in terms of a low-carbon H F R Q R P\ DQG H V R XUFLHQF \ They are crucial in improving waste management, public transport, water management and, through integrated urban planning, the efficient use of land.’ (EEA, 2015b) Acknowledging this key role, the EU is supporting a range of initiatives fostering networking of cities and local authorities , in line with the eighth objective of the 7th EAP. Ten years after its launch in 2008, the Covenant of Mayors for Climate & Energy brings together more than b O R FDQQQH J L RDQXDWK R U L W L Apv representing more than 250 million citizens across Europe to help meet the EU climate and energy objectives (Covenant of Mayors, 2019) . The initiative was embedded in the field of climate change adaptation with the setting up of Mayors Adapt, a subset of the Covenant of Mayors initiative, to engage cities in taking action to adapt to climate change (Mayors Adapt, 2015) .

Other urban initiatives supported by the EU are the urban agenda for the EU , which includes the aim of strengthening the resilience of urban settings through preventing disaster and climate-related risks, in line with the UN new urban agenda (8 W K5H I H U H Q F H Framework for European Sustainable Cities, which seeks to give all European cities practical support and a network to share information on moving towards sustainable urban development (RFSC, and the European Green Capital Award and European Green Leaf Award, which recognise and reward efforts to improve the environment, the economy and the quality of life in cities (& b . J

Companies are also increasingly concerned about environmental and climate challenges, because the latter can potentially disrupt their supply and value chains (e.g. through climate-related weather events), their profit margins can increase thanks to resource and energy efficiency, eco-innovation creates new markets or they are simply pushed to be more environmentally -friendly by their customers. Several approaches supported by the European Commission help companies that are willing to further integrate the environmental dimension into their business models. For instance, the EU Eco-Management and Audit Scheme (EMAS) is a management instrument for European companies and other organisations to evaluate, report and improve their environmental performance. As of April 2018, the EMAS Network counted b R U J D Q L V D WL R QV L W H V (EC, 2018f). Through green public procurement, Europe’s public authorities can also strengthen the demand for more sustainable goods and services, and therefore stimulate eco-innovation (EC, 2019b). Besides, corporate social responsibility , which refers to companies taking responsibility for their impact on society, also involves meeting environmental product requirements (EC, 2018e) The UN Global Compact , an initiative asking business to actively address environmental risks and opportunities, has a strong foothold in Europe where it has the largest total number of participants compared with other regions (UN Global Compact, 2018). Businesses, industries and their representatives are also key stakeholders within the Commission -led multi-stakeholder platform on the SDGs, the Circular Economy Stakeholder Platform, or the Bioeconomy Stakeholders Panel.

PART 2

Environment and climate trends

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 5 Largely on track
Trends/developments show a mixed picture	Year … Partially on track
Deteriorating trends/developments dominate	Year 6 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

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 FRQVHUYDWLRQ VWDWXV DW b IRU VSHFLHV DQG b IRU KDELWDWV %LRGLYHUVLW\ ORVV 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 GHFOLQHV LQ IDUPODQG ELUGV b DQG JUDVVODQG EXWWHUIOLHV b

- There has been progress in some areas, such as the designation of protected areas: the EU Natura 2000 QHWZRUN QRZ FRYHUV b RI ODQG DUHD DQG DOPRVW b RI ZDWHUV PDNLQJ LW WKH ZRUOG'V ODUJHVW network of protected areas.

- (XURSH V ELRGLYHUVLW\ 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 QDWXUH V EHQHILWV WR SHRSOH and society, 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 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 HQKDQFHG SXEOLF DZDUHQHVV and 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	5 Largely on track
EU protected species and habitats	Trends show a mixed picture	Developments show a mixed picture	6 Not on track
Common species (birds and butterflies)	Deteriorating trends dominate	Deteriorating developments dominate	6 Not on track
Ecosystem condition and services	Deteriorating trends dominate	Developments show a mixed picture	6 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 DUH D SDUW RI WKH QDWXUDO FDSLWDO (& b (8 b GHOLYHULQJ QXPHURXV HFRV\VWHP services — or nature's contributions to SHRSOH –3%(6 b 7KH\ DUH PDQ\ and varied and include provision of food, pollination, carbon sequestration, mitigation of natural disasters, recreation and spiritual values, among many others (8 (& –3%.(6 b

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 SURGXFWLRQ DQG FRQVXPSWLRQ &KDSWHU 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 E\ WKH UHFHQW —33%(6 b UHSRUW & K D S W H U The conclusion is that GHVWUXFWLRQ DQGbORVV RI ELRGL and nature is as catastrophic as FOLPDWHbFKDQJH

The impact of Europe's alarming rate of biodiversity loss is as catastrophic DVbFOLPDWH FKDQJH

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 –3%(6 are land use change, including habitat loss, fragmentation and degradation, as well as climate change, extraction of natural resources, pollution and invasive DOLHQbVSHFLHV

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 &%' b , and the Bern Convention &RXQFLO RIb(X. The Strategy WR bUHIOHFWV WKH FRPPLWPHQW taken by the EU in 2010 at global level in the scope of the strategic plan for biodiversity 2011 -2020, including 20 Aichi ELRGLYHUVLW\ bWDUJHWV

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 XVH RI JUHHQ LQIUDVWUXFWXUH VHFWRUV DJULFXOWXUH IRUHVWU\ 3.3 LVKHULHV LQYDLYH DOLHQ VSHFLHV DQG (8 LKeytrends and outlook biodiversity. The Seventh Environment $FWLRQ 3URJUDPPHb WKb 3333 IXOO\ 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, H J b:DWHU)UDPHZRUN 'LUHFWLYH’s protected areas Directive, Marine Strategy Framework 'LUHFWLYH FRPPRQ ILVKHULHV Management approach). The common agricultural policy (CAP), National Emission Ceilings Directive, climate change-related policies, Europe’s bioeconomy strategy and cohesion SROLF\ &KDSWHUV DQG b 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.

%LRGLYHUVLW\ ORVV KDV VLJQLILFDQW environmental, economic and VRFLDO FRQVHTXHQFHV

Terrestrial protected areas

y 6HHb7DEOHb

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 FXOWXUDO bYDOXH

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 b of sites are less than 1 b000 b K D DQG are less than 100 b K D (((E 7KLV UHIOHFWV WKH 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 (((E

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 UHVHUYHV 5DPVDU DQG 81(6&2 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 1DWXUD b VLWHV LV D FHQWU of the EU 2020 biodiversity strategy headline target and 2050 vision as well as the global Aichi biodiversity target b11, which aims to conserve at least 17 b of terrestrial and inland water areas by 2020 and ensure that those areas are well connected and HIILFLHQWO\ PDQDJHG 1DWXUD stimulated a remarkable increase in the area protected in Europe, and presently the network covers RI WKH b0HPEHU 6WDWHV (8 V WHUUHVWULDO DUHD ZL DURXQG b ((($LWHVF Together with marine Natura 2000 sites, the network encompasses nine terrestrial biogeographical regions and five marine regions (Figure 3.1) (((b F

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 QDWLRQDO ERUGHUV :KLOH WKH 2000 network targets particular species and habitats, other species also benefit from the establishment of sites, in the so-called ‘umbrella effect’ Y DQ bG H U 6 O X L S b H W b D Q estimated that there are between 1.2 and 2.2 billion

