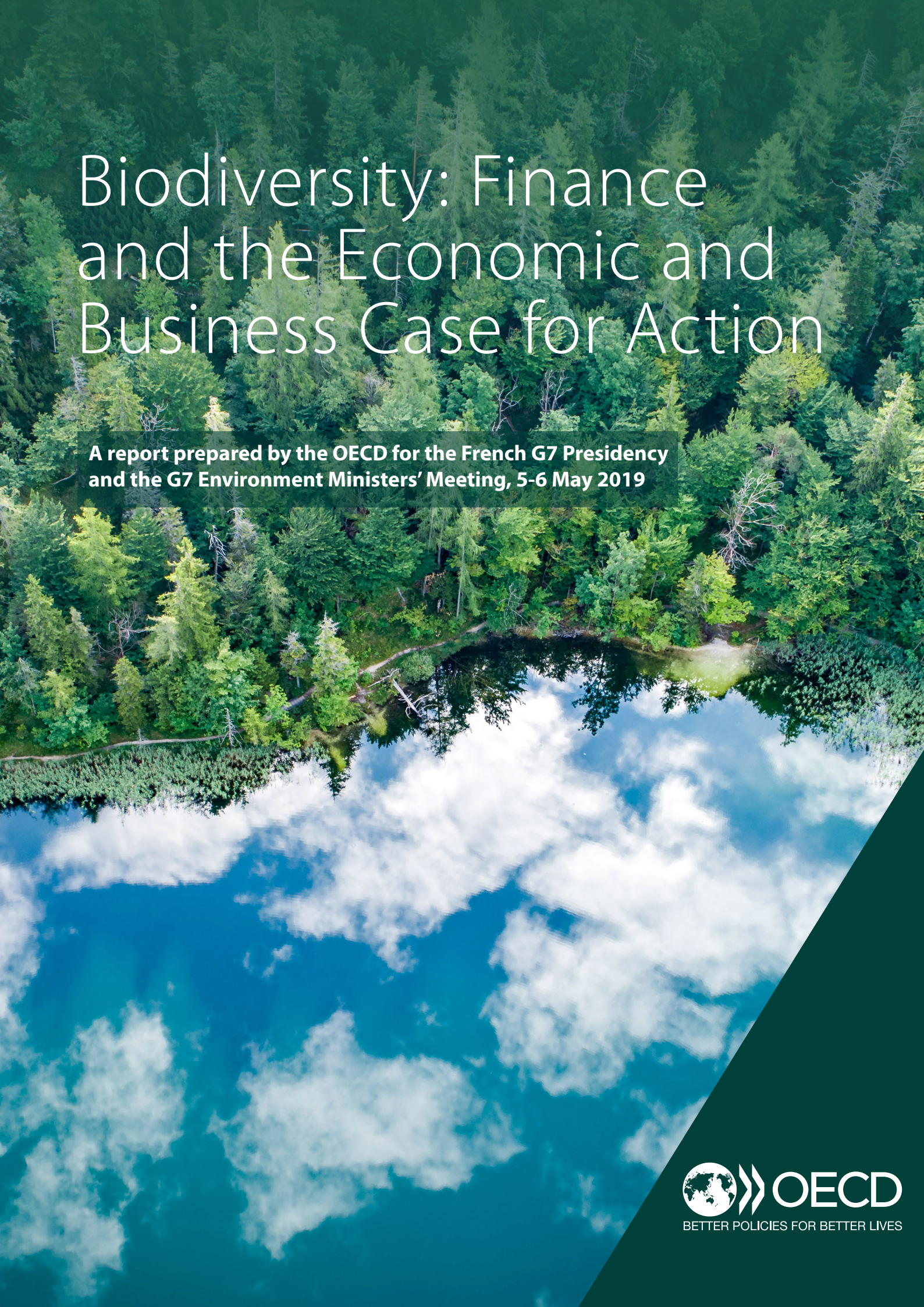
Biodiversity: Finance and the Economic and Business Case for Action

A report prepared by the OECD for the French G7 Presidency and the G7 Environment Ministers' Meeting, 5-6 May 2019



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BETTER POLICIES FOR BETTER LIVES

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Report

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Abbreviations and Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
AUM	Assets under management
B@B	Business @ Biodiversity
BIOFIN	Biodiversity Finance Initiative
BIP	Biodiversity Indicators Partnership
CAD	Canadian dollar
CalPERS	California Public Employees' Retirement System
CBD	Convention on Biological Diversity
CDI	Community for data integration
CEO	Chief executive officer
CFLR	Collaborative Forest Landscape Restoration Program
CHM	Clearing House Mechanism
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CoP FINC	Community of Practice Financial Institutions and Natural Capital
COP15	15th Conference of the Parties to the Convention on Biological Diversity
CRS	Creditor Reporting System
CSIRO	The Commonwealth Scientific and Industrial Research Organisation
DNB	De Nederlandsche Bank
EbA	Ecosystem-based adaptation
EBRD	European Bank for Reconstruction and Development
Eco-DRR	Ecosystem-based disaster risk reduction
EP&L	Environmental Profit & Loss
ESG	Environmental, social and governance
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FJD	Fijian dollar
FTSE	Financial Times Stock Exchange
G7	Group of Seven
GBIF	Global biodiversity information facility
GBO	Global Biodiversity Outlook
GEF	Global Environmental Facility
GHG	Greenhouse gas
GLC	Global land cover
GLOBIO	Global biodiversity model for policy support
ha	Hectare
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
JPY	Japanese Yen
LDN	Land Degradation Neutrality
MDB	Multilateral development bank
MEA	Millennium ecosystem assessment
NASA	National Aeronautics and Space Administration
NCFA	Natural Capital Finance Alliance

NDC	Nationally determined contribution
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
OOF	Other official flows
PA	Protected area
PES	Payments for Ecosystem Services
PINE	Policy Instruments for the Environment
PSE	Producer Support Estimate
PwC	PricewaterhouseCoopers
RBC	Responsible business conduct
RCP	Representative Concentration Pathway
SDGs	Sustainable Development Goals
SEEA	System of Integrated Environmental and Economic Accounting
SER	Society for Ecological Restoration
SETAC	Society of Environmental Toxicology and Chemistry
SMART	Specific, measurable, ambitious, realistic and time-bound
TCFD	Task Force on Climate-related Financial Disclosures
TEEB	The Economics of Ecosystems and Biodiversity
UEBT	Union for Ethical BioTrade
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	US dollar
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization

Executive Summary

Biodiversity loss is among the top global risks to society. The planet is now facing its sixth mass extinction, with consequences that will affect all life on Earth, both now and for millions of years to come. Humans have destroyed or degraded vast areas of the world's terrestrial, marine and other aquatic ecosystems. Natural forests declined by 6.5 million hectares per year between 2010 and 2015 (in total, an area larger than the U.K.), and natural wetlands declined by 35% between 1970 and 2015. Over 30% of corals are now at risk from bleaching, and 60% of vertebrate populations have disappeared since 1970. These striking changes are driven by land-use change, over-exploitation of natural resources, pollution, invasive alien species and climate change. They are occurring in spite of international efforts (such as the Convention on Biological Diversity) to conserve and sustainably use biodiversity.

Human pressures are undermining the biodiversity that underpins all life on land and below water. Ecosystem services delivered by biodiversity, such as crop pollination, water purification, flood protection and carbon sequestration, are vital to human well-being. Globally, these services are worth an estimated USD 125-140 trillion (US dollars) per year, i.e. more than one and a half times the size of global GDP.

The costs of inaction on biodiversity loss are high. Between 1997 and 2011, the world lost an estimated USD 4-20 trillion per year in ecosystem services owing to land-cover change and USD 6-11 trillion per year from land degradation. Action to halt and subsequently reverse biodiversity loss needs to be scaled up dramatically and urgently. Biodiversity protection is fundamental to achieving food security, poverty reduction and more inclusive and equitable development.

There exists a strong business case for scaling up action on biodiversity. Business impacts and dependencies on biodiversity translate into risks to business and financial organisations, including ecological risks to operations; liability risks; and regulatory, reputational, market and financial risks. Acknowledging and measuring these dependencies and impacts on biodiversity can help businesses and financial organisations manage and prevent biodiversity-related risks, while harnessing new business opportunities.

The development of a post-2020 global biodiversity framework at the Convention on Biological Diversity's (CBD) 15th meeting of the Conference of the Parties (COP15) in Kunming, China, in 2020 presents a crucial opportunity to address this challenge. The global framework must help bring about the transformative changes in national goals, policies and actions needed to avert biodiversity loss and achieve the Sustainable Development Goals.

Given the urgent need for biodiversity action, the focus of the Group of Seven (G7) Environment Ministers' Meeting on biodiversity in May 2019 is both timely and welcome. Biodiversity is increasingly recognised as one of the defining global challenges of our time. G7 leadership on biodiversity in the run-up to CBD COP15 and beyond is vitally important.

This report supports these efforts by setting the economic and business case for the G7 and other countries to take urgent and ambitious action to halt and reverse global biodiversity loss. It presents a preliminary assessment of current biodiversity-related finance flows. It discusses the key data and indicator gaps to be addressed in order to underpin effective monitoring of both the pressures on biodiversity and the actions needed and being

implemented to address them. Finally, it provides recommendations on priorities for scaling up action on biodiversity.

Action is required on all fronts: by government (national and subnational), the private sector, civil society and individuals. This report identifies ten priority areas where G7 and other countries can focus their efforts:

- Pursue and advocate for specific, measurable and ambitious targets in the post-2020 global biodiversity framework to catalyse national and international action, including by using a focused set of headline indicators, across the state of biodiversity, the pressures on biodiversity and the actions needed to address these pressures and the underlying drivers of biodiversity loss. A clear, effectively structured and operational post-2020 framework is critical.
- Encourage business, financial organisations and other stakeholders to establish and share commitments and contributions to biodiversity through the *Sharm El-Sheikh to Kunming Action Agenda for Nature and People*, in order to mobilise action in advance of COP15.
- Promote policy coherence across different sectors and areas to harness synergies and reduce trade-offs for biodiversity.
- Scale up the suite of policy instruments for biodiversity and get the economic incentives right to ensure biodiversity is better reflected in producer and consumer decision-making.
- Scale up and align finance for biodiversity from all sources, public and private.
- Establish consistent and comparable finance tracking and reporting frameworks across countries and companies.
- Identify, assess and reform subsidies harmful to biodiversity at the national level, and expand internationally comparable information on those subsidies, for example, through peer review.
- Create a multi-stakeholder advisory group on biodiversity, business and finance, to advise on the adoption of a common approach for measuring and integrating biodiversity in business and investment decisions.
- Assess and communicate socio-economic dependencies and impacts on biodiversity at relevant geographic scales.
- Ensure inclusive and equitable transformative change, with special attention to public involvement, to lower-income households and most impacted people.

1. SYNTHESIS AND KEY MESSAGES

2020 marks a critical juncture for one of the defining global challenges of our time: the loss of biodiversity and ecosystem services, which underpin nearly all of the Sustainable Development Goals (SDGs). Transformative changes are needed to ensure biodiversity conservation and sustainable use, and the delivery of the ecosystem services upon which all life depends. This report sets the economic and business case for urgent and ambitious action to halt and reverse global biodiversity loss. It presents a preliminary assessment of current biodiversity-related finance flows, and discusses the key data and indicator gaps that need to be addressed to underpin effective monitoring of both the pressures on biodiversity and the collective responses currently being implemented.

1.1. Global biodiversity loss and the international context

Biodiversity loss is one of the greatest risks of the 21st century. It undermines human health and well-being, societal resilience and progress towards the SDGs. It places severe costs on our economies and makes addressing other global challenges, such as climate change, much more difficult.

The planet is facing its sixth mass extinction, with the current rate of species extinction estimated to be as high as 1 000 times the background (pre-human) rate. In addition, widespread and rapid population declines are affecting even common species that are fundamental to ecological processes: since 1970, the world has lost 60% of its global vertebrate population, and more than 40% of insect species are declining rapidly.

Humans have transformed the majority of the world's ecosystems, destroying, degrading and fragmenting terrestrial, marine and other aquatic habitats, and undermining the services they provide. Natural forests declined by 6.5 million hectares per year from 2010 to 2015 (an area greater than the United Kingdom in 5 years), mangroves declined by 20% from 1980 to 2005, and natural wetlands declined by 35% between 1970 and 2015. **Business-as-usual projections are bleak:** coral reefs, for example, are projected to decline by a further 70-90% at a global average warming of 1.5° Celsius above pre-industrial levels, or by more than 99% if warming reaches 2° Celsius.

Ecosystems are moving closer to critical thresholds and tipping points which, if crossed, will result in persistent and irreversible (or very costly to reverse) changes to ecosystem structure, function and service provision, with the potential for profoundly negative environmental, economic and social consequences.

Key pressures on terrestrial, marine and other aquatic biodiversity include habitat loss and fragmentation (particularly from agricultural expansion and intensification), over-exploitation of natural resources (e.g. fish), pollution, invasive alien species and climate change. The root cause of biodiversity is the growing demand for food, fuel, water and land, combined with well-documented inefficiencies and resource misallocation in global production and consumption systems.

The G7 Environment Ministerial Meeting in May 2019 takes place at a crucial time. Next year marks the end of the 2011-2020 Strategic Plan for Biodiversity (and, therefore, nearly half of the targets under SDGs 14 and 15). Governments will meet in China to agree on a post-2020 global biodiversity framework. The new framework will influence national

goals and policies, and thus our collective ability to stop biodiversity loss and deliver on the SDGs.

1.2. The socio-economic case for action

The socio-economic case for more ambitious biodiversity action is clear. Thousands of valuation studies are available at the local, regional and global scales, providing estimates of the benefits delivered by biodiversity and ecosystem services (e.g. pollination, climate regulation and water purification). The most comprehensive global estimate suggests that ecosystem services provide benefits of **USD 125-140 trillion (US dollars) per year** i.e. more than one and a half times the size of global GDP.

The costs of inaction on biodiversity loss are high and are anticipated to increase. The world lost an estimated USD 4-20 trillion per year in ecosystem services from 1997 to 2011, owing to land-cover change and an estimated USD 6-11 trillion per year from land degradation. Specifically, biodiversity loss can result in reduced crop yields and fish catches, increased economic losses from flooding and other disasters, and the loss of potential new sources of medicine (as the majority of drugs used for healthcare and disease prevention are derived from biodiversity).

Conserving, sustainably using and restoring biodiversity is vital to achieving many other policy objectives, including human health, climate-change mitigation and adaptation, disaster risk reduction, and water and food security. The associated economic values can be considerable: for example, the annual market value of crops dependent on animal pollination ranges from USD 235 billion to USD 577 billion.

The benefits derived from biodiversity and ecosystem services are considerable, but are systematically undervalued or unvalued in day-to-day decisions, market prices and economic accounting. Conventional accounting approaches and measures of economic performance (such as GDP) provide only a limited picture of an economy's health, and generally overlook the costs of ecosystem degradation.

Ongoing efforts to better assess and value biodiversity and ecosystem services, and integrate these values into decision-making are vital for halting biodiversity loss. National ecosystem assessments, which map, assess and value ecosystems and their services in order to inform and influence policy decisions, and natural capital accounting can support these efforts.

1.3. The business case for action

Business and financial organisations can have adverse impacts on biodiversity and ecosystem services through their operations, supply chains and investment decisions. The luxury group Kering, for instance, estimated the 2017 impact of its activities on the environment (e.g. carbon emissions, air and water pollution, and water consumption) at EUR 482 million (euros). **Valuing of biodiversity impacts by businesses and financial organisations, however, remains limited**.

Business and financial organisations also depend on biodiversity and ecosystems services for the production of goods and services. Coral reefs alone generate USD 36 billion per year for the global tourism industry. Biodiversity loss can have direct implications on business operations and value chains, e.g. by increasing input costs.

Business impacts on biodiversity can result in "responsible business conduct" risks to society and the environment. Biodiversity impacts and dependencies also create risks to business and financial organisations. Relevant risks to business and financial organisations include *ecological risks*, i.e. operational risks related to biodiversity impacts and resource dependency, scarcity and quality; *liability risks*, i.e. risk of legal suits; *regulatory risks; reputational* and *market risks*, linked to stakeholders' pressures or preferences changes; and *financial* risks.

The conservation, sustainable use and restoration of biodiversity can provide significant business opportunities, including long-term viability of business models; cost savings and increases in operational efficiency; increased market shares; new business models, markets, products and services; and better relationships with stakeholders. The global organic food and beverage market, for instance, is expected to grow 16% per year, to reach USD 327 billion by 2022.

Businesses' awareness of and commitment to biodiversity action remain too limited, despite some forward-thinking companies' growing awareness of biodiversity. A few companies have adopted industry-led commitments (e.g. the 2018 French Act4Nature initiative) and launched various biodiversity initiatives. Financial organisations, on the other hand, are less engaged for biodiversity than businesses, and much less engaged for biodiversity than for climate change.

Business and financial organisations need to integrate biodiversity factors across key dimensions of business and investment decision-making, including strategy; governance; impact assessment and risk management; due diligence;[1] disclosure and external reporting; industry standards, labels and certification schemes; and communication. Several accounting approaches are available to help businesses assess and measure their biodiversity impacts, dependencies and risks.

Policy makers, businesses, financial institutions and civil society need to co-operate to strengthen the business case for biodiversity and ecosystem services. Policy makers could notably:

- **require business and financial organisations to publish long-term plans** factoring in the assessment and management of biodiversity;
- **mainstream quantitative biodiversity assessments in reporting requirements** (e.g. the EU Non-Financial Reporting Directive and its guidelines), impact assessments and risk-management tools;
- **set policies promoting improved due diligence** for responsible business conduct (e.g. France's 2017 Duty of Vigilance Law), drawing on OECD Due Diligence Guidance for Responsible Business Conduct;
- **raise awareness among financial regulators** of the systemic implications of biodiversity factors, which do not only have local impacts;
- **encourage businesses, financial organisations and other stakeholders to make and share commitments** and contributions to biodiversity through the *Sharm El-Sheikh to Kunming Action Agenda for Nature and People*, in order to mobilise action in advance of COP15.