TABLE 3.1 Overview of selected policy objectives and targets

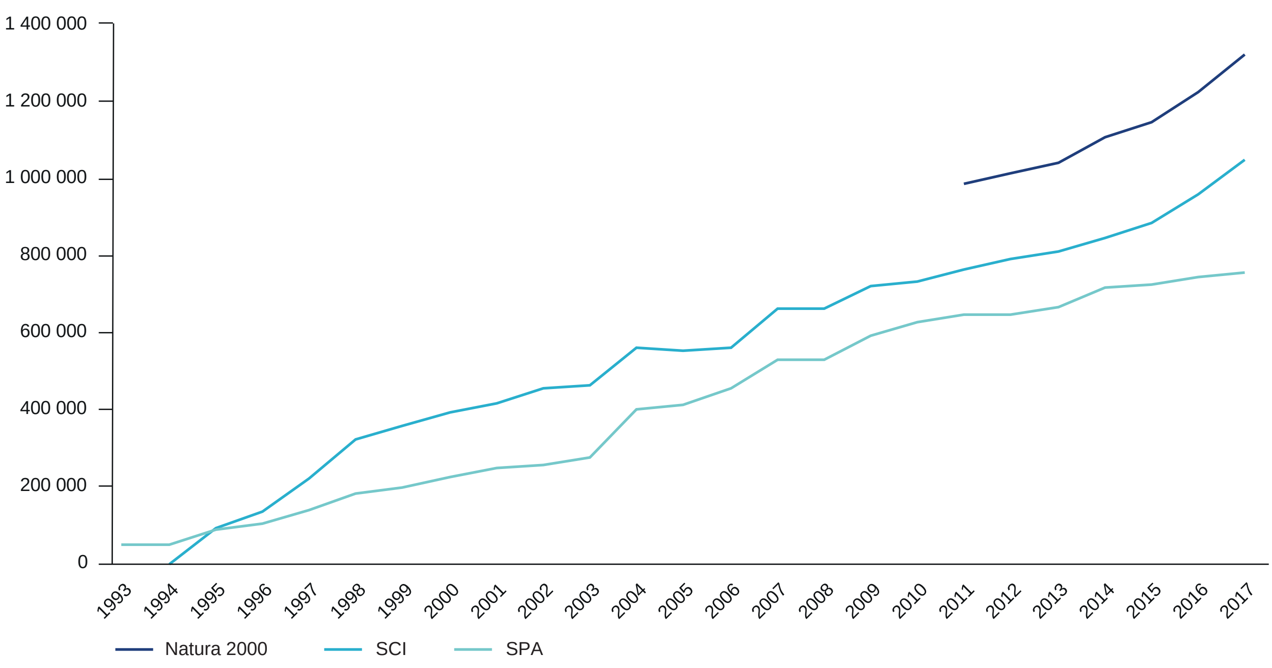
Policy objectives and targets	Sources	Target year	Agreement
Biodiversity and ecosystems			
Biodiversity and the ecosystem services it provides — its natural capital — are protected, valued and appropriately restored for their intrinsic value and essential contribution to human well-being and economic 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 (8 bQDWLRQDO (8 ELRGLYHUVLW\ VWUDWHJ\ WR 7DUJHW $FWLRQ SODQ IRU QDWXUH people and the economy	2020	Legally binding and non-binding commitments
Maintain and restore ecosystems and their services	EU biodiversity strategy to 2020, 7DUJHW WK ($3 6'*	2020	Non-binding commitment
Achieve more sustainable agriculture and forestry	EU biodiversity strategy to 2020, 7DUJHW WK ($3	2020	Non-binding commitment
Make fishing more sustainable and seas healthier	EU biodiversity strategy to 2020, 7DUJHW WK ($3	2020	Non-binding commitment
Combat invasive alien species	5HJXODWLRQ RQ LQYDVLYH DOLHQ VSHFLHV (8bELRGLYHUVLW\ VWUDWHJ\ WR 7DUJHWV DQG WK ($3	2020	Legally binding
Help stop the loss of global biodiversity	EU biodiversity strategy to 2020, 7DUJHW WK ($3	2020	Non-binding commitment
Improve knowledge of pollinator decline, its causes and FRQVHTXHQFHV WDFNOH WKH FDXVHV RI SROOLQDWRU GHFOLQH 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 EHQHILWV ZRUWK EHWZHHQ (85b 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 WKH RUGHU RI (85b WR %ULQNbHWbDO b

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 RI WKH 1DWXUD farmland, and forests make up almost 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 WR LPSURYH FRQVHUYDWLRQ 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,

Wetlands, which 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 DLPV KRZHYHU ZH FXUUHQWO\ O 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: 7KH 1DWXUD QHWZRUN LV FRPSRVHG RI 63\$V DQG 6&–V 63\$V DUHb6SHFLDO 3URWHFWLR 6&–VbLQFOXGH VLWHV DQG SURSRVHG 6LWHV RI &RPPXQLW\ –PSRUWDQFH DQG 6SHFLDO \$UH 'LUHFWLYH b0DQ\ VLWHV DUH GHVLJQDWHG XQGHU ERWK GLUHFWLYHV DV ERWK DQ 6&– DQ this overlap into account is available only from 2011 onwards.

Source: ((\$ F

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 DUHDV 6DXUD HW DO indicator shows an average value of PRUH WKDQ DQG WKHUHIRUH connectivity element of Aichi biodiversity target 11. The ProtConn value varies, however, throughout Europe: it is ORZHVW LQ WKH 1HWKHUODQGV EHWZHHQ DQG LQ)LQODQG Italy, Sweden and the Baltic States and is highest in Bulgaria, Croatia, Czechia, *HUPDQ\ 3RODQG DQG 6ORYHQLD RUbPRUH 6DXUD HWbDO b

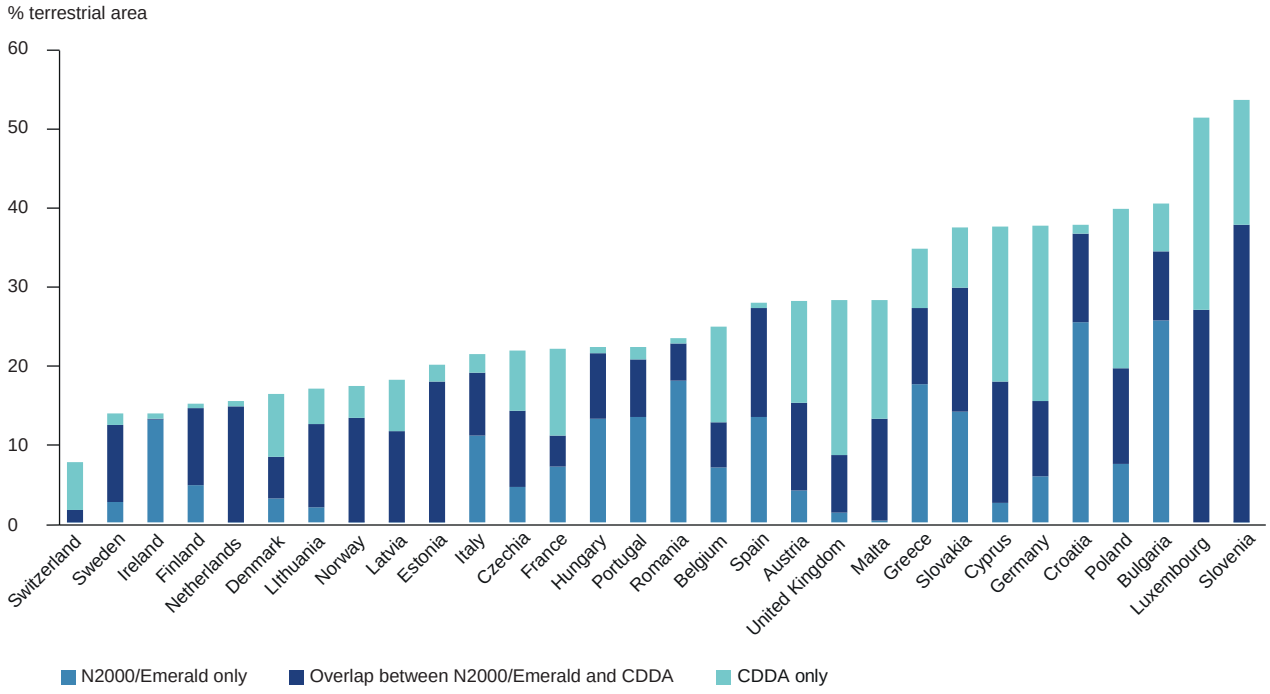
The Natura 2000 network covers 18 % of the EU's land DUHD ZLWK DURXQG VLWHV