[1] A due-diligence approach can help businesses identify and prioritise action to avoid or mitigate adverse impacts on biodiversity.

1.4. Opportunities for cost-effective restoration

The opportunities for restoration are vast. Globally, up to 6 billion hectares of land are degraded (i.e. 20 times the size of France). Ecosystem restoration can bring species back from the brink of extinction, reverse the trends in ecosystem decline and help overcome major societal challenges, such as climate change, disaster risk and achieving inclusive economic growth.

Restoration can deliver multiple benefits. Restored mangroves, for example, can protect society from storms, hurricanes and coastal erosion, sequester carbon, provide a nursery ground for fish, offer a source of fuel and support ecotourism. Recognising the multiple benefits of ecosystem restoration, governments and businesses have committed to this goal through several high-level global initiatives (e.g. the Bonn Challenge) and international agreements (e.g. SDG 15 and Land Degradation Neutrality under the United Nations Convention to Combat Desertification).

The benefits of restoration can far exceed the costs, particularly for inland and coastal wetlands, grasslands and forests. For example, achieving the Bonn Challenge target of restoring 46% of the world's degraded forests could provide USD 7-30 in benefits for every dollar spent. The net benefits depend on the objectives, degree of degradation, and ecosystem type and location, as well as the opportunity costs. In general, preventing the degradation and loss of an ecosystem is more cost-effective than restoring it.

Restoration can also offer new economic and business opportunities. In the United States, for example, restoration work provides direct employment to an estimated 126 000 workers and generates USD 9.5 billion annually in economic output.

Restoration action at a landscape scale can help maximise synergies and manage potential trade-offs between ecosystem services, as well as balance competing demands for land or ocean resources. It is important, therefore, to integrate restoration into broader land-use and marine spatial planning. Large-scale restoration should be an inclusive process, requiring the participation of a range of stakeholders, such as local and indigenous communities, local and national governments, and the private sector.

1.5. Data and indicator gaps on pressures and responses relevant to biodiversity

Tackling the biodiversity challenge requires a better understanding of the pressures on biodiversity and the range of actions (i.e. responses) that are being put in place to address the pressures. These actions include response measures such as policies, legislation, governance and finance.

Data and indicators pertaining to pressures on biodiversity have improved steadily over the past decade, but gaps remain. For example, information on the extent and ecological impacts of pollution (e.g. pesticides and marine plastics) is insufficient to target policies effectively, despite the risks posed to society and the economy.

Comparable and consistent data on the actions implemented are already collected in a harmonised way across countries for several responses – e.g. data pertaining to a selection of positive incentives (Aichi Biodiversity Target 3) and protected area coverage (Aichi Target 11) – **but lacking in many others**. For example, although mainstreaming biodiversity into national and sector-level plans, policies and processes is essential to improving biodiversity outcomes, it remains challenging to monitor progress across countries in a comparable way.

Establishing specific, measurable and (to the greatest extent possible) quantitative targets for the post-2020 framework is essential to improving the ability to monitor progress. More specific and measurable targets can enhance clarity on the actions needed by government, the private sector and civil society, and would improve the ability to monitor progress. Targets and their associated indicators need to be developed synergistically and iteratively, to ensure stronger linkages between the two.

A key challenge in monitoring aggregate progress towards the 2011-2020 Aichi Biodiversity Targets has been the lack of comparability across national-level indicators. While the CBD Indicator Framework lists 98 indicative indicators for use, uptake of these indicators at the national level has been low.

A proposal to adopt categories of indicators under the post-2020 global biodiversity framework, including a smaller set of headline indicators for which data are comparable and consistent across countries, could help prioritise the efforts of national governments and international organisations in addressing data and indicator gaps. This would also enable aggregation of national contributions to the common, global set of biodiversity targets.

International organisations, such as the OECD and the FAO, that collect and track data across countries in a consistent and comparable manner can offer substantial support. For example, more than 100 countries currently report to the OECD Policy Instruments for the Environment database, which covers biodiversity-relevant economic instruments relevant to Aichi Target 3 on incentives and the finance they mobilise. More comprehensive reporting by countries would further enrich the collective ability to monitor progress on this and other Aichi and post-2020 Targets.

Open and user-friendly data can help address data gaps. Governments can also improve the range and quality of data available by harnessing new and innovative technologies and approaches (e.g. citizen science, artificial intelligence and earth observation) for monitoring and analysing data.

1.6. Global biodiversity finance: A preliminary update

There is a major gap in the finance needed to halt biodiversity loss. Finance flows (i.e. expenditures) for biodiversity come from both domestic and international public and private sources. There are substantial opportunities to scale up biodiversity finance from all sources.

There remain considerable gaps and inconsistencies in biodiversity finance reporting and tracking. Data for several types of finance flows are not reported consistently and comparably across countries. For example, some Parties reporting to the CBD Finance Reporting Framework also include extra-budgetary and private finance in their finance on domestic biodiversity-related activities, whereas others do not. Consolidated data on biodiversity finance from multilateral development banks do not exist. There also exist several important data gaps on private finance flows. For example, finance from biodiversity-relevant bonds are difficult to isolate, given the divergence in nomenclature and definitions of relevant bonds (e.g. green bonds, environmental bonds and sustainability bonds).

The disparate and inconsistent nature of the available data sets on finance flows also entails significant risks of double counting and undercounting, undermining the robustness of any resulting estimates. Significant further analysis is needed to reach a

more robust estimate of total global finance flows for biodiversity. France, which currently holds the G7 Presidency, has called on the OECD to undertake this task as one of the follow-up areas requested to this report.

With these caveats in mind, partial data on **domestic finance on biodiversity-relevant activities, as reported to the CBD Clearing House Mechanism by 40% of the Parties, was estimated at approximately USD 49 billion in 2015.** This estimate is based predominantly on finance from central (and in some cases, state and local) government budgets.

Drawing on several other data sources – most of which do not include domestic central public biodiversity finance – *preliminary* estimates suggest that finance flows to biodiversity amount to roughly USD 39 billion. This estimate includes finance flows from economic instruments (such as biodiversity offsets), philanthropy and impact investing, and may feature some double counting owing to the way the data are reported across different data sets. It is important to note that these two estimates are partial and incomplete, and cannot be added due to a degree of overlap. As noted above, further work is required to develop robust estimates of global biodiversity finance.

It is at least equally important to track, report and reform finance flows (e.g. subsidies) that are potentially harmful to biodiversity. The OECD conservatively estimates these flows at USD 500 billion per year (based on fossil-fuel subsidies and government support to agriculture that is potentially environmentally harmful), an order of magnitude ten times higher than global finance flows for biodiversity conservation and sustainable use. There exists large scope, therefore, to reform these types of finance flows to channel them towards biodiversity-friendly activities, or at least towards activities that are not potentially environmentally harmful.

It is also important to **evaluate better the effectiveness of existing finance flows – and the related policy and finance instruments** – in achieving biodiversity impacts. Both reforming harmful subsidies and reinforcing the effectiveness of biodiversity policy could come at no additional budgetary cost. Recent OECD work finds that few rigorous impact-evaluation studies have been conducted for terrestrial biodiversity, and even fewer for ocean/marine biodiversity. The OECD encourages rigorous impact-evaluation studies and the development of strategic criteria to help identify which policies, programmes or projects require more stringent evaluation.

1.7. Opportunities to scale up action for biodiversity

1. **Pursue and advocate for a clear, effectively structured and operational post-2020 global biodiversity framework that catalyses effective international action to halt and reverse biodiversity loss**
    - establish post-2020 targets that are as specific, measurable and quantitative as possible
    - ensure that targets and supporting indicators are closely linked in order to track progress and enhance the effectiveness of appropriate policy interventions
    - develop and agree on a focused set of headline indicators across state, pressure and response (i.e. action) indicators that are consistent and comparable across countries.

2. **Mobilise action through the *Sharm El-Sheikh to Kunming Action Agenda for Nature and People* in advance of COP15**

   - encourage business, financial organisations and other stakeholders to establish and share commitments and contributions to biodiversity through the *Sharm El-Sheikh to Kunming Action Agenda for Nature and People* and its online platform.

3. **Promote policy coherence to harness synergies and reduce trade-offs for biodiversity**

   - develop specific, measurable and ambitious post-2020 national targets for biodiversity, in consultation and co-ordination with a broad range of stakeholders, and clearly assign roles and responsibilities for action
   - integrate biodiversity goals and considerations into the national development plans and policies of key economic sectors and policy areas, such as agriculture, fisheries, energy, mining, urban development, trade and climate change
   - harness the potential of restoration and other nature-based solutions to deliver on multiple policy objectives, such as those listed under the SDGs, the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification, the United Nations Framework Convention on Climate Change and the Sendai Framework on Disaster Risk Reduction.

4. **Scale up policy instruments for biodiversity and get the economic incentives right**

   - strengthen ambition and scale up policy instruments for biodiversity conservation and sustainable use (including economic instruments, such as payments for ecosystem services, biodiversity-relevant taxes, fees and charges)
   - increase the extent and strengthen efforts to improve the management effectiveness of protected areas; enhance connectivity of natural terrestrial and marine areas through land-use and marine spatial planning instruments
   - monitor and evaluate the effectiveness of policy responses and other actions in achieving biodiversity outcomes and impacts; consolidate evidence to enable sharing of best practice and lessons learned among policy practitioners.

5. **Scale up and align finance for biodiversity from all sources**

   - scale up public and private finance for the conservation, sustainable use and restoration of biodiversity to address funding gaps, with support from public and development financial institutions and relevant financial instruments; in particular, better harness the ability of economic instruments to direct finance flows to biodiversity.

6. **Strengthen finance reporting and tracking frameworks**

   - develop finance tracking and reporting frameworks for public finance that are more consistent and comparable across countries. The Paris Collaborative on Green Budgeting is well placed to support these efforts
   - develop finance tracking and reporting frameworks for private-sector finance that are more consistent and comparable across companies.

7. **Reform subsidies harmful to biodiversity**
    - identify, assess and reform subsidies harmful to biodiversity at the national level, and expand internationally comparable information on those subsidies
    - consider a peer-review process to reform subsidies harmful to biodiversity among Group of Seven (G7) and other countries.
8. **Facilitate integration of biodiversity by businesses and financial organisations**
    - mobilise G7 leadership to develop a consensus among stakeholders on a common approach for measuring and integrating biodiversity factors (impacts, dependencies, risks and opportunities) in business and investment decisions, notably calling on the OECD to launch a multi-stakeholder advisory group on biodiversity, business and finance
    - invite the OECD to develop, as part of these efforts or independently, a set of practical actions on due diligence and biodiversity to support efforts by business, drawing on the *OECD Due Diligence Guidance for Responsible Business Conduct*
    - harness the momentum and visibility of the SDGs, and enhanced climate action by business and financial organisations, to raise awareness on the need also to integrate biodiversity considerations in business and finance.
9. **Assess and communicate socio-economic dependencies and impacts on biodiversity at geographic scales relevant to decision makers**
    - develop and reinforce the strategic and operational character of National Ecosystem Assessments (or similar assessments) – including through mapping and socio-economic valuation of ecosystem services – to ensure biodiversity-relevant decisions are well informed at the national and local scales
    - develop and refine tools and methodologies for integrating the values of ecosystem services and the costs of ecosystem degradation into national accounts and decision-making.
10. **Ensure an inclusive and equitable transformative change**
    - evaluate the distributional implications of policy changes, paying special attention to potential impacts on lower-income households, as well as local and indigenous communities
    - develop a robust evidence base on the costs and benefits of action, including who stands to benefit and who stands to bear the costs
    - devise targeted measures to address potential regressive impacts on the distribution of income and assets, and implement them together with the policy actions for biodiversity conservation, sustainable use and restoration
    - reinforce direct public involvement in policy making and harness the potential of innovative methods to this aim (e.g. digital public consultations and deliberative polls)
    - ensure that the benefits of biodiversity and ecosystem services are equitably shared across society today and for future generations.

2. GLOBAL BIODIVERSITY LOSS AND THE INTERNATIONAL CONTEXT

2.1. Biodiversity picture and the international context

Over the last 50 years, humanity has unleashed unprecedented technological change and economic growth, which have raised living standards and pulled billions of people out of poverty. However, the increasing demand for energy, food, fibre, water and land has come at a significant cost to planetary systems (Steffen et al., 2015[1]). The sheer scale of production and consumption, combined with systemic inefficiencies, misallocation of resources and waste, has resulted in rapid and widespread biodiversity loss. The implications for human health and well-being, societal resilience and sustainable development are considerable and potentially even catastrophic. According to the 2019 Global Risks Report, decision makers consider biodiversity loss and ecosystem collapse one of the ten greatest risks facing society today (WEF, 2019[2]).

Biodiversity underpins human life. It is responsible for a myriad of ecosystem services upon which society depends for basic life-support functions, such as the provision of food, fuel and clean water, nutrient cycling, pollination services and climate regulation (Box 2.1 and Figure 2.1). Halting biodiversity loss and restoring degraded ecosystems is therefore an essential element of sustainable development pathways. Failure to scale up action to address biodiversity loss will come at a significant cost to economies (Chapter 3) and businesses (Chapter 4), and more generally to human well-being.

Box 2.1. Key terms and definitions

Biodiversity (biological diversity): "The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (United Nations, 1992[3]).

Ecosystem: "A dynamic complex of plant, animal, and microorganism communities and the non-living environment, interacting as a functional unit" (Millennium Ecosystem Assessment, 2005[4]).

Ecosystem services: "The benefits people obtain from ecosystems" (Millennium Ecosystem Assessment, 2005[4]).

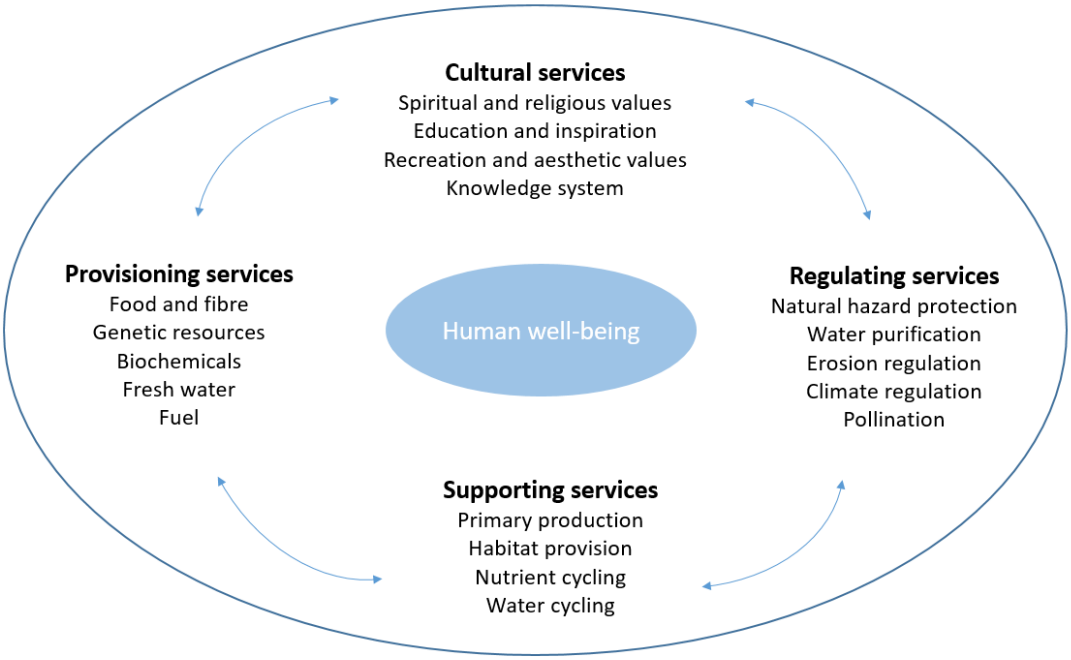
Natural capital: "The stock of renewable and non-renewable natural resources (e.g. plants, animals, air, water, soils, minerals) that combine to yield a flow of benefits to people" (Natural Capital Coalition, 2016[5]).

Addressing biodiversity loss requires ambitious domestic action by governments and non-state actors, which can be amplified by strong international co-operation. The Group of Seven (G7) Environment Ministerial Meeting in 2019 takes place at a crucial time. In 2020, the Convention on Biological Diversity (CBD)'s Strategic Plan for Biodiversity 2011-2020 and its 20 Aichi Biodiversity Targets will expire. Governments will convene in China for the 15th meeting of the Conference of the Parties to the CBD (COP15) to agree on a post-2020 global biodiversity framework. The decisions made on the post-2020 framework will influence domestic goals and policies, and thus our collective ability to achieve not only

Sustainable Development Goal (SDG) 14: Life Below Water and SDG 15: Life on Land, but also many of the other SDGs. For example, failure to address ongoing land-use change, deforestation and forest degradation will make the challenge of addressing climate change significantly more difficult. In turn, climate change will amplify the risks to biodiversity.

Although biodiversity loss is as great a challenge as climate change, it has received substantially less attention on the political agenda. The focus of the 2019 G7 meeting on biodiversity is a positive step forward. Biodiversity is connected intricately to other key themes that are more established on the G7 agenda, such as resource efficiency, climate change and marine litter. At the G7 Leaders Summit in 2018, for example, governments adopted the Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities, which recognises the threat of plastic litter to marine ecosystems and the role of natural infrastructure (ecosystems) in building coastal resilience.[2]

Figure 2.1. Types and examples of ecosystem services



Source: Adapted from (OECD, 2010[6]).

2.2. Threats and pressures on biodiversity

Biodiversity faces a wide number of threats, including land-use change, habitat loss and fragmentation (e.g. due to agricultural expansion), over-exploitation of natural resources (e.g. unsustainable logging, hunting and fishing), pollution (e.g. excess fertiliser use and marine litter), invasive alien species and climate change (OECD, 2012[7]) (SCBD, 2014[8]). For example, an analysis of over 8 500 threatened or near-threatened terrestrial, freshwater or marine species found that 72% are overexploited, and 62% are affected by agriculture (crop and livestock farming), timber plantations and/or aquaculture (Maxwell, 2016[9]). Agricultural expansion and intensification continues to be the dominant pressure on

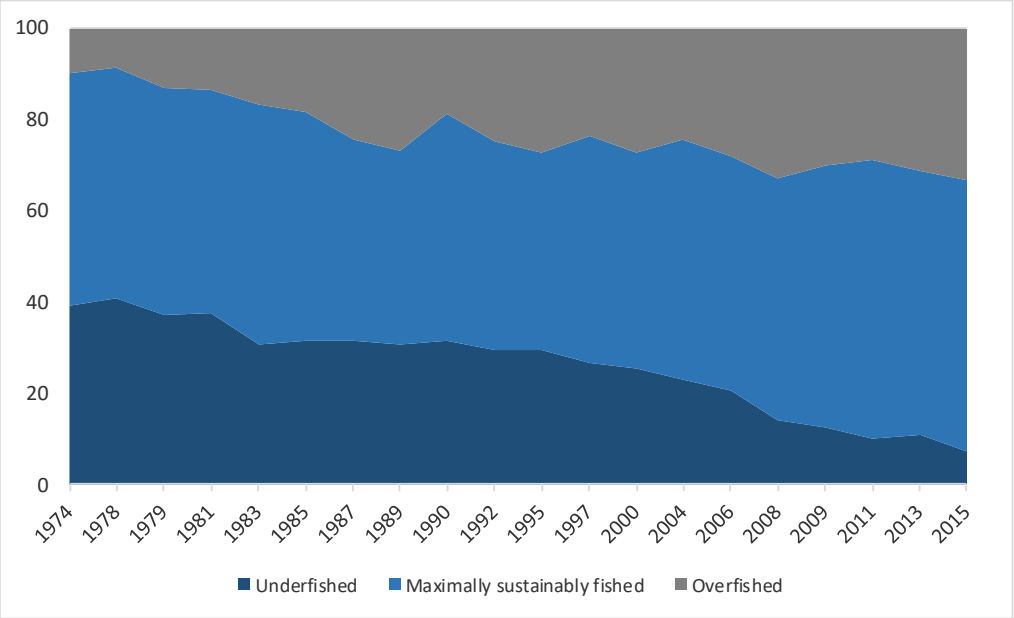
[2] For a discussion of coastal resilience and marine plastics in the context of G7, see (OECD, 2018[230]) and (OECD, 2018[229]).

terrestrial biodiversity, and is expected to increase as the demand for food and bioenergy grows (SCBD, 2014[8]). These impacts are exacerbated by international trade, which tends to shift the environmental impacts of production from developed to developing countries (Krausmann and Langthaler, 2019[10]). For example, 33% of biodiversity impacts in Central and South America and 26% in Africa are driven by consumption in other regions (Marques et al., 2019[11]).

Unsustainable fishing remains a major threat to marine ecosystems. Over 30% of fish stocks are fished at biologically unsustainable levels (Figure 2.2) (FAO, 2018[12]), and sea-bed bottom trawling is destroying irreplaceable deepwater habitats. Pollution from fertiliser run-off and sewage disposal also poses a threat to marine biodiversity, as reactive nitrogen and phosphorous can cause algal blooms, anoxic conditions and acidification. There is also growing concern about plastics pollution, with an estimated 8 million tonnes of plastic entering the ocean each year (Jambeck et al., 2015[13]), and documented impacts on around 500 species of marine mammals, fish and seabirds (SCBD, 2016[14]). Meanwhile, ocean warming and acidification are intensifying with climate change (IPCC, 2018[15]).

Climate change is putting increasing pressure on marine and terrestrial biodiversity, and exacerbating not only ocean warming and acidification, but also other pressures such as invasive alien species (Early et al., 2016[16]). A synthesis of hundreds of scientific studies found that climate change has already resulted in shifts in species distribution and disrupted species interactions, led to mismatches in the timing of migration, breeding and food supply, and contributed to declines in populations (BirdLife International and The National Audubon Society, 2015[17]). Climate change is also affecting ecosystem configuration, productivity and service provision, with significant economic implications (Lipton et al., 2018[18]). In the absence of ambitious climate action, the impacts on biodiversity and ecosystem services will be severe: coral reefs are projected to decline by a further 70-90% with global warming of 1.5° Celsius above pre-industrial levels, or by more than 99% if the world allows warming of 2° Celsius (IPCC, 2018[15]).

Figure 2.2. Global trends in the state of world marine fish stocks, 1974-2015



Source: (FAO, 2018[12]).

2.3. State of terrestrial, marine and other aquatic biodiversity

The multidimensionality and complexity of biodiversity means there is no single measure that can comprehensively capture the state of biodiversity globally. However, a range of biodiversity data and indicators on species, forests, wetlands and other ecosystems clearly point to an overall decline in biodiversity and the widespread degradation of ecosystems. While overall trends are negative, there exist a few notable examples of effective conservation and sustainable use of biodiversity, demonstrating that progress has been made, and that humankind has the knowledge and tools to address biodiversity loss.

2.3.1. Trends in species and populations

The planet is facing its sixth mass extinction. Scientists estimate the current rate of species extinction to be as much as 1 000 times higher than the natural background (pre-human) rate (De Vos et al., 2015[19]).[3] In the 20th century alone, 477 vertebrates are known to have gone extinct, while only nine would have been expected to go extinct if background rates of vertebrate extinction had persisted (Ceballos et al., 2015[20]). Species extinction not only represents an irreversible loss of global diversity and its inherent value, it has negative knock-on effects for ecosystem function, productivity and resilience (Cardinale et al., 2018[21]).

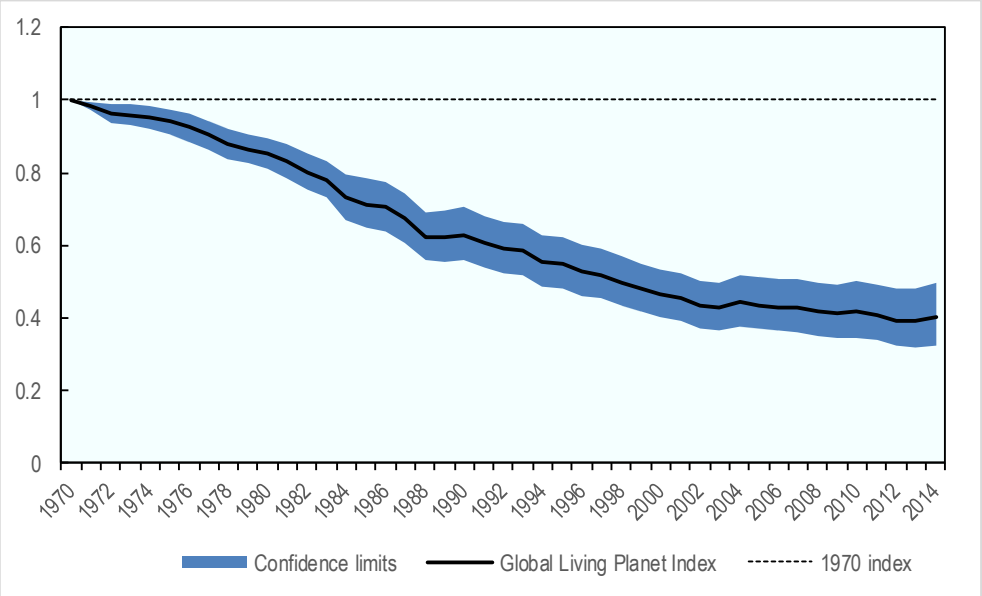
Of the 96 500 species on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species,[4] 26 500 (more than 27%) are threatened with extinction. This includes 40% of amphibians, 34% of conifers, 33% of reef corals, 31% of sharks and rays, 27% of selected crustaceans and 14% of birds. The total number of species threatened with extinction is likely to be much higher, as the Red List only covers a portion of the world's species: many (particularly non-vertebrate) species are yet to be formally identified, and gaps in available data and information remain.

In addition to species extinction, the widespread and frequent loss of populations, and declines in the numbers of individual species within remaining populations, are also cause for concern. Species abundance, not just diversity, is an important determinant of ecosystem function and resilience (Valiente-Banuet et al., 2015[22]) (Oliver et al., 2015[23]), and the delivery of ecosystem services (Inger et al., 2014[24]) (Winfree et al., 2015[25]). The Living Planet Index (Figure 2.3), which tracks the population abundance of thousands of mammals, birds, fish, reptiles and amphibians around the world, shows an overall decline in population sizes of 60% between 1970 and 2014 (WWF, 2018[26]). Globally, freshwater species show the largest declines, with an 83% loss in population size since 1970.

[3] There are uncertainties and variations in estimates of current and background extinction rates, which stem from the difficulty of estimating background extinction rates e.g. through fossil records and molecular phylogeny. However, estimates consistently indicate a notable increase in the extinction rate.

[4] The Red List of Threatened Species (established in 1964) is a widely used indicator of the health of the world's biodiversity. It uses a set of quantitative criteria to evaluate the extinction risk of thousands of species. It divides species into nine categories: Not Evaluated, Data Deficient, Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct in the Wild and Extinct.

Figure 2.3. Living Planet Index, 1970-2014



Source: (WWF, 2018[26]).

Population declines are affecting not only rare and threatened species, but also common ones. In Europe, for example, common farmland birds declined by 57% between 1980 and 2016 (EBCC et al., 2017[27]). Similar trends exist in Canada and the United States, where 74% of farmland bird species declined between 1966 and 2013 (Stanton, Morrissey and Clark, 2018[28]). The causes of these declines include loss of natural habitats, mowing/harvesting, exposure to pesticides and a decline in the insects upon which most birds depend. For example, flying-insect biomass in 63 protected areas in Germany declined by more than 75% over 27 years (Hallmann et al., 2017[29]). Globally, 40% of insects are in decline and one-third are threatened with extinction (Sánchez-Bayo and Wyckhuys, 2019[30]). In addition to its impacts on the food web, the loss of insect biomass and diversity negatively affects crop pollination, waste disposal and nutrient cycling (Losey and Vaughan, 2006[31]).

2.3.2. Trends in the extent and state of ecosystems

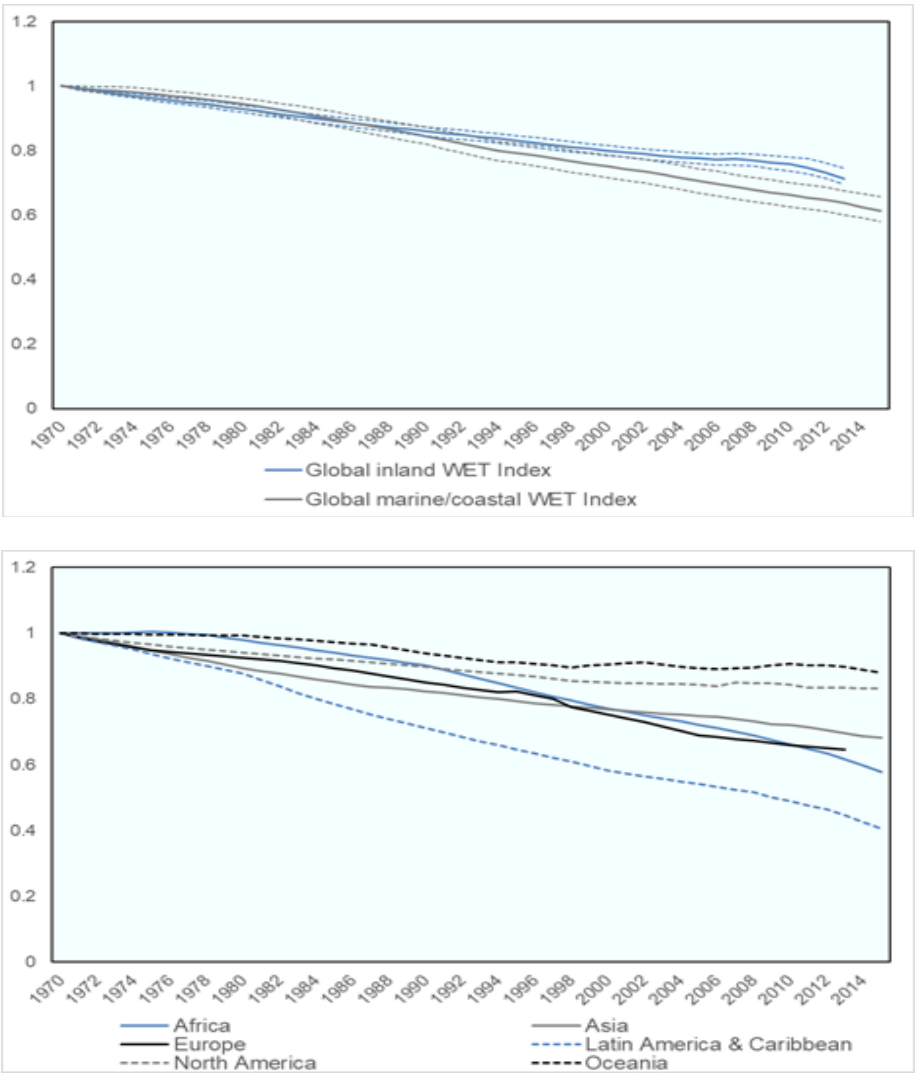
Humans have transformed the majority of terrestrial, marine and other aquatic ecosystems across the globe. Ecosystems and the habitats they provide continue to be converted, degraded and fragmented, altering their function, productivity and resilience.

Global forest cover continues to decline as demand for food and land increases (Hansen et al., 2013[32]). Planted forests have increased, but this increase has been offset by a decline in natural forests (FAO, 2019[33]), which tend to be more biodiverse (Gibson et al., 2011[34]). Natural forest area declined by 10.6 million hectares per year from 1990 to 2000, and by 6.5 million hectares per year from 2010 to 2015 (FAO, 2019[33]). Natural wetland coverage has declined by an estimated 35% over 1970-2015 (Darrah et al., 2019[35]), and continues to decline at a rate of 0.85-1.6% per year (Ramsar Convention on Wetlands, 2018[36]). The fragmentation of forests, wetlands and other habitats is also concerning, as it is a precursor of species loss and disrupts ecosystem functions by decreasing biomass and altering nutrient cycles (Haddad et al., 2015[37]). Habitat fragmentation is expected to become

increasingly problematic with climate change, as it undermines the ability of species to track suitable habitats (SCBD, 2009[38]).

The state of marine and coastal ecosystems has also deteriorated. For example, global mangrove area is estimated to have declined by about 20% between 1980 and 2005 (FAO, 2007[39]), and the coverage of seagrass is estimated to have declined by 29% over the last 100 years (Waycott et al., 2009[40]). The world lost approximately half of its shallow water corals in the past 30 years (WWF, 2018[26]), and 31% of the world's corals are now at risk from bleaching, compared to 8% in the 1980s (Hughes et al., 2018[41]). While severe bleaching events used to occur every 27 years, the median time between events had declined to 6 years by 2016 (Hughes et al., 2018[41]).

Figure 2.4. Global and regional trends in natural wetland coverage, 1970-2015



Note: Wetlands Extent Trend index for global marine/coastal and inland wetlands, and for natural wetlands in six regions. Natural regional wetland trends are reported from 1970 to 2015 except for Europe (1970-2013) due to data availability. The dashed lines for the global index show 95% confidence intervals.
Source: Based on data from (Darrah et al., 2019[35]).

The widespread destruction, degradation and fragmentation of ecosystems is accelerating, with profound implications for human well-being and the global economy. The loss of biodiversity already costs the world billions of dollars per year (Chapter 3). Moreover, because ecosystems are complex, non-linear systems, incremental increases in pressure in the coming years could have a disproportionately large impact on biodiversity and the ecosystem services upon which economies and human well-being depend (Box 2.2).

Box 2.2. Ecosystem thresholds and tipping points

Ecosystems can only absorb pressure up to a certain threshold. Beyond this threshold, an incremental increase in human pressure can lead to a large, often abrupt, change in an ecosystem's structure and function. Such abrupt regime shifts tend to be persistent and irreversible (or costly to reverse), and can have profoundly negative environmental, economic and social consequences.

Thresholds are expected to be crossed more frequently in the coming decades in marine, aquatic and terrestrial ecosystems owing to the increasing intensity of pressures, and their combined and often synergistic effects. The complex non-linear dynamics of ecosystems and their interactions with human systems make it difficult to predict where thresholds lie, when they will be crossed, and what will be the scale of impact. Given this uncertainty and the potential impact of regime shifts, it is prudent to take a precautionary approach and keep disturbance well below likely thresholds. Maintaining or restoring biodiversity can make ecosystems more resilient, reducing the likelihood of regime shifts.

Sources: (Folke et al., 2004[42]) (Leadley et al., 2014[43]) (Scheffer et al., 2001[44]).

3. THE SOCIO-ECONOMIC CASE FOR BIODIVERSITY ACTION

3.1. Biodiversity and ecosystem services: the foundation of economic development and human well-being

Biodiversity and ecosystem services underpin the global economy and human well-being. They provide indispensable services at the local, regional and global scales, such as food production, water purification, flood protection and climate-change mitigation. According to one estimate, the economic value of these services was USD 125-140 trillion (US dollars) in 2011 (Costanza et al., 2014[45]), i.e. well over one and a half times the size of the world's gross domestic product (GDP) that year. While these and other estimates (Table 3.1) involve a degree of uncertainty,[5] they indicate the magnitude of the economic value derived from biodiversity.

Failure to address biodiversity loss is (and will continue to be) costly. Between 1997 and 2011, global estimates suggest the world lost USD 4-20 trillion per year in ecosystem services owing to land-cover change (Costanza et al., 2014[45]) and USD 6.3-10.6 trillion per year from land degradation (ELD Initiative, 2015[46]). Meanwhile, poor management of oceans (e.g. invasive marine species carried in ship ballast water, over-exploitation of fisheries and nutrient pollution) costs at least USD 200 billion per year (UNDP and GEF, 2012[47]). Given the current trends in biodiversity loss, the economic costs will continue to rise and, because ecosystems are complex systems with tipping points, potentially increase exponentially. Failure to address biodiversity loss will also compromise efforts to achieve other policy objectives, such as climate-change mitigation, and food and water security.