–Q WKH (8 WKH

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, DQG VLQFH 'HFHPEHUb WZR (XU 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 b of their land area as Natura 2000 sites: Bulgaria, Croatia, Cyprus, Estonia, Greece, Hungary, Italy, Luxembourg, Poland, Portugal, Romania, Slovakia, Slovenia and Spain ((\$ F 7KH GHJUHH RI RYHUOD 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 V\VWHPV ((\$ (Figure 3.2).

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



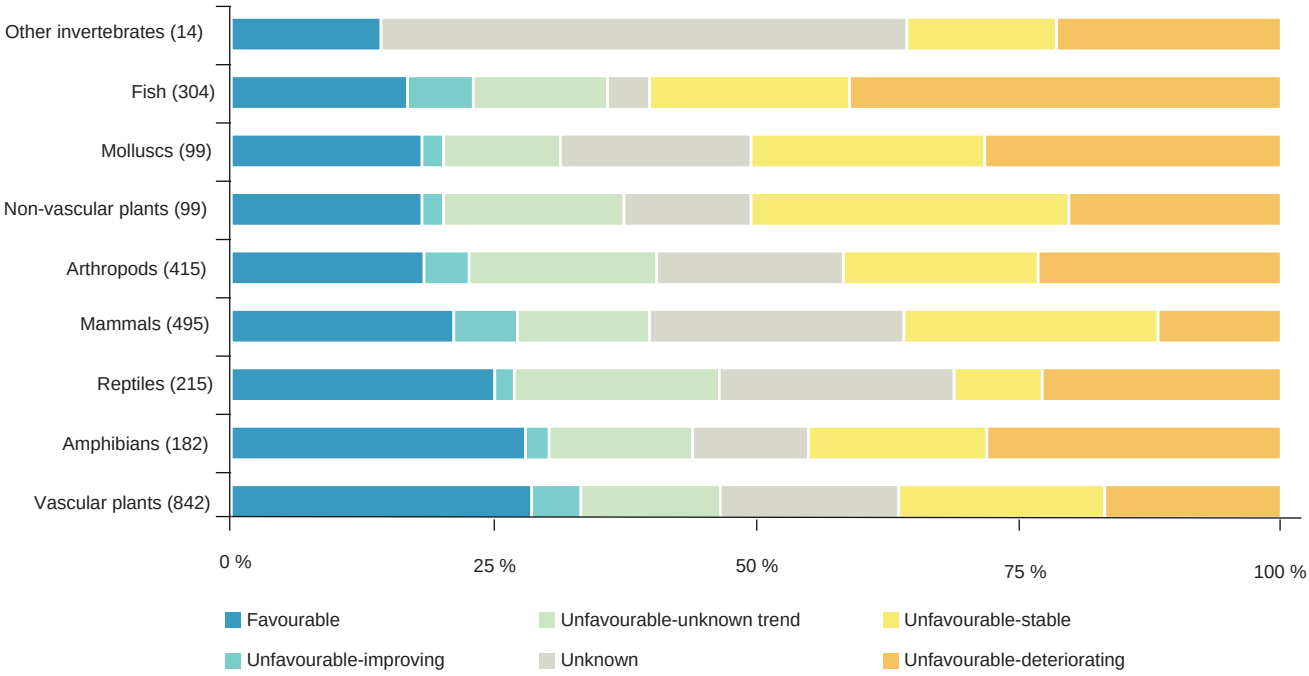
Note: A 'nationally designated protected area' (CDDA) is an area protected by national legislation. If a country has included sites designated under international agreements such as the EU Birds and Habitats Directives, or the Bern or Ramsar Conventions in its legislation, the corresponding protected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

Source: (($ E

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	5	7KH JOREDO $LFKL ELRGLYHUVLW\ WDUJHW RI RI WHUUHVWULDO DUHDV FR WKH (8 WKH 1DWXUD QHWZRUN DOUHDG\ FRYHUV RI WKH ODQG DUHD
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 DVVHVVPHQWV LV b

Source: ((\$ H EDVHG RQ FRQVHUYDWLRQ VWDWXV RI KDELWDW W\SHV DQG VSHFLHV UHSRUWLQ

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 OHJLVODWLRQ 6RPHb1DWXUD VLWHV QHDUO\ 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 YHU\ VLJQLILFDQWO\ E\ FUHDWLQJ 1DWXUD 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.

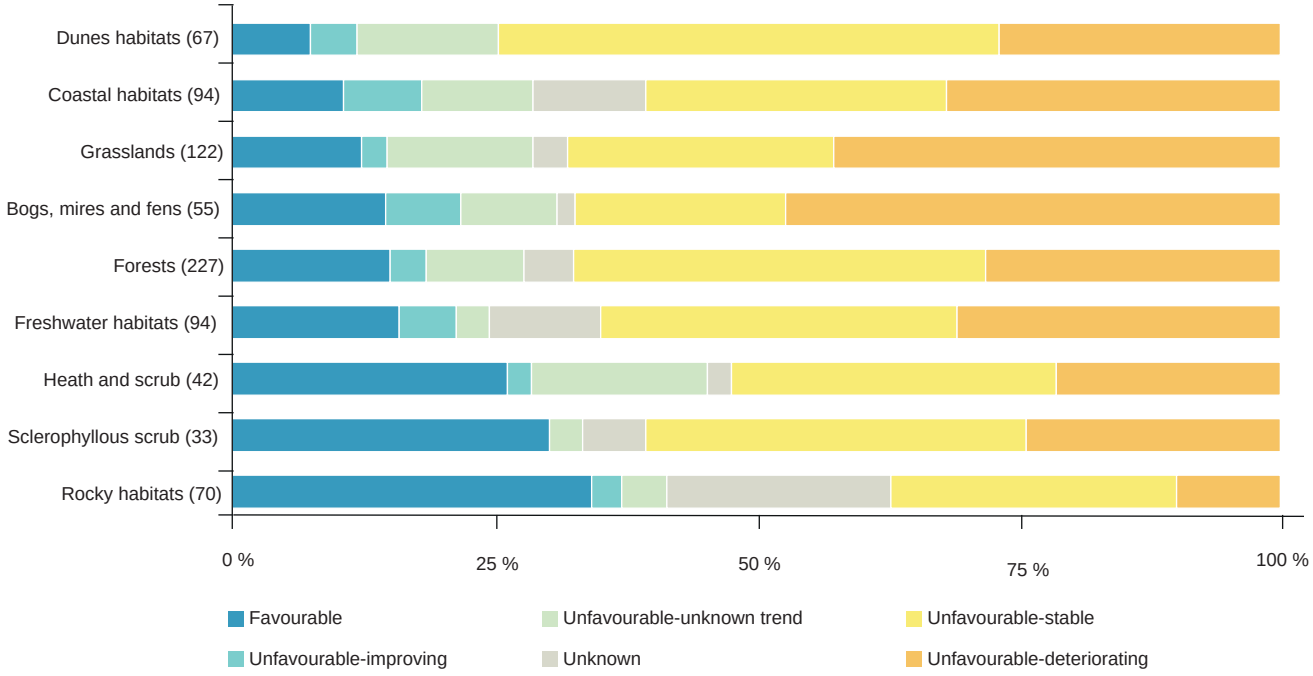
Designation as a protected area is not a guarantee RI H•HFWLYH ELRGLYHUVLW\ protection; hence the need for management plans and FRQVHUYDWLRQ PHDVXUHV

Whether the location and extent of the complementarity, it is clear, however, that the process of designing 1DWXUDb VLWHV DORQJ ZLWKb 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 VDIHJXDUGbELRGLYHUVLW\ DQG HF but it is a pre-condition to prevent species and habitats of European interest being lost forever.