Table 3.1. Biodiversity and ecosystem service values

Scale	Good or service	Estimated annual value
Global	Seagrass nutrient cycling	USD 1.9 trillion
Global	Annual market value of animal pollinated crops	USD 235-577 billion
Global	First sale value of fisheries and aquaculture	USD 362 billion
Global	Coral reef tourism	USD 36 billion
Europe	Ecosystem services from Natura 2000 protected area network	EUR 223-314 billion
Canada	Value of commercial landings from marine and freshwater fisheries	CAD 3.4 billion
France	Recreational benefits of forest ecosystems	EUR 8.5 billion
Germany	Direct and indirect income from recreational fishing	EUR 6.4 billion
Italy	Habitat provision	EUR 13.5 billion
Japan	Water purification from tidal flats and marshes	JPY 674 billion
United Kingdom	Physical and mental-health benefits of the natural environment	GBP 2 billion
United States	Air purification from trees and forest (avoided morbidity and mortality)	USD 6.8 billion

Notes: EUR: euros; CAD: Canadian dollars; JPY: yen; GBP: pounds sterling.
Sources: (Waycott et al., 2009[40]) (IPBES, 2016[48]) (FAO, 2018[12]) (Spalding et al., 2017[49]) (EU, 2013[50]) (Government of Canada, 2018[51]) (Garcia and Jacob-Revue D, 2010[52]) (Schröter-Schlaack et al., 2016[53]) (Comitato Capitale Naturale, 2018[54]) (Japan Ministry of Environment, 2014[55]) (White et al., 2016[56]) (Nowak et al., 2014[57]).

[5] For a discussion of valuation techniques, recent progress in valuation and limitations, see: (OECD, 2018[227]).

Although biodiversity and ecosystem services deliver considerable benefits, these tend to be undervalued or unvalued in day-to-day decisions, economic accounts and market prices. One reason for this is that decision makers lack knowledge about the interactions between economies and ecosystems. Another, predominant, reason is market failures: the majority of ecosystem services are not priced in the market because they are public goods (i.e. non-excludable and non-rival in their consumption)[6]. As a result, there are insufficient economic incentives to conserve and sustainably use biodiversity. Those ecosystem services that are priced (e.g. food and timber provision), are often distorted by subsidies or uncompetitive markets. The failure to account for the full economic values of biodiversity and ecosystem services in decision-making is one of the main contributing factors to their loss and degradation.

Policy makers' understanding of ecosystem-economy interlinkages and the valuation of ecosystem services has improved considerably over the past 30 years. International assessments and initiatives, such as the Millennium Ecosystem Assessment (MEA); The Economics of Ecosystems and Biodiversity (TEEB), initiated in response to a proposal by the Group of Eight + Five countries meeting in Potsdam, Germany, in 2007; and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) have contributed to this progress. They have also brought international attention to the socio-economic benefits of biodiversity and the impacts of biodiversity loss. A large number of empirical studies that estimate the monetary values associated with the various benefits provided by ecosystem services at the local, regional and global scales are now available (Box 3.1).

Although economic valuation of biodiversity continues to face some methodological limitations and is sometimes criticised on ethical grounds, it remains a useful and necessary tool for integrating biodiversity values into policy making, as they are otherwise effectively priced at zero. The decisions of ministries responsible for national development strategies and budget allocations, for example, are informed predominantly by interests such as economic growth, competitiveness, food security, and other issues that are politically "weightier" or perceived to be more pressing. Putting a monetary value on ecosystem services can help convey their importance, and ultimately lead to more efficient, cost-effective and equitable decisions.

[6] Non-excludable: It is difficult to exclude other people from benefitting from e.g. flood protection provided by wetlands, or the aesthetic value of forests. Non-rival: one person benefitting from flood protection by wetlands does not reduce the flood protection benefits obtained by another person.

Box 3.1. Valuing ecosystem services

The benefits generated by ecosystem services have direct-use values (e.g. timber), indirect-use values (e.g. pollination), option values and non-use values. Option values are the values people place on the potential for future use of biodiversity. Non-use values refer to the benefits individuals derive from the knowledge that biodiversity exists (existence values) and will be available to future generations (bequest values).

The benefits society derives from ecosystem services accrue at the local, regional or global level, or a combination of these. The spatial scales of ecosystem services provide an indication of the roles and responsibilities associated with the conservation, sustainable use and restoration of biodiversity. For example, the premise of Reducing Emissions from Deforestation and Forest Degradation, a mechanism through which developing countries receive finance from developed countries to protect their forests, is that forests provide a global public good (carbon sequestration).

Type of value	Examples of ecosystem services	Geographical scale of benefits		
		Local	Regional	Global
Direct use	Food (e.g. fisheries and aquaculture)	✓	✓	✓
	Fuel (e.g. timber)	✓	✓	
	Water	✓	✓	
	Natural products (e.g. sand, pearls and diatomaceous earth)	✓	✓	✓
	Genetic and pharmaceutical products	✓	✓	✓
Indirect use	Atmospheric composition, carbon sequestration and climate regulation			✓
	Shoreline stabilisation/erosion control	✓	✓	
	Natural hazard protection (e.g. from storms, hurricanes and floods)	✓	✓	
	Pollution buffering and water quality	✓	✓	
	Recreation and tourism	✓	✓	✓
Option values	Potential for future use of the above	✓	✓	✓
Non-use values	Cultural and spiritual values, existence and bequest values, e.g. associated with habitat for species	✓	✓	✓

3.2. The economic values of biodiversity and costs of inaction across multiple policy areas

The conservation, sustainable use and restoration of biodiversity is vital to achieving a number of policy objectives beyond biodiversity, such as human health, food and water security, climate-change mitigation and adaptation, and disaster risk reduction. Drawing on a range of local, national, regional and global studies, this section highlights the economic case for scaling up biodiversity action in qualitative and quantitative terms.

3.2.1. Biodiversity and human health

Biodiversity provides services critical for human health and well-being. These services include the provision of basic needs (e.g. food and protection from environmental hazards, discussed in 3.2.2 and 3.2.4) biomedical resources, air purification, and opportunities for recreational and therapeutic activities.

Biomedical resources and insights: many of the drugs used today for health care and disease prevention were discovered from plant sources (e.g. digoxin), lizards (e.g. exenatide), cone snails (e.g. ziconotide), fungi (e.g. penicillin) and other wild species. More than 80% of the small-molecule anticancer drugs approved between 1981 and 2014 are either natural products, based on natural products or mimic natural products (Newman and Cragg, 2016[58]). The most profitable drug to date, atorvastatin (Lipitor), is a cardiovascular drug descended directly from a microbial natural product that posted annual sales of USD 12-14 billion between 2004 and 2014 (Newman and Cragg, 2016[58]).

The untapped potential for future drug discovery and medical insights from biodiversity is vast, but is diminishing because of biodiversity loss. Although plants have been a major source of natural product drugs, only a fraction of the 400 000 plant species on Earth have been studied for their pharmacological potential.[7] Arthropods, microbes and fungi are even less studied. Given their diversity and the medicines already discovered from them, these taxa hold considerable potential for the development of new drugs (Neergheen-Bhujun et al., 2017[59]) (WHO and SCBD, 2015[60]).

Regulating air quality: morbidity and mortality from air pollution is a major health challenge, particularly in urban areas. The OECD estimates the welfare cost from premature deaths stemming from exposure to outdoor fine particles and ozone at USD 5.3 trillion globally in 2017. Investing in nature can help reduce this burden. Trees and forests in the conterminous United States, for example, removed 17.4 million tonnes of air pollution in 2010, providing health benefits (avoidance of human mortality and incidences of acute respiratory symptoms) valued at USD 6.8 billion (Nowak et al., 2014[57]).

Recreational and therapeutic activities: access and proximity to nature and green spaces correlate with reductions in mortality, cardiovascular disease and depression, and increases in perceptions of well-being (WHO and SCBD, 2015[60]). The physical and mental-health benefits of natural environments (e.g. parks, woodlands and beaches) in the United Kingdom are estimated at GBP 2 billion (pounds sterling) a year (White et al., 2016[56]). With over half of the world's population living in urban areas today, and given current urbanisation trends, the savings in healthcare costs from integrating biodiversity conservation into urban planning and building design are likely only to increase.

3.2.2. Biodiversity and food

Conserving and sustainably managing biodiversity is vital to meeting growing food demand and achieving Sustainable Development Goal 2: Zero Hunger. Biodiversity is the foundation of our food system. Biodiversity is the food we eat – domesticated and wild livestock and crops, aquatic species harvested from the wild or raised through aquaculture – as well as the myriad plants, animals and micro-organisms that underpin production processes such as maintaining healthy soils, regulating water and pollinating plants. Although food production has increased considerably to match growing demand, this increase has often come at the expense of the biodiversity and ecosystem services that underpin global food systems.

The economic value of biodiversity's contribution to food systems is considerable. Pollination from bees, birds, bats and other species contributes directly to between 5% and 8% of current global crop production. The annual market value of these crops is USD 235-

[7] For example, the National Cancer Institute repository contains only c. 60,000.

577 billion (in 2015 USD) (IPBES, 2016[48]). Higher pollinator density and species diversity can lead to higher crop yields (Garibaldi et al., 2016[61]) (Garibaldi et al., 2013[62]). The dramatic decline in the abundance of bees and other insects (see 2.3.1), therefore, poses a considerable economic risk. The loss of all animal pollinators would result in an estimated annual net loss in welfare of USD 160-191 billion globally to crop consumers, and an additional loss of USD 207-497 billion to producers and consumers in other markets (IPBES, 2016[48]).

Biodiversity is also important to control pest outbreaks. Maintaining habitat within agro-ecosystems and surrounding landscapes for insectivorous birds and bats, and microbial pathogens that regulate populations of agricultural pest, can reduce the need for pesticides. The estimated value of this service for controlling a single pest – the soybean aphid – in four US states in 2007-08 was USD 239 million (Landis et al., 2008[63]). The total value of natural pest-control services in the United States, based on the value of crop losses to insect damage and insecticide expenditure, is estimated at USD 13.6 billion per year (Losey and Vaughan, 2006[31]). Reducing pesticide use and supporting biological control would help reduce one of the primary threats to bee and other insect populations, while also increasing the efficiency of farms (Lechenet et al., 2017[64]).

Genetic and species diversity among crops and livestock (and the wild varieties of domestic species) is fundamental to ensuring agricultural systems' resilience to drought, flood, pests and disease. Maintaining genetic diversity allows farmers to adapt their livestock breeds and crop varieties to changing environmental conditions, reducing the vulnerability of farmers and the global food system. Nevertheless, the Food and Agriculture Organization of the United Nations (FAO) reports increasing extinction risk among wild varieties and livestock breeds; declining crop diversity; and widespread genetic erosion as a result of poor cross-breeding practices, the use of non-native breeds and the pursuit of more productive breeds at the expense of less productive ones (FAO, 2019[33]).

3.2.3. Biodiversity and water security

A major challenge facing governments across the globe is water security, which is projected to deteriorate in many regions owing to increasing water demand, water stress and water pollution. An estimated 40% of the global population is already affected by water scarcity (UN and WBG, 2018[65]), and around 30% lacks safely managed drinking water supplies (WWAP, 2019[66]).

The mismanagement and degradation of ecosystems is a root cause of water insecurity. To tackle water insecurity, governments must tackle biodiversity loss. Healthy soils, forests, wetlands, grasslands and other ecosystems provide vital hydrological services that can reduce water-related disaster risks (Section 3.2.4), and improve water availability and quality. For example, nearly one-third of the world's 105 largest cities – including Los Angeles, New York, Rome and Tokyo – depend on protected forests for a significant share of their drinking water (Duley and Stolton, 2003[67]).

Conserving or restoring natural ecosystems, or enhancing the creation of natural processes in modified or artificial ecosystems, can be a sustainable solution to water insecurity and may be more cost-effective than grey-infrastructure alternatives, as shown in the examples below:

- *United States:* a cost-benefit analysis conducted for Philadelphia estimated the net present value of low-impact "green" infrastructure for storm-water control (e.g. tree planting, permeable pavement, green roofs) at USD 1.94-4.45 billion

over a 40-year period. The net benefits for the grey-infrastructure alternative (e.g. storage tunnels) were much lower at USD 0.06-0.14 billion (Stratus Consulting Inc, 2009[68]). An analysis of options for improving water quality in Portland found that green infrastructure would be 51-76% cheaper (USD 68-72 million cheaper) than water-filtration plant upgrades (Talberth et al., 2012[69]) and would bring ancillary benefits (i.e. salmon habitat and carbon sequestration) estimated conservatively at USD 72-125 million.

- *Kenya:* Tana River provides 80% of Nairobi's drinking water and 70% of Kenya's hydropower. However, ecosystem degradation from unsustainable agricultural practices has led to higher levels of erosion and sedimentation. As a result, the cost of water treatment for Nairobi has increased, and the hydropower reservoir capacity has declined. Planned investment of USD 10 million in sustainable land-management measures in the Tana River Delta is expected to deliver a return of USD 21.5 million over 30 years as a result of increased power generation and agricultural crop yields, and savings in water and wastewater treatment (TNC, 2015[70]).

3.2.4. Biodiversity, climate change and disaster risk

Countries need to decrease greenhouse gas emissions by 25% by 2030 compared to 1990 levels to achieve the 2 degrees Celsius (°C) target of the Paris Agreement and 55% to reach the 1.5°C target (IPCC, 2018[15]). Conserving, sustainably managing and restoring ecosystems can provide a substantial and cost-effective contribution to these efforts. Plants and soils in terrestrial ecosystems absorb an estimated 9.5 billion tonnes of carbon dioxide equivalent every year (Le Quéré et al., 2015[71]). However, land-use change and poor management have depleted carbon stocks in terrestrial ecosystems, resulting in large emissions of carbon into the atmosphere. For example, deforestation and forest degradation account for around 12% of global emissions of carbon dioxide (CO_2) (Van der Werf et al., 2009[72]). The destruction of marshes, mangroves and seagrasses releases an estimated 0.15-1.02 gigatonnes of carbon dioxide ($GtCO_2$) per year, resulting in annual economic damages of USD 6-42 billion (Pendleton et al., 2012[73]).[8]

Griscom et al. (2017[74]) estimate that conservation, restoration and improved management of forests, grasslands, wetlands and agricultural lands could deliver 23.8 $GtCO_2$ of cumulative emission reductions by 2030. About half of this mitigation potential represents cost-effective climate mitigation, defined as a marginal abatement cost of less than or equal to 100 USD per tonne of CO_2 by 2030.[9] Deploying these approaches could deliver up to 37% of the emission reductions needed by 2030 in order to have a greater than 66% likelihood of holding warming below 2°C, and up to 20% of the emission reductions needed between now and 2050.

In addition to mitigation, biodiversity and ecosystem services play an important role in adapting to the impacts of climate change, and reducing the risk of climate-related and non-climate-related disasters. For example, floodplains and wetlands can protect communities from floods. Coral reefs, seagrass and mangroves buffer coastlines from waves and storms. Forested slopes stabilise sediments, protecting people and their assets from landslides.

Healthy, connected and biodiverse ecosystems also tend to be more resilient to the effects of climate change than degraded ecosystems (Oliver et al., 2015[23]) (Spalding et al.,

[8] Economic damages per tonne of carbon were valued at USD 41 (2007 US dollars).

[9] One-third of this could be achieved at low cost (less than or equal to USD 10 per tonne of carbon dioxide equivalent).

2017[49]). Hence, conserving, sustainably using and restoring biodiversity is critical to ensuring ongoing ecosystem function and service provision in a changing climate. In some cases, the speed and scale of climate change will make it difficult – if not impossible – for some species and ecosystems to adapt. The Fourth National Climate Assessment of the United States highlights some of the economic implications (Box 3.2).

Box 3.2. The costs of inaction – Insights from the U.S. Fourth National Climate Assessment

The Global Change Research Act of 1990 mandates that the U.S. Global Change Research Program deliver a climate change report to Congress and the President no less than every four years. The Fourth National Climate Assessment (2018) finds that climate change is having widespread impacts on ecosystem services. Changes are occurring in agricultural and fisheries production, the supply of clean water, protection from extreme events and culturally valuable resources. The report provides estimates of the economic costs of some of the (projected) impacts:

- By mid-century, the annual area burned in the western United States could increase 2–6 times, partly because of increased temperatures, earlier snowmelt and more intense droughts. The associated costs are large. For example, over 2000-16, a period of increased wildfire (due in part to climate change), US federal wildfire suppression expenditures ranged from USD 809 million to USD 2.1 billion per year.
- By 2090, cold-water recreational fishing days in the United States are predicted to decline, costing USD 1.7 billion per year under a low greenhouse gas scenario (representative concentration pathway [RCP] 4.5) or USD 3.1 billion per year under a higher scenario (RCP 8.5).
- By 2100, climate change is projected to result in the loss of USD 140 billion in recreational benefits associated with coral reefs (in 2015 dollars) under a high scenario (RCP 8.5).
- Ocean acidification is expected to reduce harvests of US shellfish, with cumulative consumer losses of USD 230 million (in 2015 dollars) anticipated by 2099, under a high greenhouse gas-emission scenario.

Notes: RCP is a plausible greenhouse gas concentration trajectory adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. RCP 4.5 is the second-lowest of four modelled pathways. RCP 8.5 is the highest.

Source: (Reidmiller et al., 2018[75]).

The concepts of ecosystem-based adaptation[10] (EbA) and disaster risk reduction[11] (Eco-DRR) – also called nature-based solutions – have emerged based on the recognition that biodiverse ecosystems are more climate-resilient than degraded ones and can deliver greater flows of ecosystem services. If well planned, EbA and Eco-DRR can be cost-effective and provide multiple benefits beyond adaptation and disaster risk reduction, including species habitat, climate mitigation, and amenity values:

- *Canada*: investment in wetland conservation in the Smith Creek Drainage Basin in Saskatchewan is estimated to deliver over a ten-year period CAD 7.70 (Canadian dollars) (in flood control, nutrient removal, recreation and carbon sequestration) for every dollar invested in wetland conservation, and CAD 3.22

[10] Defined as "The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. EbA aims to maintain and increase the resilience and reduce the vulnerability of ecosystems and people in the face of the adverse effects of climate change" (SCBD, 2009[38]).

[11] Defined as "Sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development" (Estrella and Saalismaa, 2013[228]).

for every dollar invested in 25% restoration of lost wetlands (Pattison-Williams et al., 2018[76]).

- *Fiji*: Lami Town faces potential losses from flooding, estimated at FJD 31 million (Fijian dollar). A cost-benefit analysis was conducted to inform the choice between four adaptation scenarios. The benefit-to-cost ratios were highest for EbA, but engineering approaches were assumed to have higher damage avoidance (Table 3.2). This points to the potential role of hybrid approaches.

Table 3.2. Cost-benefit analysis for Lami Town

	Benefit-to-cost ratio	Assumed damage avoidance
Ecosystem-based adaptation only	19.50	10-25%
Ecosystem-based adaptation emphasis	15.00	25%
Engineering emphasis	8.00	25%
Engineering only	9.00	25-50%

Source: (Rao et al., 2013[77]).

- *United States*: an assessment of the value of coastal wetlands in the Northeastern United States found that wetlands prevented USD 625 million of flood damage from Superstorm Sandy in 2012 and lowered flood damage by 11% on average. A more localised study in the region estimated that properties located behind marshes in Barnegat Bay, New Jersey, suffered 16% less annual flood damage than properties that had lost their marshes (Narayan et al., 2017[78]).

3.3. Reflecting the true value of biodiversity in national decision-making

Countries are taking steps to gain a better understanding of their economic dependence on biodiversity and ecosystem services at a national and local level.[12] Notable initiatives include national ecosystem assessments (NEAs) to map, assess and in some cases economically value ecosystem services. NEAs build on and complement the MEA, the TEEB and IPBES assessments. For example, the first comprehensive assessment of ecosystem services in the United Kingdom was delivered in response to a UK House of Commons recommendation following the MEA. With the adoption in 2011 of the EU Biodiversity Strategy to 2020, EU Member States committed to "map and assess the state of ecosystems and their services", and integrate "these values into accounting and reporting systems at EU and national level by 2020" (European Union, 2011[79]).

Evidence shows that NEAs can – and are already – informing policy. NEAs conducted in Japan and the United Kingdom, for example, have been mentioned in documents setting out future policy or biodiversity strategies, and in legal documents pertaining to the conservation and sustainable use of biodiversity (Wilson et al., 2014[80]). The sharing of experiences on NEAs (e.g. objectives, scope, design and policy application) could help refine future NEAs and their utility in policy making (Wilson et al., 2014[80]) (Schröter et al., 2016[81]).

Another major initiative underway is natural capital accounting, which seeks to overcome two limitations of traditional national accounting approaches and the use of GDP as an

[12] For an overview of ecosystem assessments, see the IPBES catalogue (IPBES, 2019[240]).

indicator of economic performance (OECD, forthcoming[82]). First, GDP focuses narrowly on current income and production, ignoring the underlying assets essential to long-term economic performance. Second, national accounting does a poor job of capturing stocks and flows of natural capital. To address this limitation, the United Nations developed a System of Integrated Environmental and Economic Accounting (SEEA) as a complement to its System of National Accounts. The SEEA is currently being revised to reflect lessons learned from practical experimentation and testing in countries, as well as advances in science and environmental economics. The revised version is due in 2021.

A number of countries have made progress on integrating natural-resource stocks and flows into their national accounts. Most have focused on compiling accounts for natural resources linked to priority sectors, e.g. timber, water and minerals, rather than establishing comprehensive economy-wide environmental economic accounts. However, several countries are experimenting with integrating non-market ecosystem services, which are more difficult to value. The World Bank initiative on Wealth Accounting and the Valuation of Ecosystem Services, and the UN-led Natural Capital Accounting and Valuation of Ecosystem Services, funded by the European Union, are supporting these efforts. Establishing natural capital accounts is an important first step, but further efforts are needed to better link accounts to policy decisions.

Natural capital accounting, NEAs and wider efforts to value ecosystem services are increasing the economic visibility of biodiversity and ecosystem services, and helping policy makers improve the cost-effectiveness and efficiency of policies and projects. Governments have used ecosystem valuation to determine environmental externality costs to optimally priced taxes, determine compensation payments for natural-resource damage, and inform cost-benefit analyses for policies and projects (OECD, 2012[7]). Nevertheless, there remains significant scope for scaling policies to internalise better the costs of biodiversity loss in private decision-making (Chapters 4, 7 and 8).

Even when decision makers have information on the values of ecosystem services and integrate them in their policy appraisals, political-economy factors, such as competitiveness concerns and vested interests, may prevent markets and governments from achieving efficient outcomes. Drawing on case studies, OECD (2017[83]) provides insights on how these challenges can be overcome, e.g. through broad stakeholder engagement, a solid and clearly communicated foundation of evidence (reiterating the role of NEAs), and targeted measures to address potential impacts on competitiveness and income distribution (Chapter 8).

4. THE BUSINESS CASE FOR BIODIVERSITY ACTION

Business and financial organisations[13] have a clear role to play in biodiversity conservation and sustainable use. They can actively help achieve national biodiversity goals, the Convention on Biological Diversity (CBD) Aichi Biodiversity Targets and the Sustainable Development Goals (SDGs),[14] in close co-operation and co-ordination with policy makers and civil society. Even though business and financial organisations can have significant adverse impacts on biodiversity, they also depend on biodiversity for the production of goods and services (IPBES, 2016[48]) (FAO, 2018[84]). Loss of biodiversity and ecosystem services can therefore result in higher costs and risks for business and financial organisations, and directly affect their performance (Kering, 2017[85]) (DNB, 2019[86]). Private-sector investments in biodiversity and ecosystem services can also generate opportunities and cost savings. Managing biodiversity-related risks to businesses and the potential to capitalise on opportunities is a key driver of business action for biodiversity. Additional work is needed to better understand business dependency on biodiversity, as well as the adverse impacts of business activities on biodiversity.

Growing awareness of biodiversity risks by a number of companies and financial organisations has resulted in business commitments and action towards the conservation and sustainable use of biodiversity (Smith et al., 2018[87]) (PwC, 2018[88]). Several targets, metrics and accounting approaches are available to help businesses understand and assess their biodiversity impacts and dependencies. However, progress in integrating biodiversity in business and investment decisions (e.g. strategy, governance, impact assessments and risk management, due diligence and disclosure) remains insufficient. Several tools enable public and private stakeholders to co-operate towards strengthening the business case for biodiversity and ecosystem services (Berger et al., 2018[89]) (Addison et al., 2018[90]). Political and private-sector engagement can foster support towards a harmonised approach to assessing and managing biodiversity in business. The Group of Seven (G7) could notably support the creation of a multi-stakeholder advisory group on biodiversity, business and finance, to advise on the adoption of a common approach for measuring and integrating biodiversity in business and investment decisions in support of post-2020 biodiversity goals, building on the *OECD Due Diligence Guidance for Responsible Business Conduct* (OECD, 2018[91]).

4.1. Business and biodiversity: Dependencies, impacts, costs and risks

4.1.1. Dependencies, impacts and costs

Managing costs and ensuring long-term value creation across supply chains requires businesses to understand better their dependencies on biodiversity and ecosystem services, and to integrate these considerations into long-term business strategies, risks-management approaches and other business activities. The profitability and long-term survival of a number of business sectors (such as agriculture and fisheries) depend directly on biodiversity and well-functioning ecosystems. The loss of biodiversity has a direct impact

[13] The financial organisations considered include banks, institutional investors – i.e. asset owners (pension funds, insurance companies and sovereign wealth funds) and asset managers (including investment funds) – and insurers as underwriters.

[14] In addition to future goals under the post-2020 global biodiversity framework, as well as other multilateral environmental agreements: the Conservation of Migratory Species of Wild Animals; the Convention on International Trade in Endangered Species of Fauna and Flora; and the Ramsar Convention on Wetlands of International Importance.

on the key activities in a value chain and can result in increases in costs of inputs and raw materials (e.g. in agriculture, forestry, fisheries, aquaculture and ecotourism). As discussed in Chapter 3, specific examples include the reliance of:

- The agricultural sector on pollination services: USD 235-577 billion (US dollars) worth of annual global food production relies on the direct contribution of pollinators (IPBES, 2016[48]);
- The timber, pulp and paper sectors on forestry: forest products account for USD 247 billion in global trade exports (FAOSTAT-Forestry database, 2017[92]);
- Multiple sectors on sustainable water supply across their supply chains: the garment and footwear sector is responsible for around 20% of global wastewater use (UNECE, 2018[93]);
- The ecotourism sector on well-functioning coral reefs, which generate USD 36 billion in global tourism value per year (Spalding et al., 2017[49]).

Business operations, supply chains and investment decisions can also have direct and indirect adverse impacts on biodiversity and ecosystem services. Business activities can directly cause adverse impacts on biodiversity, contribute to actual and potential impacts, or have indirect impacts (e.g. through business linkages).[15] As discussed in Chapter 3, possible adverse impacts include habitat loss and degradation owing to land use; over-exploitation of biodiversity resources; pollution, including air and water pollution (e.g. from pesticides and fertilisers, or chemicals from industrial sectors); and invasive alien species (e.g. from the shipping industry, owing to ballast water). Examples of business impacts on biodiversity include:

- The fisheries sector: around 76% of the world's marine fish stocks monitored by the Food and Agriculture Organization of the United Nations (FAO) are now fully exploited, overexploited or depleted (FAO, 2018[84]). The share of stocks fished at biologically unsustainable levels increased from 10% in 1974 to 33% in 2015 (FAO, 2018[12]).
- The garment and footwear sector: Impacts stem from all segments of the value chain, including raw materials, manufacturing, transportation of goods, consumer care and end-of-life disposal (Aiama et al., 2015[94]). The fashion industry alone is responsible for around 20% of global wastewater. Cotton farming is responsible for 24% of insecticide use and 11% of pesticide spread, despite using only 3% of arable land (UNECE, 2018[93]).

With few exceptions, existing approaches to value the costs of biodiversity (and broader "natural capital"[16]) dependencies and impacts remain limited. In 2013, the unpriced natural capital consumed by primary production (agriculture, forestry, fisheries and mining) and some primary processing sectors (including cement, steel, pulp and paper) was valued at

[15] Direct impacts occur through direct interaction of an activity with biodiversity and ecosystems. Indirect impacts on biodiversity are those which are not a direct result of the project, site or facility, often produced away from or as a result of a complex impact pathway. Sectors like agro-food, mining, construction and power generation can have both direct and indirect impacts on biodiversity and ecosystems. Other industries, like pharmaceuticals or cosmetics, can have indirect impacts as their products use biological resources. Pharmaceuticals are also increasingly recognised as an environmental concern when their residues enter freshwater systems (OECD, forthcoming[239]).

[16] Including climate change, water, energy, biodiversity and waste.

USD 7.3 trillion (Natural Capital Coalition, 2016[95]). The luxury group Kering estimated the impacts of its operations and supply chains on the environment at EUR 482 million in 2017, mostly in raw-material production and processing (using Kering's Environmental Profit & Loss (EP&L) account) (Kering, 2017[85]).[17]

4.1.2. Risks

Risks to business and financial organisations

Biodiversity-related risks to businesses manifest themselves primarily through the dependencies from – and impacts on – biodiversity of business and financial organisations (especially investors, lenders and insurers). Drawing on the typology of climate-related risks defined by Bank of England Governor Mark Carney,[18] biodiversity-related risks to businesses are briefly categorised here as:[19]

- *Ecological risks:* these comprise risks related to biodiversity, and ecological impacts and dependencies (similar to climate-related physical risks). Such risks are mainly operational risks associated with resource dependency, scarcity and quality, for example linked to: increased raw material or resource costs (e.g. limited natural resources like timber or fresh water); deteriorated supply chains (e.g. due to resource scarcity or more variable production of natural inputs); or disrupted business operations (CBD, 2019[96]) (Natural Capital Coalition, 2016[5]).
- *Liability risks*: parties who have suffered biodiversity-related loss or damage seek compensation from those they hold responsible. The risk of legal suits founded in biodiversity may increase as disclosure and external reporting on companies' biodiversity impact assessments increases (especially at the local site level).[20]
- *Regulatory risks*: these include restrictions on land and resources access, clean-up and compensation costs, procurement standards, and licensing and permitting procedures or moratoriums on new permits.
- *Reputational risks*: businesses face reputational risk linked to growing pressure by investors, consumers, shareholders, policy makers and civil society to assess, report and manage risks to society and the environment, including biodiversity risks. According to the Union for Ethical BioTrade (UEBT) Biodiversity Barometer 2018, a majority of consumers expect companies to respect biodiversity, but do not trust them to do so (UEBT, 2018[97]). Consumer preferences can even lead to boycotts, e.g. on Bluefin tuna or palm oil.
- *Market risks*: changes in consumer preferences (e.g. towards products with reduced biodiversity impacts) or purchaser requirements (e.g. biodiversity safeguards in supply-chain requirements) can create market risk for companies

[17] See Box A.4.1 on EP&L Account in the Annexes available online here (oe.cd/bio-fin-econ-case4action).

[18] See (Carney, 2015[231])and the Task Force on Climate-related Financial Disclosures' recommendations (TCFD, 2017[232]).

[19] See Annex A.4.1 in the Annexes available online here (oe.cd/bio-fin-econ-case4action) for more information on risks to businesses.

[20] Examples of lawsuits include the 2010 Deepwater Horizon Oil Spill Case, which cost USD 65 billion to BP (Bousso, 2018[233]) and lawsuits to protect spotted owls (Welch, 2009[234]). See the Annexes available online here for more information.

(Girvan et al., 2018[98]). Market risk is likely to increase as consumer awareness and understanding of biodiversity rises globally (Table 4.1) (UEBT, 2018[97]).

- *Financial risks*: businesses, banks and investors may also face financial risk, including insurance risks (e.g. linked to higher insurance premiums stemming from biodiversity loss); access to capital (owing to higher cost of capital, or more stringent lending requirements based on negative impacts or dependencies on biodiversity); and loss of investment opportunities as investors increasingly integrate biodiversity in their investment strategies (Girvan et al., 2018[98]). As ecological risks to businesses increase, business and financial organisations may face depreciation of assets, e.g. in agriculture and food production (Caldecott and McDaniels, 2014[99]). The risk of "stranded assets" linked to regulatory or market risk likely remains smaller for biodiversity than for climate change.

Table 4.1. Consumer awareness and understanding of biodiversity in selected G7 countries

(Over the period 2009-18)

	France	United Kingdom	Japan	United States	Germany
Have heard of biodiversity (%)	90%	66%	62%	55%	53%
Correct definition of biodiversity (%)	34%	22%	29%	25%	25%

Source: (UEBT, 2018[100]).

A few businesses, investors and regulators (such as Unilever, the California public pension fund CalPERS and the Dutch central bank DNB) are beginning to recognise that biodiversity loss and degradation can create a "material" risk to the profitability of businesses and investors, albeit to a lesser extent than climate risks (Dempsey, 2013[101]) (Unilever, 2019[102]) (Friends of the Earth (FOE), 2018[103]) (DNB, 2019[86]).[21] Several OECD instruments and international guidelines calls on business and financial organisations to assess the materiality of biodiversity impacts (OECD/FAO, 2016[104]). Assessing the materiality of biodiversity issues for companies remains extremely challenging, however, especially at the project and site levels (Alliance for Corporate Transparency Project, 2019[105]). More work is needed to integrate biodiversity considerations into risk management and integrated reporting. In particular, aggregation tools are needed to reflect local materiality issues at the corporate or portfolio level, and ensure accountability at the board and management levels (CEF and WEC, 2015[106]).

Responsible business conduct risks to society and the environment

Business impacts and dependencies on biodiversity create risks to society and the environment – which are part of broader "responsible business conduct" (RBC) risks – in addition to risks to businesses. According to the *OECD Guidelines on Multinational Enterprises* (OECD, 2011[107]), "RBC risks are defined as possible adverse impacts on society and the environment related to the environment, human rights, workers, bribery, consumers and corporate governance". RBC is important to ensure trust in business (OECD, forthcoming[108]). Acknowledging and managing their dependencies and impacts

[21] According to the International Accounting Standards Board (IASB), "information is material if omitting, misstating or obscuring it could reasonably be expected to influence the decisions that the primary users of general purpose financial statements make on the basis of those financial statements, which provide financial information about a specific reporting entity." (IASB, 2018[235]).

on biodiversity can help business and financial organisations manage and avoid risks associated with biodiversity loss and threats to ecosystem services.

4.2. Business opportunities for biodiversity and ecosystem services

The conservation, sustainable use and restoration of biodiversity provides significant opportunities for businesses and thus, incentives to integrate biodiversity and broader sustainability issues in business models, operations, investment decisions and sourcing across supply chains. Such opportunities include:

- Long-term viability of business models: making more sustainable use of resources to address business dependencies on biodiversity can help ensure long-term availability of natural resources, thereby guaranteeing long-term viability of business operations and long-term value creation (CBD, 2019[96]).
- Cost savings and increases in operational efficiency: improved tracking on the origin and processing of inputs and resources (e.g. energy savings from green roofs or increased productivity of permaculture) can help control costs, while minimising adverse impacts on biodiversity.
- Increased market share: customer loyalty favouring environmentally responsible business conduct can lead to market share gains.[22]
- New business models: business action for biodiversity can generate new products, technologies and services with reduced impacts on biodiversity, driven by changes in consumer awareness and preferences and new business models; new markets (e.g. ecotourism, organic agriculture and certified sustainable products); new businesses (e.g. ecosystem restoration); and new revenue streams (e.g. for new markets or payments for ecosystem services in wetlands and forests) (Table 4.2) (BITC, 2011[109]).
- Better relationships with stakeholders, including customers, shareholders, regulators, civil society and employees.

[22] Several studies suggest RBC and corporate social responsibility (including on environmental issues) have a direct effect on customer loyalty by enhancing trust in business (Raza et al., 2018[236]) (Han, Yu and Kim, 2019[237]).