(8 SURWHFWHG VSHFLHV DQG y6HHb7DEOHb

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: 7KH QXPEHU RI DVVHVVPHQWV LV LQGLFDWHG LQ SDUHQWKHVLV 7KH WRWDO QXPEHU RI DVVH

Source: ((\$ E EDVHG RQ FRQVHUYDWLRQ VWDWXV RI KDELWDW W\SHV DQG VSHFLHV UHSRUWLQJ

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 UHSRUW RQ WKRVH GLUHFWLYHV HYHU\ \HDUV The most recent results cover the period DQG WKH RXWFRPHV RI WKH QH[W URXQG RI UHSRUWLQJ 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 ((\$ b .A parallel mechanism for reporting on the conservation status of species and habitats has been developed under the %HUQ &RQYHQWLRQ 5HVROXWLRQ results from this reporting will also be available in 2020, which will contribute to a full pan-European perspective on their FRQVHUYDWLRQ bVWDWXV

60 %

of species assessments show unfavourable conservation VWDWXV

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 b 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 ((\$ b (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 ((\$ b . H 2QO\ b RI WKH DVVHVVPHQWV RI K 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 ((\$ E (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	6	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, 2015b).

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, more than a fifth of bird species are still threatened, declining or depleted (EEA, 2015b).

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, 2015b).

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 targets specifically aiming 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 the decline of birds and butterflies

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.

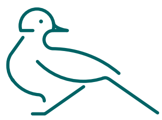
The status of birds and butterflies has been the subject of long-term

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 SUH\ HJ bUHG NLWH ZKLW[illegible] 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 LQ WKH 1DWXUDb QHWZR[illegible] 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 SDUD OD 7UDQVLFLµQ (FROµJLFD –QWHUQDWLRQDO b

The success stories also work alongside social change and embracing the interactions between wildlife and people. The recovery of birds of prey [illegible] 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 (%&& (XURVWDW [illegible] 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).



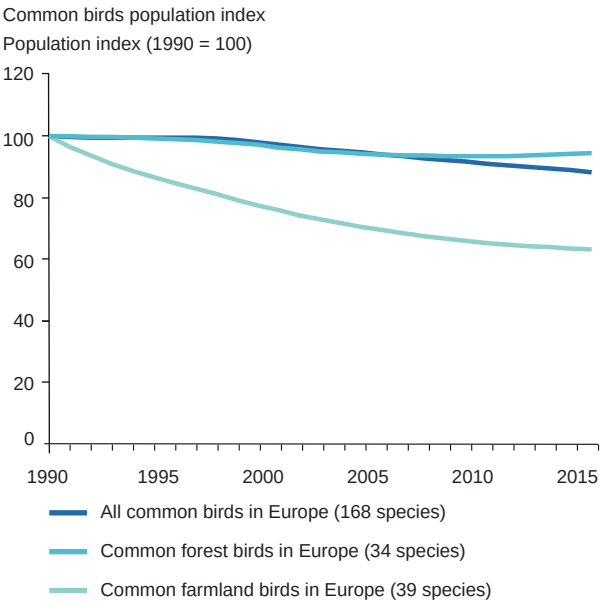
The long-term trends in many ELUG DQG EXWWHUIO\ SRSXODWLRQV demonstrate that Europe has experienced a major decline LQbELRGLYHUVLW\

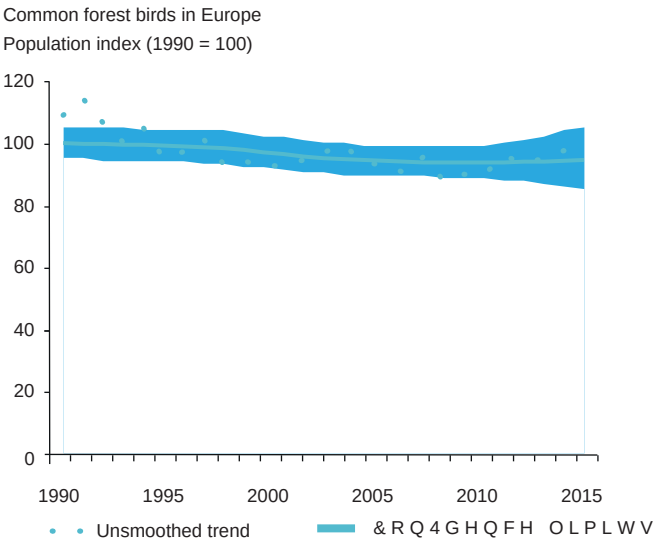
Long-term trends (over 25 years) from monitoring schemes of common birds (in particular farmland birds) and grassland butterflies show significant declines and no sign of recovery (EEA, 2019a). Figure 3.5 shows that, between DQG WKHUH ZDV D [illegible] RI b LQ WKH LQGH[RI FRPPRQ ELUGV LQ WKH (8 0HPEHU 6WDWHV WKDW KDYH bird population monitoring schemes. 7KLV GHFUHDVH LV VOLJKWO[illegible] 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 b (8 DQG b (8 SOXV 1RUZD\ DQG [illegible] Switzerland). The common forest bird LQGH[GHFUHDVHG E\ b (8 DQG [illegible] plus Norway and Switzerland) over the VDPH SHULRG ((\$ D :KLOH WKLV [illegible] indicator takes 1990 as a starting point, it should be borne in mind that significant decreases had already occurred before that date.

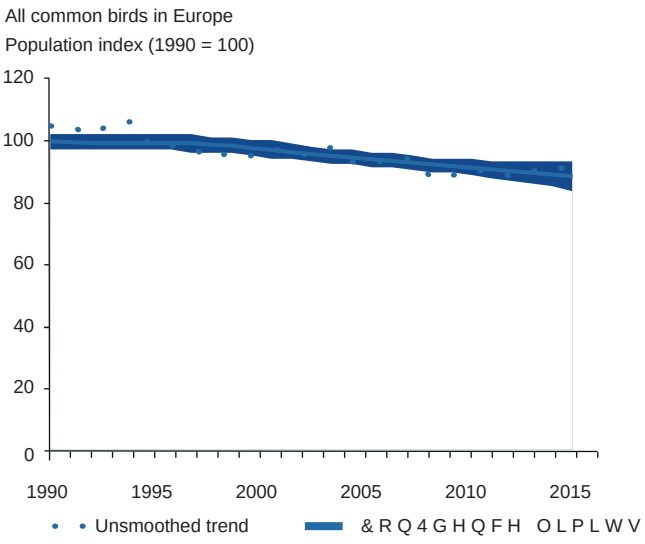
In spite of year-to-year fluctuations, which are typical of butterfly populations, the index of grassland butterflies has declined significantly in the 15 EU Member States where butterfly population monitoring schemes exist (Figure 3.6). In 2017, the index ZDV b EHORZ LWV [illegible] countries. As with bird indices, the reductions observed since 1990 are on top of decreases occurring before that year (EEA, 2019a).