Table 4.2. Scale and growth potential of new markets with reduced biodiversity impacts and dependencies

Sector/market (globally)	Current market size (annual revenue, USD billion) (latest year available)	Forecasted compound annual growth rate (timeframe)	Projected market size (annual revenue) (USD billion) (year)	Estimated annual investment needs (USD billion)
Organic food and beverages	116 (2015)	16.4% (2015-22)	327 (2022)	n/a
Ecotourism	77 (2009)	10-30%	n/a	n/a
Eco fibres	n/a	11.46% (2015-20)	75 (2020)	n/a
Sustainable forest management	n/a	n/a	n/a	70-160
Sustainable seafood	12.7 (2017)	4.97% (2017-25)	18.6 (2025)	n/a
Biopharma	240-270 (2018)	n/a	n/a	n/a

Sources: (Allied Market Research, 2016[110]) (Globe Newswire, 2018[111]) (OECD, 2018[112]) (Sustainability Watch, 2009[113]) (Markets and Markets, 2015[114]) (World Bank, 2016[115]) (Rader, 2018[116]) (Global Market Insights, 2016[117]).

Of course, the business and investment opportunities associated with biodiversity are not the only rationale for action, as biodiversity delivers broader benefits and public goods to society and the environment (Chapter 2). In the agriculture sector, for instance, land should not be perceived solely as a productive asset; its environmental and socio-cultural roles should be recognised as well (OECD/FAO, 2016[104]).

4.3. Signs of progress

4.3.1. Increasing awareness from businesses

Forward-thinking businesses increasingly recognise the case for biodiversity action (Smith et al., 2018[87]). According to PwC's 21st Annual Global CEO Survey, climate change and environmental damage rank in the top 10 threats to the growth prospects of organisations (PwC, 2018[88]). Most companies acknowledge environmental, social and governance (ESG) issues in their reports (KPMG, 2017[118]). A recent assessment of 100 companies in selected sectors in the European Union finds that 55% mention risks associated with biodiversity (Alliance for Corporate Transparency Project, 2019[105]). Few companies, however, distinguish biodiversity issues from other ESG issues, and more are aware of climate change than of biodiversity (KPMG, 2017[118]).

4.3.2. Emerging business commitments

In December 2016, over 100 companies signed the Cancun Business and Biodiversity Pledge to take concrete actions that deliver solutions for biodiversity conservation and sustainable use (CBD, 2018[119]). In 2018, 65 French companies committed to the Act4Nature initiative. Act4Nature featured both a joint commitment to factor biodiversity into all activities (from governance and strategy to the most concrete operations) to achieve a net positive contribution to nature, as well as individual company commitments (Act4Nature, 2018[120]). Financial organisations are also gradually committing to decreasing the impact of their activities and investment strategies on biodiversity, e.g. under the Natural Capital Financial Alliance (NCFA) or the Finance for One Planet initiative, launched by 15 banks and institutional investors under the Community of Practice Financial Institutions and Natural Capital (CoP FINC), representing around

EUR 1 trillion (euros) in assets under management (AUM) (CoP FINC, 2016[121]). Business and financial organisations' awareness of biodiversity factors (including impacts, dependencies, risks and opportunities) remains limited, however, compared to their awareness of climate change. By comparison to the CoP FINC, 323 investors, representing more than USD 32 trillion in AUM, have signed the Climate Action 100+ initiative. As of 2018, more than 500 organisations, representing USD 7.9 trillion in market capitalisation – including 289 financial firms responsible for nearly USD 107 trillion in assets – have also supported the Task Force on Climate-related Financial Disclosures (TCFD).

Business and biodiversity initiatives – including domestic, regional or international networks, councils, partnerships and platforms aiming to integrate biodiversity across business activities and supply chains – are emerging with support from industry associations and civil society. In Japan, a group of 14 corporations launched the Japan Business Initiative for Biodiversity in 2018, which now comprises 50 companies (including Fujitsu) committed to biodiversity conservation (JBIB, 2016[122]). Other examples in G7 countries include the Canadian Business and Biodiversity Council, the French Initiative for Business and Biodiversity, Germany's Biodiversity in Good Company' Initiative, and the Japan Business and Biodiversity Partnership (CBD, 2019[123]).

Several sector-specific initiatives, partnerships and platforms on biodiversity also exist (e.g. CanopyStyle in the garment sector or the Indonesia Palm Oil Platform), in addition to individual corporate initiatives. Business initiatives driven by sectoral champions (like Kering or Unilever) can help share information and emerging good practices among businesses and industry associations. Biodiversity initiatives remain fewer among financial organisations than corporations, despite a few initiatives (e.g. Engage the Chain in food supply).

Business initiatives for biodiversity also receive support from international organisations and collaborations. They include the CBD Global Platform on Business and Biodiversity, the World Business Council for Sustainable Development (WBCSD), the International Union for Conservation of Nature (IUCN), the EU Business @ Biodiversity Platform, the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), the Economics of Ecosystems and Biodiversity initiative, and the Natural Capital Coalition (Section 4.3.4).

4.3.3. Towards a framework for integrating biodiversity in business and investment decision-making

A few leading companies are already integrating biodiversity into their decision-making process (Smith et al., 2018[87]) (Rainey et al., 2014[124]) (Addison et al., 2018[90]). Several targets, indicators and accounting approaches are available to help businesses understand, measure and account for their biodiversity impacts and dependencies, as well as associated costs, risks and opportunities, across business activities (e.g. risk management) and organisational levels (e.g. site, product, supply chain, corporate and portfolio). Mainstreaming biodiversity is a priority across key business activities, i.e. strategy, governance, impact assessment, risk management, due diligence, internal reporting, external disclosure, and internal and external communication. However, business action on biodiversity is mostly driven by corporate responsibility and risk management (Smith et al., 2018[87]). In addition, no consensus has yet been reached on an agreed protocol or

framework for integrating biodiversity in business and investment decision; there exists only a protocol for natural capital (Box. 4.1).[23]

Box 4.1. The Natural Capital Protocol

The Natural Capital Protocol was launched in 2016 by representatives from over 160 leading business, civil-society and policy organisations. It is a standardised decision-making framework to generate information allowing businesses to identify, measure, value and prioritise their direct and indirect impacts and dependencies on natural capital, and understand the associated risks and opportunities. The protocol has been applied to sector-specific guides, including in apparel, food and beverages, and forest products. It has limitations, however, in terms of valuating biodiversity benefits (e.g. it does not incorporate the value of the quality-of-stock decline for key biodiversity sectors like forestry, only its quantity). Recognising those challenges, the Natural Capital Coalition launched a project in 2017 to strengthen the Protocol's coverage of biodiversity.

The Natural Capital Coalition, the NCFA and the Dutch Association of Investors for Sustainable Development have also developed a Finance Sector Supplement to the Natural Capital Protocol, recognising the critical role the financial sector needs to play to factor biodiversity in business and investment decisions.

Sources: (Natural Capital Coalition, 2016[5]) (Natural Capital Coalition, 2016[95]) (Natural Capital Coalition, 2018[125]).

Goals and targets

Businesses and investors need to set clear goals and quantitative targets for managing biodiversity that are tailored to their dependencies and impacts, and measure their progress (Addison et al., 2018[90]). Such goals, targets and commitments can be voluntary, encouraged or required by regulation, or can relate to international biodiversity goals and societal targets (Lammerant et al., 2019[126]). Existing biodiversity-related goals and targets for businesses and financial organisations to consider include: societal targets (including international biodiversity goals, i.e. the Aichi Targets and the SDGs[24]) (Smith et al., 2018[87]); No net loss or Net positive impact (or Net gain) goals on biodiversity, which are increasingly being adopted by businesses; science-based targets; corporate-level biodiversity commitments; and other targets linked to regulator and permitting requirements, voluntary standards and agreements, and lender requirements.

Biodiversity metrics, measurement and accounting approaches

Several metrics or indicators, and around a dozen accounting approaches and methodologies, are available for businesses and investors to understand and measure their dependencies and impacts on biodiversity (Lammerant et al., 2019[126]) (Berger et al., 2018[89]) (Lammerant et al., 2018[127]). Ongoing work by UNEP-WCMC and the EU B@B Platform shows these indicators and approaches are applicable to different segments of the value chain and organisational levels, i.e. product and service, project, site, supply options, corporate and portfolio. Existing accounting approaches support businesses and investors in assessing biodiversity performance for diverse business applications, e.g. strategy, risk

[23] See Annex A.4.3. in the Annexes available online here (oe.cd/bio-fin-econ-case4action) for more information about the targets, goals, metrics and approaches to measure and integrate biodiversity in business and investment decisions.

[24] SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development; and SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

management, impact assessment, disclosure and due diligence. They typically do not currently cover ecosystem services.

Several metrics for business to measure biodiversity impacts and dependencies. These include: mean species abundance; potentially disappeared fraction; risk of extinction; and natural capital value, whether expressed in monetary terms (e.g. euros) or using Environment Profit & Loss (EP&L) accounting, developed by Kering and used by other companies to monetise the costs associated with biodiversity dependencies and impacts.[25]

Key measurement approaches and indicators include the Global Biodiversity Score, the Biodiversity Impact Metric, Biodiversity Indicators for Extractives, the Product Biodiversity Footprint, the Biodiversity Footprint for Financial Institutions, Biodiversity Return on Investment, the Agrobiodiversity Index, the Biodiversity Footprint Calculator, the LIFE Impact Index and Bioscope, as well as assessments under the Life Cycle Assessments and the Natural Capital Protocol.

Most accounting methodologies have been developed through collaboration between academia and the private sector. They typically rely on one of the aforementioned metrics. Approaches are either sector-specific or cover multiple sectors. They use real or estimated data, drawing on existing biodiversity data sets (e.g. the IUCN Red List of Threatened Species). They then typically link economic activities to pressures[26] (using, for instance, input-output modelling) before linking pressures to impacts (using models such as GLOBIO or ReCiPe Life Cycle Analysis). Most methodologies are not fully aligned with the Natural Capital Protocol.

Key areas to integrate biodiversity in business and investment decisions

Opportunities to factor biodiversity arise across several dimensions of business and financial operations. In addition to metrics and targets, key entry points for integrating biodiversity are broader than the areas identified by the Task Force on Climate-related Financial Disclosures (TCFD) and include:[27]

- **Strategy**: embedding biodiversity in the overall corporate strategy of businesses and financial actors is critical to integrate biodiversity in their decisions (e.g. by developing a biodiversity-specific or broader environmental policy, strategy, plan or management plan that accounts for biodiversity), in addition to aligning goals and targets with corporate strategy. Several investment strategies (including thematic investment in support of biodiversity) are available to help banks, asset owners and asset managers factor biodiversity in their investment decisions. Banks and institutional investors in particular can influence the behaviour of investee corporations (e.g. to encourage producers of soft commodities to reduce their impacts on forest ecosystems).
- **Governance**: aligning corporate governance frameworks with biodiversity factors through strong leadership and changes in governance at the board and management levels is critical to ensure consistent business action for diversity across organisational levels.

[25] See Box A.4.1 on EP&L in the Annexes available online here (oe.cd/bio-fin-econ-case4action).

[26] Including habitat change, overexploitation, invasive alien species, pollution and climate change (Lammerant et al., 2019[126]).

[27] See Annex A.4.4 in the Annexes available online here (oe.cd/bio-fin-econ-case4action) for further details.

- **Impact and dependency assessment and risk management**: businesses and financial organisations need to undertake biodiversity-related impact and dependency assessments across organisational levels (site, product, project and supply chains) and aggregate them at the corporate and portfolio levels. Several performance-assessment and impact-assessment methodologies are available in addition to existing risk-screening tools and biodiversity-monitoring approaches. Additional work is needed to mainstream biodiversity in corporate and financial risk management. Analyses at sectoral and geographical levels can be used to screen portfolios to determine risky assets (AXA and WWF, 2019[128]).
- **Due diligence**: a due-diligence approach can help businesses identify and prioritise action in order to avoid or mitigate adverse impacts on biodiversity. As recommended under the *OECD Guidelines for Multinational Enterprises* (OECD, 2011[107]) and *OECD Due Diligence Guidance for Responsible Business Conduct* (OECD, 2018[91]), businesses and financial organisations need to consider biodiversity and broader RBC risks in their due-diligence approach (Box 4.2).

Box 4.2. OECD Due Diligence Guidance for Responsible Business Conduct

The OECD due-diligence approach, as defined in the *OECD Guidelines for Multinational Enterprises* and *OECD Due Diligence Guidance for Responsible Business Conduct*, can help enterprises prioritise the order in which they take action based on the severity and likelihood of adverse impacts through a risk-based, ongoing process of prioritisation. The OECD has also developed sector-specific guidance on the agriculture, garment and footwear, mineral supply chains and financial sectors.

Additional work is needed to better highlight biodiversity as a key risk businesses need to address as part of implementing RBC through internationally recognised standards on due diligence. Following the OECD guidance and undertaking new OECD work to tailor it to biodiversity could help businesses identify, prioritise, prevent and address adverse impacts on biodiversity, and regularly report on these efforts and their outcomes (See Chapter 8).

Sources: (OECD/FAO, 2016[104]) (OECD, 2018[91]) (OECD, 2011[107]) (OECD, 2017[129]) (OECD, 2016[130]) (OECD, 2017[131]).

- **Disclosure and external reporting**: disclosure and external reporting of biodiversity impacts, dependencies, risks and opportunities remain limited compared to climate disclosure, which has gained momentum in recent years. Companies rarely disclose specific, measurable and time-bound biodiversity commitments (e.g. quantitative indicators on biodiversity), biodiversity impacts or internal impact assessments. However, they need to disclose how they assess the impacts and dependencies of their operations and value chain on biodiversity, society and the environment, in addition to the risks and opportunities for their businesses. Any approach towards developing a harmonised framework or protocol for measuring biodiversity should ensure it is compatible with existing reporting and disclosure frameworks. Integrated reporting for financial and non-financial information can help in this regard, and in this respect we acknowledge existing initiatives such as the ongoing mission in France on extra financial reporting.

- **Voluntary industry standards, labels and certification schemes**: these are being developed by businesses to embed biodiversity in their products, services, operations and supply chains.
- **Communication**: communicating internally and externally (to staff, consumers and local communities) on biodiversity impacts and dependencies is critical for businesses to raise awareness about biodiversity and encourage education, knowledge sharing and engagement with key stakeholders. Business efforts should build on education initiatives to sensitise an increasingly urbanised population to the importance of biodiversity. Engaging civil society and local communities is particularly important to factor in human well-being and human rights issues, as well as the potential trade-offs between the desired biodiversity outcomes and the desired social outcomes.

4.4. The role of policy makers and other stakeholders in addressing barriers to business actions for biodiversity

4.4.1. Challenges and opportunities for integrating biodiversity in business and investment decisions

Despite some signs of progress – especially from large global companies and well-known business champions on business action on biodiversity – progress in integrating biodiversity in business and investment decisions remains limited across most corporations, investors and insurers (Addison, Bull and Milner-Gulland, 2018[132]) (CBD COP14, 2018[133]). A study by Arcadis and JNCC (2018[134]) found that 46% of FTSE companies that have a medium to high impact on biodiversity have no policies in place to manage exposure to biodiversity. The challenges with integrating biodiversity in business and investment decisions relate to:

- Lack of business case in the absence of pricing of biodiversity: further efforts are needed to internalise externalities associated with biodiversity loss or degradation.
- Lack of awareness and understanding by businesses and the financial sectors on biodiversity impacts and dependencies, and related risks and opportunities: many companies still need to understand how biodiversity is material to their businesses.
- Quantifying the value of biodiversity, and agreeing on common metrics and a framework to understand and measure biodiversity impacts and dependencies: a common protocol with harmonised metrics for measuring biodiversity impacts and dependencies (such as the Greenhouse Gas Protocol for climate change) is missing.
- Integrating the measurement of biodiversity impacts and dependencies across governance, strategy, risk management, impact assessment, due diligence, disclosure and communication of corporations and financial actors: biodiversity and natural-capital assessments often remain an academic exercise, with limited business applications beyond a few industry leaders. This is partly due to the multiplicity and diversity of available indicators and accounting approaches. Corporate balance sheets rarely reflect biodiversity impacts, even though biodiversity measurement and accounting approaches are now available. Further work is notably needed to assess the dependencies,

impacts and materiality of biodiversity for corporations and investors, and align accounting approaches in order to aggregate biodiversity impacts at portfolio level.

- Short-termism in business and investment decisions: building the business case for biodiversity requires a long-term approach, yet short-term investment can lead to long-term returns (WBCSD, 2018[135]).
- Considering biodiversity investment opportunities within green sustainable finance: this is critical for the financial sector to promote the transition towards a more sustainable model of agriculture, forest management, fishery and other key sectors, as recommended by the EU High-Level Expert Group on (HLEG) Sustainable Finance.

Policy makers have multiple opportunities to scale up business action on biodiversity, in co-operation with other stakeholders (as discussed in more detail in Chapter 8):

- The G7 could notably create a multi-stakeholder advisory group on biodiversity, business and finance, to advise on the adoption of a common approach for measuring and integrating biodiversity in business and investment decisions in support of post-2020 biodiversity goals. Such an approach would address biodiversity-related impacts and dependencies – and associated risks and opportunities – and develop methodologies, metrics and guidelines. This new initiative would notably develop a set of practical actions on due diligence and biodiversity to support efforts by businesses, drawing on the *OECD Due Diligence Guidance for Responsible Business Conduct* (OECD, 2018[91]). The framework could be improved over time through a learning-by-doing approach.
- Policy makers can also exploit the momentum and visibility of the SDGs, and climate action by business and financial organisations. Linking biodiversity and climate pressures in measurement approaches and reporting is also critical, in order to avoid trade-offs between business investment decisions with climate-mitigation benefits and negative impacts on biodiversity (e.g. land-use impacts of biomass fuels).
- Biodiversity requires taking a supply-chain approach. Kering's 2017 EP&L account revealed that 90% of its total biodiversity impacts are generated in the supply chain (Kering, 2017[85]).