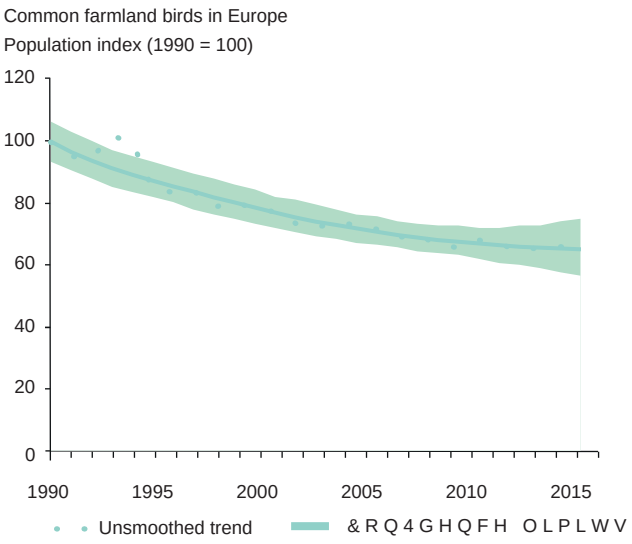
The long-term trends in farmland, forest and all common bird and grassland butterfly populations demonstrate that Europe has experienced a major decline in biodiversity. This has been primarily due to the loss, fragmentation and degradation of natural and semi-natural ecosystems, mainly caused by agricultural intensification 'RQDOG HW DO b 9DQ '\FN HWbDO b -HOLD]NRY HWbDO [illegible] intensive forest management 9LOHUWKD b)UDJ[HGDVbHW D[illegible] land abandonment and urban sprawl (Chapters 5 and 13). For example, through habitat simplification HJ bUHPRYDO RI KHGJHURZV DQG treelines to make fields larger), loss and fragmentation, birds lose their nesting sites and food sources, which adds to population decline *XHUUHURbHWbDO b 8UEDQ[illegible] increases anthropogenic light levels as well as noise levels, which affects the behaviour of singing birds and their acoustic communication in ELUGVb &KDSWHU

FIGURE 3.5 Common birds population index, 1990-2016





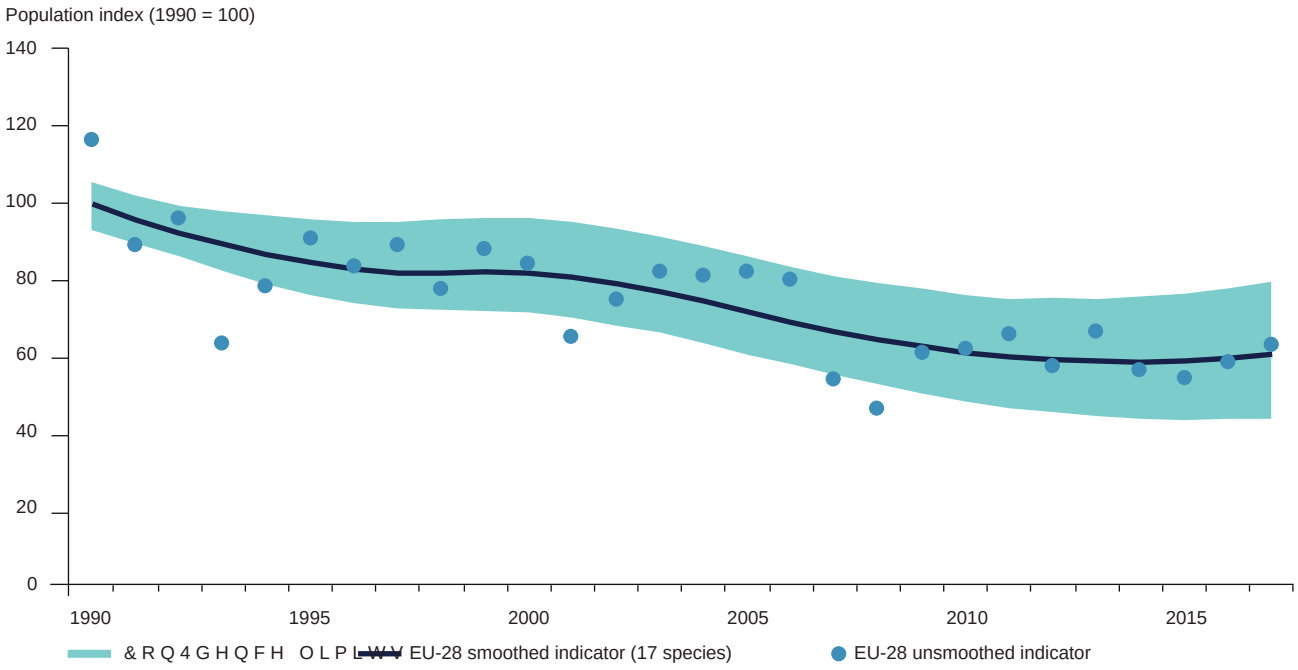




Note: 7KH VKDGHG DUHDV UHSUHVHQW WKH FRQILGHQFH OLPLWV *HRJUDSKLFDO FRYHUDJH (8 DQGb1RUZD\ DQG 6ZLW]HUODQG

Sources: EEA (2019a), European Bird Census Council, Royal Society for the Protection of Birds, BirdLife International and Czech Society IRUb2UQLWKRORJ\

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 E L U G V 9 L F N H U \ H W D O b 0 X V L W H O O L H W D O $ S D U W I U R P E H L Q J D Q important source of food for birds and other animals, insects play a key role in ecosystem processes and provide various ecosystem services 6 F K R Z D O W H U H W D O widely recognised role is pollination 6 H F W L R Q b D Q G % R [are also instrumental in developing soil nutrient cycling and providing

*U D V V O D Q G E X W W H U I O \ S R S X O D W L R Q V declined by 39 % in 15 EU 0 H P E H U 6 W D W H V V L Q F H

pests, diseases and invasive alien species U H J X O D W L R Q 1 R U L H J D H W D O 7 K H L U P R V W Recently, reports of dramatic losses of insects have been widely discussed. Hallmann et al. (2017) reported a decline R I P R U H W K D Q b R Y H U flying insect biomass in protected areas in Germany. Declines concern pollinators too, including butterflies, as discussed earlier, but also honey bees and wild E H H V 3 R W W V H W D O (& E xhaustive global review of 73 reports of insect species declines (Sánchez-Bayo D O G : \ F N X \ V F R Q F O X G H G W K 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 DbUDQJH RI SROLF\ PHDVXUHV LQFOXGLQJ VHFWRUDO SROLFLHV LV UHTXLUH
Prospects of meeting policy objectives/targets		
2020	6	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 FURSV *RXOVRQ b EXW RQO\ D YHU\ small percentage of this dressing DSSUR[LPDWHO\ b LV DEVRUEHG E\ WKH 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 ((\$ b D 7KH LQFUHDVH LQ GHPDQG for land could also intensify agricultural production in the EU, through land take via urbanisation as well as for producing UHQHZDEOH HQHUJ\ DQG b ELRIXHOV

Ecosystem condition and services

y 6HHb7DEOHb

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 %LUKRIHU HWbDO . /DQGLV 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 EHHWOHV :LWKRXW WKHP species would decline and eventually disappear along with the organisms that depend on them. They are also important from an economic SHUVSHFWLYH LQ WKH (8 RI FURSV DQG b RI WHPSHUDWH flowers depend, at least in part, on animal pollination and an estimated (85b bELOOLRQ RI WKH (8 agricultural output is directly attributed WR LQVHFW SROOLQDWRUV

In recent decades pollinators have declined dramatically and many species are on the verge of extinction (EC, F ([LVWLQJ HYLGHQFH VXJJHVWV 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 – 3 % (6 0LWLJDWLQJ WKHVH GHFOLQHV will require actions across sectors, particularly in land management.