4.4.2. Policy and regulatory tools to integrate biodiversity in business and investment decisions

This section briefly summarises key policy recommendations to consider biodiversity in business and investment decisions, drawing on a review of key policy and regulatory tools available.[28] Policy makers can encourage the business and financial sectors to factor biodiversity dependencies and take a longer-term approach through multiple policy and regulatory tools, e.g. by:

[28] See Annex A.4.5 in the Annexes available online here (oe.cd/bio-fin-econ-case4action) for more information.

- requiring companies to publish long-term plans factoring in long-term management of biodiversity and other sustainability impacts, dependencies and risks.
- requiring corporations, banks, asset owners and asset managers to assess both their impacts and dependencies on biodiversity, ecosystem services and natural capital, and how they can become financially "material"[29] (HLEG, 2018[136]).
- mainstreaming quantitative biodiversity assessments in reporting requirements and disclosure schemes, e.g. under the EU Non-Financial Reporting Directive, whose guidelines could be updated to improve biodiversity reporting.
- setting policies promoting RBC (such as France's 2017 Duty of Vigilance Law) and improved due diligence for RBC, and tailoring RBC to biodiversity impacts and risks, drawing on the OECD Guidelines on Multinational Enterprises (OECD, 2011[107]) and OECD Due Diligence Guidance for Responsible Business Conduct (OECD, 2018[91]) (which requires further technical support and guidance for companies on how to measure their biodiversity impacts and dependencies so that they can incorporate them into a due-diligence approach). This work could be undertaken as part of the proposed advisory group on biodiversity, business and finance, or independently.
- increasing awareness from financial regulators and supervisors on biodiversity and other sustainability risks, building on central banks and other regulators' increased awareness of climate risks (DNB, 2019[86]).

[29] See Section 4.1.2 and footnote 18 for a definition of materiality.

5. OPPORTUNITIES FOR COST-EFFECTIVE RESTORATION

5.1. The rationale for ecosystem restoration

Ecosystem restoration, i.e. the "process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed" (SER, 2004[186]), provides a crucial opportunity to improve the global outlook for biodiversity. Ecosystem restoration can also provide significant societal benefits, through the enhanced provision of ecosystems services such as carbon sequestration, flood regulation, clean air and water. Furthermore, ecosystem restoration can be cost-effective. For example, a recent analysis estimates that restoring 350 million hectares of degraded forest areas globally[30] could generate USD 7-30 of benefits for every dollar invested (Verdone and Seidl, 2017[137]).

Ecosystem restoration is complementary to more traditional conservation approaches for biodiversity. While conservation is important to prevent further declines in biodiversity and ecosystem services, restoration can help bring species back from the brink of extinction and enhance ecosystem services. To be effective, restoration actions must be accompanied by measures to reduce the pressures that led to degradation in the first place.

Restoration can be technically challenging and expensive (although this is not always the case, as for passive restoration). Thus, the conservation of intact ecosystems is a more cost-effective option than restoration to ensure the flow of ecosystems services from a given landscape (IPBES, 2018[138]).

Several multilateral environmental agreements include ecosystem restoration. These include Convention on Biological Diversity (CBD)'s Aichi Biodiversity Targets 14[31] and 15,[32] the Sustainable Development Goals,[33] and the United Nations Convention to Combat Desertification's land degradation neutrality (LDN) Target Setting Programme and LDN Fund. At the United Nations (UN) General Assembly in March 2019, governments declared 2021-30 the UN Decade on Ecosystem Restoration.

Governments have also agreed on ecosystem-specific restoration targets. For example, Target 12 of the Ramsar Convention's Fourth Strategic Plan 2016-2024 focuses on restoring degraded wetlands and prioritises those relevant to biodiversity conservation, disaster-risk reduction, livelihoods and/or climate-change mitigation and adaptation. The United Nations Forum on Forests (Goal 1), the Bonn Challenge and the New York Declaration on Forests all include forest-specific restoration commitments (Box 5.1). Similar commitments for other ecosystems – either terrestrial (e.g. grasslands) or marine (e.g. coral reefs, seagrass beds and kelp forests) – are lacking.

[30] This study assumed the 350 million ha was distributed evenly across forest biomes globally.

[31] Target 14: by 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

[32] Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced through conservation and restoration, including restoration of at least 15 % of degraded ecosystems, thereby contributing to climate-change mitigation and adaptation, and to combating desertification.

[33] SDG 14 (14.2) and SDG 15 (15.1, 15.2 and 15.3, which includes a specific commitment to land degradation neutrality by 2030).

Box 5.1. The Bonn Challenge and the New York Declaration on Forests

Launched in 2011 by the Government of Germany and the International Union for Conservation of Nature (IUCN), and later endorsed and extended by the New York Declaration on Forests at the 2014 UN Climate Summit, the Bonn Challenge is a global multi-stakeholder effort to bring 150 million hectares of the world's deforested and degraded land into restoration by 2020, and 350 million hectares by 2030. The Bonn Challenge supports efforts to deliver on a number of international commitments, including Aichi Target 15, the Paris Agreement and the Rio+20 LDN goal. It is supported by several regional initiatives. These include Initiative 20x20, a country-led effort to bring 20 million hectares of land in Latin America and the Caribbean into restoration by 2020, and AFR100, a similar initiative to bring 100 million hectares of land in Africa into restoration by 2030. As of April 2019, 58 commitments promising restoration on 170.43 million hectares exist globally.

Source: (IUCN, 2019[139]).

5.2. Opportunities for cost-effective restoration

The opportunities for restoration are global. Degradation is occurring across all types of terrestrial, freshwater and marine ecosystems, and in all regions of the world. Estimates of the extent of global degradation vary considerably,[34] but are large. The recent Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report estimates that 75% of world's land surface is degraded (IPBES, 2018[138]). Gibbs and Salmon (2015[140]) estimate that up to 6 billion hectares (20 times the size of France) of land are degraded. Recent work by the Global Restoration Initiative highlights areas where restoration has the potential to improve food security, reduce poverty and mitigate climate change.[35]

Identifying restoration opportunities from an economic perspective requires comparing the costs of restoration with the benefits. Restoration costs include opportunity costs (e.g. foregone revenue from agriculture or timber harvest), capital costs (e.g. planting or fencing), management costs (e.g. monitoring), and transaction costs (e.g. negotiating contracts and organising programmes). Total restoration costs, therefore, vary according to the project's objectives, land use and ownership; the degree of degradation; the type of restoration intervention required; and the timescale for restoration (Bullock et al., 2011[141]) (Iftekhar et al., 2016[142]). While there exists a shortage of information on the costs of restoration[36] (De Groot et al., 2013[143]), the available evidence indicates that project costs can range from several hundreds to thousands of US dollars per hectare (USD/ha) for grasslands, rangelands and forests, to several tens of thousands of US dollars for inland waters and millions of USD/ha for coral reefs (Nebhöver, Aronson and Blignaut, 2011[144]).

The potential benefits delivered by a restoration project also vary between ecosystems (according to the type, quantity and quality of ecosystem services they provide), spatially (e.g. according to the location of ecosystem service beneficiaries), and over time. Ecological functioning and ecosystem service delivery may take many decades to fully

[34] The multifaceted nature of biodiversity and the wide variety of ecosystems globally mean the definition of degradation is context-specific. Furthermore, different methodologies exist for assessing degradation. Consequently, estimates of the extent of degraded land are highly variable.

[35] For more details see the Atlas of Forest Landscape Restoration Opportunities (WRI, 2014[239]).

[36] The Economics of Ecosystems and Biodiversity initiative, for example, reviewed over 20 000 restoration case studies and found that only 96 contained useful cost data.

recover: for example, wetlands have on average 26% lower plant diversity and 23% lower carbon sequestration one century after restoration action than in their pristine state (Moreno-Mateos et al., 2012[145]). Restoration success is also context-specific, with some areas (e.g. tidal and tropical in the case of wetlands) recovering more rapidly than others. The value of the ecosystem services provided by restoration is also highly dependent on the density and number of beneficiaries (Jones et al., 2016[146]). Thus, understanding the spatial and temporal variability of ecosystem-service delivery and consumption is key to assessing the cost-effectiveness of restoration (Birch et al., 2010[147]).

Trade-offs may also exist between different ecosystem services or policy objectives, highlighting the need for clear restoration objectives and a holistic approach to cost-benefit analyses. The Grain to Green Project[37] in China, for example, included the planting of non-native trees on agricultural land to decrease soil erosion, which led to decreased native vegetation cover and increased water use (Cao, Chen and Yu, 2009[148]).

Overall, the available evidence suggests that the benefits of restoration outweigh the costs, particularly when considering the full range of ecosystem service values. For example, de Groot et al. (2013[143]) analysed restoration case studies with information on costs (94 studies) and benefits (225 studies),[38] and integrated the information into a cost-benefit analysis. Benefit-cost ratios were greater than 1 for inland wetlands, tropical forests, temperate forest, woodlands and grassland, and as high as 35 in grasslands. Based on the same dataset, Blignaut et al. (2014[149]) found that the average benefit-cost ratio varies between 0.4 (coral reefs, seagrass meadows and other non-wetland coastal systems) and 110 (coastal wetlands, including mangroves), with the majority of biomes recording an average benefit-cost ratio of 10.

In addition to improving biodiversity outcomes and the provision of ecosystem services, restoration can generate business and job opportunities. In the United States, restoration work is estimated to provide direct employment for 126 000 workers and generate USD 9.5 billion in economic output annually. An additional 95 000 jobs and USD 15 billion in economic input are supported through indirect (business-to-business) linkages and increased household spending (BenDor et al., 2015[150]). The number of jobs created per USD 1 million invested in restoration in the United States is estimated to range from 7 jobs for county-level wetland restoration to 40 jobs for national-level forest, land and watershed restoration (BenDor et al., 2015[150]). It is estimated that restoring 15% of degraded ecosystems in the European Union (Target 2 of the EU 2020 Biodiversity Strategy) would result in between 20 000 and 70 000 full-time jobs (Eftec et al., 2017[151]).

5.3. Putting restoration into practice

Although countries have established restoration targets under several global initiatives, these vary considerably in their ambition, specificity and consistency. Table 5.1 provides an overview of Group of Seven (G7) country commitments. An analysis of adaptation plans submitted under the Paris Agreement found that 103 plans committed to restoration, management or protection of natural habitats, but these commitments were rarely translated into quantitative targets (Seddon et al., 2018[152]). The post-2020 global biodiversity framework, and the process of updating nationally determined contributions (NDCs) under the United Nations Framework Convention on Climate Change, may provide an

[37] Also known as the Sloping Lands Conservation Programme.

[38] Only direct costs (capital costs and management costs), and known benefits (ecosystem services, not other indirect benefits) were considered.

opportunity to revisit national restoration targets to improve their specificity and consistency.

Targets and policies for restoration need to account for – and aim to contribute to – a number of policy areas, including biodiversity conservation and sustainable use, climate-change mitigation and adaptation, and food and water security. Although restoration can deliver multiple benefits, governments may need to address some potential trade-offs. Enhancing biodiversity should be a primary consideration for all restoration action, given the importance of diversity for ecosystem productivity (Liang et al., 2016[153]) and resilience (Oliver et al., 2015[23]),and the potential of poorly planned restoration initiatives to harm biodiversity (Ouyang et al., 2016[154]).

As restoration can be technically challenging, it is important to build on previous successes and learn from the challenges that may have hindered the success of previous projects. One means to this end is through guidance and standards that ensure good practice for restoration action and facilitate landscape-scale planning of restoration action. Several international guidelines exist. For example, the Restoration Opportunities Assessment Methodology of the IUCN provides detailed guidance on forest landscape restoration, from identifying opportunities to implementing projects.[39] Ensuring standards and guidelines are maintained and updated for national contexts through knowledge hubs, such as *Réseau d'Échanges et de Valorisation en Écologie de la Restauration* in France and *Società Italiana di Restauro Forestale* in Italy, is an important component of cost-effective restoration (Menz, Dixon and Hobbs, 2013[155]).

Restoring an ecosystem may require restrictions on certain activities, changes in production practices or active replanting. To support these actions, governments may need to draw on a mix of policy instruments. No-take marine reserves, for example, have been effective in restoring biomass, the structure and health of food webs, and ecosystem resilience (Sala and Giakoumi, 2018[156]), while providing spillover benefits for fisheries (Halpern, Lester and Kellner, 2010[157]). Further, creating positive incentives for restoration through economic instruments such as taxes, subsidies and payments for ecosystem services is important. Economic policy instruments can ensure the true costs of degradation are appropriately priced into economic activity (e.g. though taxes, fees and charges) or that the value of ecosystems services provided through restoration is channelled back to the stakeholders instigating the restoration.

Paradoxically, environmental legal frameworks can impede restoration activity. In France, for example, soils are not considered a component of ecosystems, limiting the scope of restoration action to decontamination for public-health and security reasons (Buisson et al., 2017[158]). In Indonesia, the government passed a decree enabling "production forests" designated for logging to also be leased as long-term ecological restoration concessions for conservation, carbon sequestration and other benefits provided by natural forests. Fundamental changes to legal frameworks may be required for effective and equitable restoration.

[39] See also the Ramsar guidelines on restoring wetlands and peatlands; the United Nations Convention to Combat Desertification (UNCCD) database on sustainable land management; and the World Overview of Conservation Approaches and Technologies Global Database on Sustainable Land Management.

Table 5.1. National targets for ecosystem restoration in G7 countries

Country	National Biodiversity Strategies and Action Plans	Paris Agreement NDCs	Ramsar		LDN Commitment (UNCCD)	Bonn Challenge
			Priority sites for restoration identified	Restoration effectively implemented		
Canada	2020: Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities	No specific mention	Yes	Yes	No	No
France	2020: Preserve and restore ecosystems and their functioning	EU-wide commitment No specific restoration targets	Partially	Yes	No	No
Germany	2020: National flood-protection programme "Giving back space to our rivers"	EU-wide commitment No specific restoration targets	Yes	Yes	No	No
Italy	2020: Restoration mentioned several times, including in reference to agricultural lands; no specific targets	EU-wide commitment No specific restoration targets	No	No	Yes	No
Japan	2020: Restoration mentioned in three targets and four key actions goals, referencing invasive species, ecosystem services, and climate-change adaptation and mitigation	2030: Target of 36Mt-CO_2e for removals by land use, through forestry and improved cropland management	Partially	Yes	No	No
United Kingdom	2020: 15% of degraded ecosystems restored (England) 2020: Deliver peatland and wetland habitat restoration around the Lough Neagh Basin "Futurescape" through support for "Rebuilding the Countryside" Programme for 2015/16 (Northern Ireland) 2020: Restore 240 ha of ancient woodland (Northern Ireland) Ecosystems are restored to good health (Scotland)	EU-wide commitment No specific restoration targets	Yes	Yes	No	0.17 million ha (Scotland)
United States		No specific mention	Yes	Yes	No	15 million ha by 2020

Notes: NDCs: Nationally Determined Contributions; LDN: land degradation neutrality; ha: hectare; Mt: million tonnes; CO_2e: carbon dioxide equivalent. Effectiveness of restoration under Ramsar is self-reported.
Sources: Extracted from NBSAPs, NDCs, Ramsar national reports, the UNCCD website and the Bonn Challenge website.

Broad and inclusive stakeholder participation is an integral part of effective restoration (see Box 5.2). To make informed decisions regarding restoration and its inherent trade-offs, and avoid negative distributional impacts, an understanding of the way local (and in some cases downstream) communities utilise and manage ecosystem services is needed. This is particularly important in developing regions, where a high proportion of people (particularly vulnerable and indigenous communities) rely directly on ecosystem goods for food and fuel (Ding et al., 2018[159]). Further, incorporating local ecological knowledge and indigenous management approaches into restoration plans can ensure projects are both inclusive and effective.

Finally, to demonstrate the cost-effectiveness of restoration, projects should monitor and report not only the ecological results, but also the changes in the flows of ecosystem

services. Much of the information currently available is based on the expected flows of services based on theory, often using the pristine ecosystem as a baseline, Better information demonstrating the actual increases in ecosystem services from restoration, particularly at the scale of individual projects and ecosystems, is crucial for influencing land-use decisions (Ding et al., 2018[159]). Many projects either do not report costs at all or report only a portion of the total costs, often failing to report monitoring or transaction costs (Bayraktarov et al., 2016[160]).[40]

Box 5.2. Examples of ecosystem restoration

France: *Green Infrastructure in Nord-Pas-de-Calais*

The Nord-Pas-de-Calais region in northern France is a heavily industrialised region, with extensively degraded ecosystems from pollution, industry and fragmentation in the 19th and 20th centuries. Historic mining activity in the region had resulted in large areas of polluted and degraded soils, which posed a considerable risk to public health. Restoration work began in 2002 and aimed to avoid further degradation, restore natural heritage and improve connectivity between remaining natural vegetation. The restoration was completed in 2015.

Restoration action was part of a larger national programme for green infrastructure and connectivity ("*Trame verte et bleue*") and included a broad long-term commitment to stakeholder engagement. The steering committee comprised representatives from the public, local governments, the private sector and non-governmental organisations. A wide-ranging public information campaign was launched, garnering significant public support for the restoration project. The project cost EUR 9.8 million (euros) and was ecologically successful, with several species returning to the area. Societal benefits included increased green space for recreation and reduced public-health risks from contaminated soils.

United States: *Collaborative Forest Landscape Restoration Program (CFLR)*

Forested land in the United States delivers multiple societal benefits, with an estimated 124 million people relying on water from National Forest System lands alone. The programme aims to encourage collaborative, science-based restoration; support ecological, economic, and social sustainability; and leverage local, national, and private resources. The CFLR supported projects covering 52 000 to 970 000 hectares, equating to USD 5-35 million in lifetime funding. The types of activities supported included reforestation, invasive species removal, infrastructure upgrades (e.g. forest roads), removal of accumulated biomass (to reduce fire risk) and sustainable timber production.