Acknowledging the urgent need to address pollinator decline, on b - XQH b WKH (XURSHDQ 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 GHFOLQH LWV FDXVHV DQG FRQVH (2) tackling the causes of pollinator GHFOLQH DQG UDLVLQJ DZDUH engaging society at large and promoting FROODERUDWLRQ (&„ D E

status for almost all terrestrial ecosystem types and that the majority of non -provisioning ecosystem services such as regulation of freshwater quality RU SROOLQDWLRQ %R[b WUHQGV – 3 % (6 .

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 OHDVW b RI GHJUDGHG HFRV\VWHPV by 2020. $FWLRQ b LQ 7DUJHW 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 HW DO :RUN DW Q\ 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.

Biodiversity targets will not be met without wider and more H•HFWLYH LPSOHPHQWDWLRQ of existing policies and stronger societal responses WRbELRGLYHUVLW\ ORVV

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 RQ WKH LQFUHDVH bQRP RU WKDQ HFRV\VWHPV DVVHVVV.The (($ F 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 QDWLRQDO LPSDFW 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, H J bJUHHQ LQIUDVWUXFWXUH LQYHVWPHQWV WKH 3ROOLQDWRUV LQLWLDWLY improvements.
Prospects of meeting policy objectives/targets		
2020	6	Europe is not on track to meet the 2020 target of maintaining and enhancing ecosystems and their services by HVWDEOLVKLQJ JUHHQ LQIUDVWUXFWXUH DQG UHVWRULQJ DW OHDVW RI G 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 F O L P D W H F K D Q J H b(EEA, 2017)

Another key pressure on biodiversity and H F R V \ V W H P V L V L Q Y D V L Y H animals and plants that are introduced accidentally or deliberately into a natural environment where they are not normally found, with serious negative consequences : D O W K H U b H W b D O 6 L P E H U O R I I b H W b D O b . They spread through different pathways 5 D E L W V F K H, 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 (8 b . 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) - 5 & b . F

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 LQYDVLYH DOLHQ bVSHFLHV

*HQHWLF GLYHUVLW\ DQG VRLO ELRGLYHUVLW\

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 NH\ OHYHO RI ELRGLYHUVLW\ 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 DQG $PUL) $2 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.

:KLOH (XURSH LV KRPH WR D ODUJH 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 HW DO) $2. 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 H J bORVV RI JUD]LQJbODQG

:LWK FOLPDWH FKDQJH WKH FRQVHUYDWLRQ 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)$2 b . 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 (8 bSODQW DQG DQLPDO JHQHWLF UHVRXUFHV (& , 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 ZDWHU bEDODQFH

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 %UXVVDDUGbHWbDO

One hectare of agricultural soil contains DERXW b bNJ RI VRLO RUJDQLVPV (Bloem et al., 2005) LQYROYLQJ EHWZHHQ b DQG b VSHFLHV \ HWbDO 2015). According to size and weight, earthworms dominate, whereas in terms of species richness, bacteria and fungi GRPLQDWH RI ZKLFK RQO\ b D detected) 2UJLD]]L HW. DO

Although soil biodiversity is difficult to investigate, there is evidence that pollution from metal and nanomaterials significantly reduces diversity *DQVbHWb,DO, 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 *DUGL HW DO 2UJLD]]L HW DO (Chapter 5).

3.4 Responses and prospects of meeting agreed targets and objectives

The recent fitness check of the EU nature legislation (& 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 (8 b3 R O O L Q D W R U V L Q L W L D W L Y H V 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 ( ) 6 $. Improving coherence between different environmental policies, such as the EU biodiversity strategy, W K H : D W H U) U D P H Z R U N ' L U H F W L Y H 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 X Q G H U W K H : D W H U) U D P H Z R U N 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

Pressures on biodiversity and drivers of loss are mainly linked to a range of economic V H F W R U V D Q G V H F W R U D O S R O L F L H V

plans or programmes of measures (($ b D b . D

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 V L J Q L I L F D Q W H [W H Q W : K L O H 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 P H D V U H V D F F R X Q W L Q J I R U direct payments budget (& . 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 S U D F W L F H V R Q R Q O \ b R I (U However, 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.

: K L O H E L R G L Y H U V L W \ L Q (X U R S H 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 L V F R Q V L G H U D E O H L W V W R W D O ecological goods and services exceeds what its own ecosystems supply (EEA, E & K D S. The implementation R I W K H (8 b E L R G 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 u R 3 % (K . 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 enable 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 LPSRUWDQW UROH WKHVH GD\V in the patterns of food consumption and consumption of other goods 0DUNHWV HW DO HWb DO. 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 ((&G(&.

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 aim of redefining priorities, achieving more coherent development of policies and stronger policy implementation, to contribute WRbVXVWDLQDEOLW\ WUDQVLWLRQ EbVRFLHW\

04.

Freshwater

Key messages

- Water is an essential resource for human health, agriculture, energy production, transport and nature. Securing its sustainable use remains a key challenge globally and within Europe.

- & X U U H Q W O \ R Q O \ b R I (X U R S H D Q surface water bodies achieve good ecological status and wetlands are Z L G H O \ G H J U D G H G D V D U H floodplains. This has a critical impact on the conservation status of wetland habitats and the species that depend on them. Although point source pollution, nitrogen surpluses and water abstraction have been reduced, freshwaters continue to be affected by diffuse pollution, hydromorphological changes and water abstraction.

- Diffuse pollution and water abstraction pressures are expected to continue in response to intensive agricultural practices and energy production. This requires balancing societal demands for water with ensuring its availability for nature. Climate change is likely to change the amount of water available regionally, increasing the need for either flood protection or drought management and making this balance more difficult to achieve.

- Improved implementation and increased coherence between EU water-related policy objectives and measures is needed to improve water quality and quantity. Looking ahead it will also become increasingly critical to address and monitor the climate -water-ecosystem-agriculture nexus and connection with energy needs.

- It is on the river basin scale that effective solutions for water management can be found and essential knowledge is being developed through the implementation of river basin management plans under the Water Framework Directive. Solutions such as natural water retention measures, buffer strips, smart water pricing, more efficient irrigation techniques and precision agriculture will continue to grow in importance. An ecosystem-based management approach, considering multiple environmental objectives and co-benefits to society and the economy, will further support progress.

Thematic summary assessment

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Water ecosystems and wetlands	Trends show a mixed picture	Developments show a mixed picture	6 Not on track
Hydromorphological pressures	Deteriorating trends dominate	Developments show a mixed picture	6 Not on track
Pollution pressures on water and links W R b K X P D Q K H D O W K	Trends show a mixed picture	Developments show a mixed picture	6 Not on track
Water abstraction and its pressures R Q b V X U I D F H D Q G J U R X Q G Z D W H U	Improving trends dominate	Developments show a mixed picture	6 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 4.3, Key trends and outlooks (Tables 4.2, 4.3, 4.4 and 4.5).

04.

Freshwater

4.1 Scope of the theme

Clean water is an essential resource for human health, agriculture, industry, energy production, transport, recreation and nature. Ensuring that enough water of high quality is available for all purposes, including for water and wetland ecosystems, remains a key challenge globally and within Europe. Europe's waters and wetlands remain under pressure from water pollution from nutrients and hazardous substances, overabstraction of water and physical changes. Climate change is expected to exacerbate many of these pressures, which depending on the pressure, may act on groundwater, rivers, lakes, transitional and coastal waters, as well as the riparian zone and wetlands. In return, this reduces the quality of the natural services provided by those ecosystems (Figure 4.1).

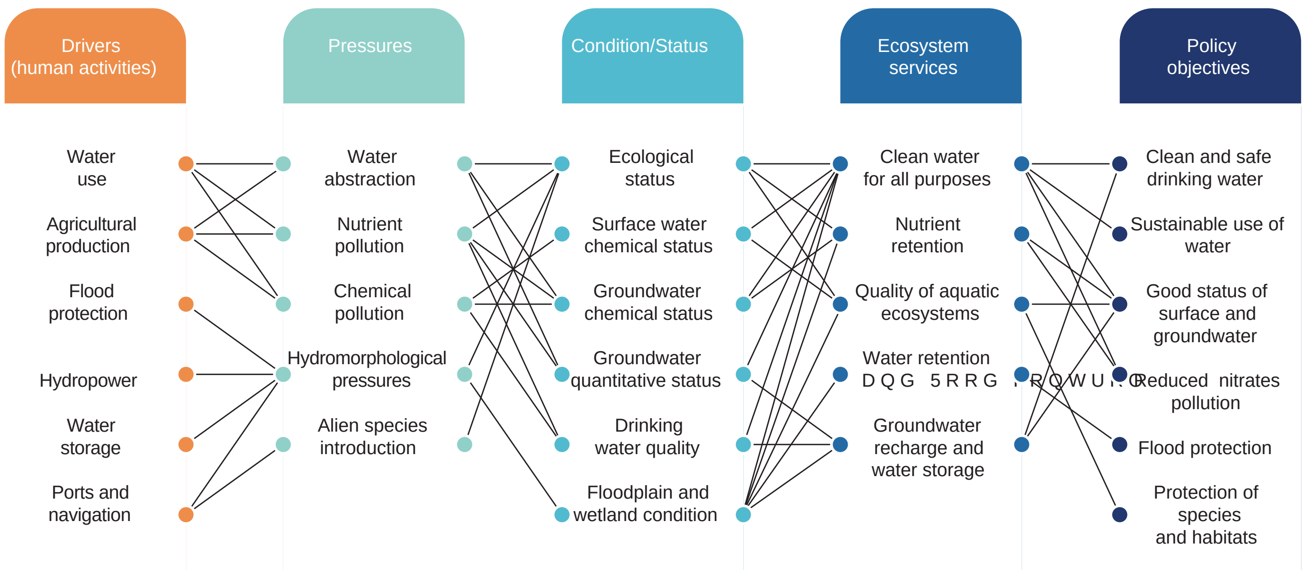
The remaining challenge is to further reduce the many pressures on water. These are linked to intensive agriculture, as well as other human uses that are economically important, but unfortunately also add large pressures to the environment. Improving water status will support improvements in biodiversity (Chapter 3) and in the marine environment &KDSWHU)LQDOO\ b(XURSH LQGLUHFWO\ uses freshwater resources in countries outside its boundaries by importing goods with water-intensive production chains (Chapter 1).

(XURSH V ZDWHUV DUH D•HFWHG by pressures from pollution, RYHUDEVWUDFWLRQ DQG SK\VLFDO FKDQJHV

4.2 Policy context

Europe's water policy has developed gradually over the last few decades. The first EU policies aiming to improve water quality date back to 1991, with the adoption of the Urban Waste Water Treatment and Nitrates Directives (EU, 1991a, 1991b), both targeting (among other things) reducing pollution pressures on water. In 2000, with the adoption of the Water Framework Directive (EU, 2000), an integrated ecosystem-based approach to managing water was introduced. Public safety and health objectives were secured by the Drinking Water, Bathing Water and Floods Directives (EU, 1998, 2006, 2007), and presently a proposal on the minimum requirements for water reuse is under discussion. While the directives tend to be very specific, the importance of water in relation to biodiversity and marine policies is pursued through the EU biodiversity strategy to 2020 (EC, 2011a) and the priority objectives of the Seventh Environment Action

FIGURE 4.1 Selection of links between drivers, pressures, condition, ecosystem services and policy objectives



Note: BOD, biological oxygen demand.

Source: Modified from Maes et al. (2018).

Programme, or 7th EAP (EU, 2013a). Water quantity remains an area of national competence, although issues linked to overall sustainable water use are of transboundary and thus European interest (EC, 2011b). (($ b P H P E H U F R X Q W U L H V W K H Q not Member States of the EU also implement water policies inspired by the Water Framework and Floods Directives. Switzerland has set binding targets and requirements for its water policy and collaborates with its neighbours to achieve shared objectives through International Commissions for the Protection of the Rhine, / D N H b & R Q V W D Q F H D Q G / D N H b * H Q H Y D. Turkey developed a national river basin management strategy for 2014-2023 with a view to ensuring the sustainable management of water resources in line with EU legislation. Iceland has adopted the Water Framework Directive, and it is working towards its implementation, albeit on a different timeline from the rest of the EU and Norway.

Europe's water policy also contributes to United Nations (UN) Sustainable ' H Y H O R S P H Q W * R D O 6 ' * b 6 (W b D U Table 4.1) and to a range of other policies, for example in the areas of biodiversity and nature (Chapter 3), the marine environment (Chapter 6) and chemical pollution (Chapter 10). Conversely, another range of policies also influences freshwater: air pollution policies (Chapter 8), industrial pollution policies (Chapter 12), and sectoral policies (Chapter 13). An overview of environmental pressures stemming from agriculture is covered in Chapter 13. In the context of water it is important to mention that the common agricultural policy (CAP) includes requirements that support achieving environmental R E M H F W L Y H V) X Q G L Q J b S U R Y L G H G X Q G H U CAP Pillar II potentially supports the Water Framework Directive's objectives. 7 D E O H b 1 gives an overview of selected policies on freshwater addressed in W K L V b F K D S W H U

4.3 Key trends and outlooks

4.3.1 Water ecosystems and wetlands

y 6 H H b 7 D E O H b

In the context of European policy, surface water ecosystems are defined as rivers, lakes, and transitional and coastal waters. In addition many wetlands such as floodplains, bogs and mires depend on the availability of water for their existence. They are often found in the proximity of surface waters or depend on groundwater. These ecosystems provide important regulating ecosystem services, such as water purification, carbon capture

TABLE 4.1 Overview of selected policy objectives and targets

Policy objectives and targets	Sources	Target year	Agreement
Water ecosystems and wetlands			
Achieve good ecological status of all water bodies in Europe	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Protect, conserve and enhance freshwater as well as the biodiversity that supports this natural capital	7th EAP, PO 1 (EC, 2013)	2050	Non-binding commitment
Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6 ' * 8 1	2020	Non-binding commitment
Hydromorphological pressures			
To assess and manage flood risks, aiming to reduce the adverse consequences for human health, environment and cultural heritage	Floods Directive (2007/60/EC)	2015	Legally binding commitment
* R R G K \ G U R P R U S K R O R J L F D O V W D W X V (supporting good ecological status)	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Pollution pressures on water and links to human health			
Achieve good chemical status of all surface and groundwater bodies	Water Framework Directive (2000/60/EC)	2015	Legally binding commitment
Reducing and further preventing water pollution by nitrates from agricultural sources	Nitrates Directive (91/676/EEC)	N/A	Legally binding commitment
To protect the environment in the EU from the adverse effects of urban waste water through collection and treatment of waste water. Implementation period depends on year of accession	Urban Waste Water Treatment Directive (91/271/EEC)	EU-15: 1998-2005 EU-13: 2006-2023	Non-binding commitments
To preserve, protect and improve the quality of the environment and to protect human health	Bathing Water Directive (2006/7/EC)	2008	Legally binding commitment
To protect human health from adverse effects of contamination of water for human consumption	Drinking Water Directive (98/83/EC)	2003	Legally binding commitment
Eliminate challenges to human health and well-being, such as water pollution and toxic materials	7th EAP, PO 3 (EC, 2013)	2050	Non-binding commitment
Improve water quality by reducing pollution	6 ' * 8 1	2030	Non-binding commitment
Water abstraction and its pressures on surface- and groundwater			
Achieve good groundwater quantitative status of all groundwater bodies	Water Framework Directive (2000/60/EC)	2015	Legally binding
Water stress in the EU is prevented or significantly reduced	7th EAP; PO 2 (EC, 2013)	2020	Non-binding commitment
Water abstraction should stay below 20 % of available renewable water resources	Roadmap to a resource efficient Europe (EC, 2011b)	2020	
Substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater	6 ' * 8 1	2030	Non-binding commitment
Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6 ' * 8 1	2030	Non-binding commitment

Note: EU-13, countries joining the EU on or after 1 May 2004; EU-15, countries joining the EU (or its predecessors) before 30 April 2004;
3 2 b 3 U L R U L W \ R E M H F W L Y H 1 $ Q R Q D S S O L F D E O H

and storage, and flood protection, in addition to providing habitats for many protected species. Hence, achieving good status of Europe's surface waters not only serves the objective of providing clean water but also supports the objective of providing better conditions for some of Europe's most endangered ecosystems, habitats and species, as listed under the Habitats and Birds Directives. Unfortunately, however, both surface water ecosystems and wetlands are under considerable pressure.

40 %

RI WKH VXUIDFH ZDWHU ERGLHV LQ (XURSH KDYH D JRRG HFRORJLFDO VWDWXV

7UHQGV LQ WKH HFRORJLFDO VWDWXV RI ZDWHUV

The quality of surface water ecosystems is assessed as ecological status under the Water Framework Directive. The ecological status assessment is SHUIRUPHG IRU ZDWHU ERGLHV across Europe and it is based on assessments of individual biological quality elements and supporting physico-chemical and hydromorphological quality elements (definitions can be found in EEA, 2018b and Section 4.3.2). A recent compilation of national assessments, done as part of the second river basin management plans required under the Water Framework 'LUHFWLYH ((& E WKDW RI (XURSH V VXUIDFH ERGLHV DFKLHYH JRRG HFRORJLFDO VWDWXV RU EHWWHU This is the same share of water bodies achieving good status as reported in the first river basin management plans. Lakes and coastal waters tend to achieve better ecological status than rivers and transitional waters, and natural water bodies are generally found to have better ecological status than the ecological potential found for heavily modified or artificial ones. Across Europe, there is a difference between river basin districts in densely populated central Europe, where a high proportion of water bodies do not achieve good ecological status, and those in northern Scandinavia, Scotland and some eastern European and southern river basin districts, where more tend to achieve good ecological status (Map 4.1).

The ecological status assessment is based on the 'one out, all out principle', i.e. if one assessed element of quality fails to achieve good status, the overall result is less than good status. Thus, the status of biological quality elements may be better than the overall status. Overall, IRU ULYHUV RI FODVVLILHG ZDWHU bodies have high or good status for several quality elements, whereas only RI ULYHUV DFKLHYH JRRG HFRORJLFDO VWDWXV status or better. Since the first river basin management plans, many more individual quality elements have been monitored, improving the confidence of assessments, even though variability of methods used by Member States remains so large that comparisons would have to be made with caution (Table 4.2).

7UHQGV LQ ZHWODQGV

Across Europe, wetlands are being lost. Between the years 2000 and 2018 the already small area of wetlands GHFUHDVHG IXUWKHU E\ DSSUR[LPDWHO\ (Chapter 5). Many wetlands are found in undisturbed floodplains, the areas next to the river covered by water during floods. Scientific estimates suggest that RI IORRGSODLQV DUH 7RFNQHU DQG 6WDQIRUG

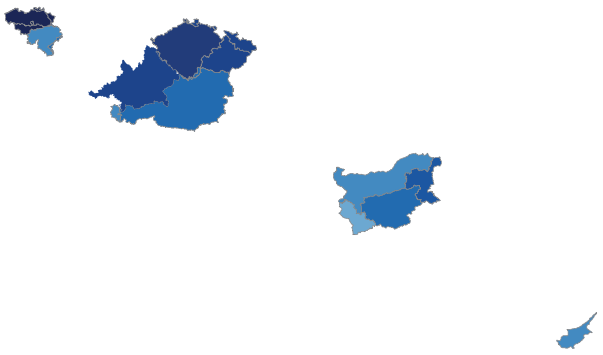
As a consequence, the capacity of floodplains to deliver important and valuable ecosystem services linked to flood protection and healthy functioning of river ecosystems has been reduced, ultimately reducing their capacity to support achieving good ecological and conservation status. The conservation status of many freshwater habitats and species listed in the Habitats and Birds Directives is not changing, and it remains predominantly unfavourable or bad (Table 4.2). The habitat group 'Bogs, mires and fens' (different wetland types) has the highest proportion of unfavourable DVVHVVPHQWV DOPRVW & KD The group 'Freshwater habitats' is also predominantly unfavourable, as are assessments of amphibians (Chapter 3).

3UHVVXUHV DQG GULYLQJ IRUF

The main reasons for not achieving good ecological status are linked to K\GURPRUSKRORJLFDO SUHVVXUH HFRORJLFDO SROOXWLRQ DQG abstraction (Section 4.4). The understanding of the links between status and pressures has improved with the development of river basin management plans, and it is expected that the implementation of the Water Framework Directive will increasingly lead to a reduction in the most critical pressures and thus to improved ecological status of surface water bodies (Table 4.2). Freshwater habitats are subject to many of the same pressures as surface water bodies, and they are often very sensitive to overabstraction of water. In reporting under the Habitats Directive for freshwater habitats, changes in hydrology are most frequently reported as being important, as is 'pollution to surface ZDWHUV &KDSWHU – Q SDUWV where groundwater abstraction is high (EEA, 2018c). The pressure on wetlands

(1) The WISE WFD database that underlies the WFD visualisation tool is subject to updates. This may lead to values in the visualisation tool differing IURP WKRVH SUHVHQWHG LQ WKLV FKDSWHU 7KH QXPEHUV LQ WKH WH[W UHIHU WR YDOXHV DYDL updated by Norway and Ireland, and these updates are captured in Map 4.1 and Map 4.2 but not in the values provided in the text.

MAP 4.1 Country comparison — results of assessment under the Water Framework Directive of HFRORJLFDObVWDWXV RU SRWHQWLDO VKRZQ E\ ULYHU EDVLQ GLVWULFW



Notes: Caution is advised when comparing results among Member States as the results are affected by the methods used to collect and analyse data and often cannot be compared directly.
RBMP, river basin management plan.

Coverage: EU Member States, Norway and Iceland.

Source: EEA (2018e).

The European environment — state and outlook 2020

Knowledge for transition to a sustainable Europe

European Environment Agency