The CFLR was allocated USD 40 million per year from 2010 to 2015; it created (or maintained) an average of 4 360 jobs per year, generating a total local labour income of USD 661 million. From an environmental perspective, the CFLR has facilitated the planting of over 27 000 hectares of forest, treated around 600 000 hectares to reduce the risk of uncharacteristic wildfire and enhanced the wildlife value of over 500 000 hectares.

Japan: *Coral reef restoration, Okinawa*

The coral reefs around Okinawa island in Japan have suffered significant declines in live coral cover since the 1970s, falling as low as 3% in some areas (Kushibaru). This degradation has several causes: mass bleaching events caused by El Niño in 1997 and 1998, over-exploitation of reef fish, increased water turbidity from poorly managed development and predation by crown-of-thorns

[40] This meta-analysis found that only 33% of 954 studies of marine restoration projects reported any cost data at all, and only 10% included some details of both capital and operating costs.

starfish. Coral reefs surrounding Japan are estimated to provide USD 1 billion per year in tourism benefits alone, and are thus are strong candidate for restoration.

Coral reef restoration in Okinawa has three key components. The first is an extensive process of stakeholder engagement and participation. The second is a major technical programme of artificial reef restoration, involving the cultivation and translocation of corals to sites. While these techniques can be effective, they can also cost well over USD 200 000 per hectare, making them predominately suitable for small, high-value restoration projects with broad public support, as in Okinawa. The final component is a strong, science-based monitoring and research programme that assesses the effectiveness of efforts and continues to develop the more technical elements of the coral reef restoration.

Source: (Eftec et al., 2017[151]) (USDA and USFS, 2015[161]) (Omori, 2010[162]) (Spalding et al., 2017[49]) (Bayraktarov et al., 2016[160]) (Foo and Asner, 2019[163])

6. DATA AND INDICATOR GAPS ON PRESSURES AND RESPONSES

6.1. The need to improve data and indicators on biodiversity pressures and responses

A better understanding of the source and magnitude of pressures on biodiversity will help inform the design and implementation of effective responses (i.e. actions), whether by government, the private sector or households. Similarly, improving data and indicators on the types of responses implemented (at the national, regional and global scales), their level of ambition and their effectiveness, is crucial to tracking progress towards achievement of the intended biodiversity objectives. An improved set of biodiversity indicators would also enhance understanding of the mechanistic links between the state of biodiversity, the pressures on biodiversity and the responses (Box 6.1).

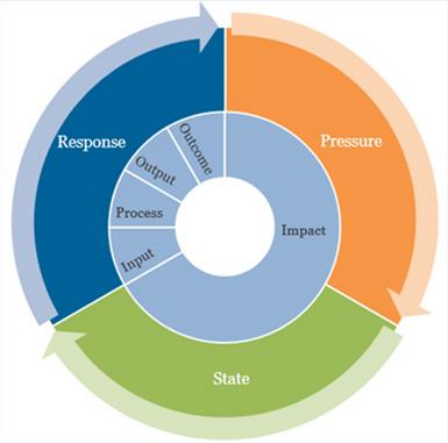
As the process of negotiating the post-2020 global biodiversity framework advances, taking stock of data and assessment efforts, understanding current limitations and devising ways to address gaps, is of paramount importance. The post-2020 process presents a crucial opportunity to create a more effective global biodiversity framework. Establishing more specific and measurable targets and indicators in the post-2020 framework will help improve the ability to monitor progress compared to the existing framework (Butchart, Di Marco and Watson, 2016[165]). Previous efforts to evaluate progress, such as the Global Biodiversity Outlook-4 (SCBD, 2016[14]), have struggled to identify accurate, nationally consistent data across countries in order to track progress towards many of the targets in a comparable manner (Tittensor et al., 2014[166]).

Hence, the post-2020 framework should include specific, measurable, ambitions, realistic and time-bound (SMART) targets to ensure that implementation and monitoring improve on the Aichi Targets. To support this, indicators for the post-2020 global biodiversity framework should be developed in tandem with targets in an iterative process. A first step is to take stock of the available data and indicators, and to identify the gaps.

Box 6.1. The pressure-state-response model

The pressure-state-response model is a commonly accepted framework for identifying and structuring indicators. It distinguishes indicators of environmental pressures (both direct and indirect), indicators of environmental conditions (i.e. state) and indicators of societal responses (i.e. actions taken). Following the literature on the theory of change, response indicators can be further disaggregated into inputs (e.g. finance), processes (e.g. institutional changes), outputs (e.g. new legislation or policies), outcomes (e.g. increase in protected area coverage) and impacts (e.g. decline in the number of threatened species) (Figure 6.1). Thus, if the responses are effective (and lead to positive impacts in the last stage), they should manifest in an improved state of biodiversity.

Figure 6.1. A schematic of the pressure-state-response indicator framework and how it relates to the theory of change



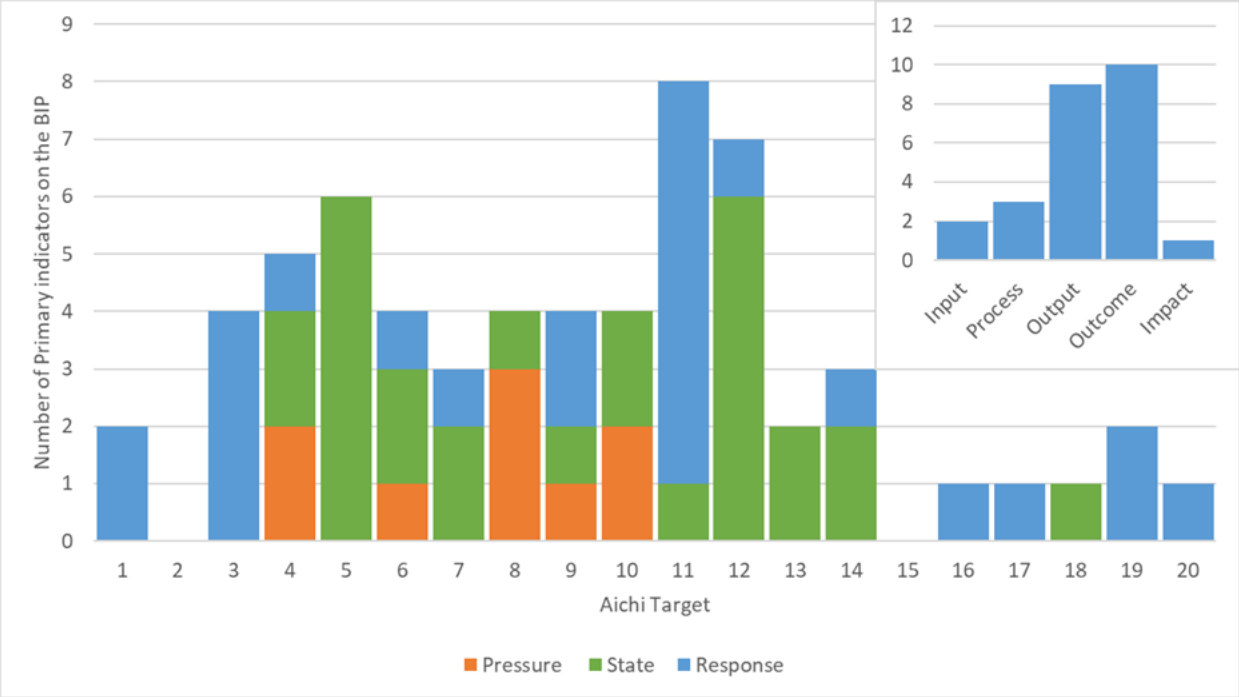
Source: (OECD, 2019[167]).

6.2. The current status of data and indicators to monitor pressures and responses

There have been large advances in the collection and analysis of biodiversity-relevant data. Remote-sensing technology now allows near-real-time monitoring of several key pressures globally, such as land-cover change in forest areas, fishing effort and forest fires (Global Forest Watch, 2019[168]) (Global Fishing Watch, 2019[169]) (VIIRS Active Fire, 2019[170]). Citizen-science data platforms, such as the Global Biodiversity Information Facility (GBIF) and the Ocean Biogeographic Information System, now contain well over 1 billion species occurrence records globally. Databases such as the OECD Policy Instruments for the Environment (PINE), which contains information on biodiversity-relevant economic instruments reported by more than 100 countries, and the World Database on Protected Areas, which maintains a record of the boundaries of protected areas globally, provide a rich landscape of data on policy responses. There have also been significant advances in the modelling of biodiversity responses to increasing anthropogenic pressure: indices such as the Biodiversity Habitats Index (CSIRO, n.d.[171]) and the Biodiversity Intactness Index (Newbold et al., 2016[172]) can help assess changes in biodiversity over time and understand the impacts of policy responses.

Decision XIII/28 of the Convention on Biological Diversity (CBD) lists 98 indicative indicators to monitor progress towards the Aichi Targets, and 64 indicators are currently listed under the Biodiversity Indicators Partnership (BIP). The BIP covers a wide variety of information, with 9 primary indicators (14%) on pressures, 28 (44%) on the state of biodiversity and 25 (39%) on the policy responses (Figure 6.2). [41]

Figure 6.2. Number and types of primary indicators under the BIP to track progress towards the Aichi Targets



Note: Inset graph shows the type of response indicators across all targets. For a full list of the Aichi Targets see: www.cbd.int/sp/targets/.

Information asymmetries exist across the Aichi Targets (and the environmentally relevant Sustainable Development Goals [SDGs], notably SDG 14 and SDG 15).[42] For example, there currently exist no indicators to monitor progress towards Aichi Target 2 (on mainstreaming) and Aichi Target 15 (on ecosystem resilience and restoration). In addition, of the 25 response indicators available under the BIP, nearly a third relate to protected areas (i.e. Aichi Target 11).

Kuempel et al. (2016[173]) suggest that identifying a comprehensive set of indicators that are able to represent the changing state of a study system is an important step, which should be taken every time new targets are being defined. For each indicator, it is important to clarify whether it refers to conservation outputs (e.g. new legislation for protected areas [PAs]), outcomes (e.g. greater coverage of protected areas) or impacts (e.g. higher species abundance); to ascertain the availability of baseline data; and to determine the cost of collecting and maintaining new data. Table 6.1 provides further examples of possible

[41] Note that the data providers also assign categories themselves, resulting in 23 state, 19 pressure and 20 response indicators.

[42] 68% (63) of the environmentally relevant SDG indicators cannot be measured due to a lack of data (UN Environment Programme, 2019[238]).

comprehensive sets of indicators that could help to represent the changing state of a study system.

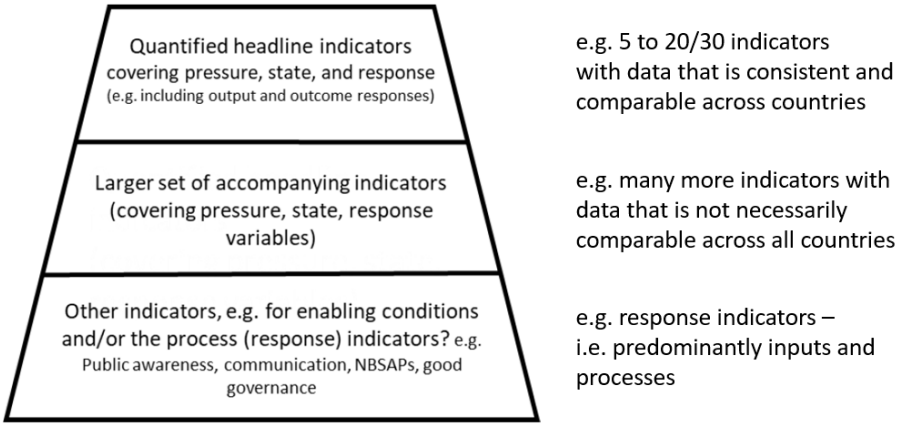
Table 6.1. Examples of potential sets of indicators for policy responses

Response theme	Input	Process	Output	Outcome	Impact
Protected areas	Increase in finance and staff for PAs	Systematic conservation planning	New legislation to increase PAs	Increase in PA coverage	Increase in species abundance
Sustainable fisheries		Inter-Ministerial Committee on Sustainable Ocean	Fisheries management plans	Increase in % of fish from sustainable sources	Reduction in the number of fisheries overexploited
Pesticide use		Assessment of environmental impacts of pesticides	Reduction in pesticide subsidies; Introduction of pesticide taxes	Decline in pesticide use per hectare	Increase in farmland biodiversity (e.g. farmland bird index)
Sustainable agriculture		Assessment of subsidy impacts on biodiversity	Farm-level biodiversity management plans	Increase in uptake of sustainable practices and habitat creation	Increase in farmland biodiversity (e.g. farmland bird index)

6.3. A proposal for headline indicators in the post-2020 framework

Under the CBD, indicators are currently arranged in a "flat" structure, suggesting all indicators are equally important. Some indicators may be more policy-relevant and important for tracking progress than others however. An alternative approach utilised by the OECD Green Growth Indicators is to identify a smaller set of *headline indicators* from the broader set of about 50 green growth indicators (OECD, 2017[174]).[43] The data for headline indicators must be consistent and comparable across countries. Figure 6.3 proposes a similar approach for the post-2020 biodiversity framework.

Figure 6.3. Possible categories of indicators for the post-2020 biodiversity framework



Source: (OECD, 2019[167]).

[43] The OECD Core Set of Environmental Indicators also uses a similar approach, where ten key indicators have been endorsed by national ministries.

An internationally agreed set of headline indicators could help prioritise national efforts and those of international organisations to develop the indicators that are considered most important. Table 6.2 provides a selection of possible headline indicators for policy responses.

Table 6.2. Examples of possible headline indicators for policy responses

Indicator	Data Provider	Status
Protected area coverage	World Database on Protected Areas	Available
Economic policy instruments (biodiversity-relevant taxes, fees and charges; tradable permits; positive subsidies)	OECD PINE database	Available (data on payments for ecosystem services and biodiversity offsets under development)
Potentially environmentally harmful support to agriculture	OECD PSE database	Available
Area under sustainable forest management	FAO	Under development
Extent of sustainable agriculture	FAO	Under development

Notes: FAO: Food and Agriculture Organization of the United Nations; PINE: Policy Instruments for the Environment database; PSE: Producer Support Estimate database.

6.4. Data and indicator gaps

6.4.1. Pressures

Multiple anthropogenic pressures are exerted on biodiversity. These pressures include habitat loss and fragmentation (e.g. particularly from agriculture expansion), over-exploitation of natural resources, pollution, invasive alien species and climate change (Chapter 2).

Although the impacts of agriculture on biodiversity are generally well-known, comprehensive monitoring of these pressures and impacts is largely absent. Data on nutrient balances, pesticide sales and soil erosion have inconsistent coverage across countries. The Farmland Bird Index is the only direct indicator of agricultural biodiversity across many countries. However, data collection for this indicator relies on volunteers and is therefore vulnerable to changes in the availability of volunteer labour in terms of both space and time, limiting its scope. Efforts to develop new indicators for agricultural biodiversity are underway in the European Union. Given the importance of agriculture to the global economy and environment, addressing this data gap is essential. Further, the impacts of agriculture and other forms of production are transmitted globally through international trade. However, detailed information on the biodiversity impacts embedded in the trade of many consumption goods is not available, complicating the implementation of effective policy solutions.

Pollution is a key pressure on both terrestrial and marine biodiversity (OECD, 2018[175]). While there is clear and increasing evidence of the impacts of plastic debris on marine species (see Chapter 2), the impacts of the bioaccumulation of micro plastics on ecosystem health, and, through consumption, on human health, are poorly understood (Koelmans et al., 2017[176]). Given the crucial role healthy marine and freshwater ecosystems play in the economy, the bioaccumulation of micro plastics and increasing plastic debris could have far-reaching implications throughout society. Similarly, data and indicators on pesticide pollution, its impacts and risks are not measured in a comprehensive manner.

Better understanding the source and magnitude of pressures from pollution at local, national and would be important.

Over-exploitation of biological resources is one of the major pressures on terrestrial, freshwater and marine biodiversity. Inappropriate management of fish stock, for example, can have severe impacts on biodiversity and the coastal communities that depend on it. But data are lacking: in 2016, the most recent year for which data are available, 29% of countries (12.8% of global catch) had not reported data to the FAO (FAO, 2018[12]). Furthermore, illegal, unreported or unregulated fishing catches are not included in these figures, and will likely have significant and currently unknown impacts on marine biodiversity. From a terrestrial perspective, over-exploitation is also a major driver of declines, again with considerable data deficiencies. Such is the case for trade in endangered species, where a lack of data on the flows of both legal (regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora) and illegal trade is undermining the effectiveness of enforcement and demand-side measures aiming to address it (Symes et al., 2017[177]).

The development of satellite-based and other remote-sensing techniques has rapidly expanded understanding of land-cover change in recent years (e.g. through Global Land Cover, Community for Data Integration and Landsat) (Hansen et al., 2013[32]). Further development of such satellite-based and other techniques should also allow the assessment of land use. Information on the type and intensity of land use at high resolution will improve understanding of how the threats to biodiversity vary across space, and would help optimise investments in biodiversity (including conservation, sustainable use and restoration) through the management of associated economic trade-offs (Naidoo et al., 2006[178]). Better remote sensing of land cover and land use can also provide information on the changes in ecosystem fragmentation and the impacts on biodiversity (Haddad et al., 2015[37]).

Finally, it bears noting that the multiple pressures on biodiversity do not occur in isolation; instead, they act cumulatively or synergistically to heighten pressure (Chapter 3) (Barlow et al., 2016[179]; Symes et al., 2018[180]). This is particularly important for climate change and international trade, which have highly variable and complicated impacts on biodiversity (Marques et al., 2019[11]; IPCC, 2018[15]). Consequently, actions and investment for biodiversity must strive to account for the potential consequences of climate change (e.g. changes in weather patterns, species composition and phenological responses) that could undermine their impacts in the future. Understanding the mechanistic linkages between pressures on biodiversity and how investments in biodiversity can leverage these links to amplify their effectiveness is vital to designing cost-effective interventions.

6.4.2. Responses (i.e. actions)

Despite progress in the actions put in place to address biodiversity loss, much about the policy responses remains unknown. For example, despite the wide-scale application and long history of protected areas (PAs), information regarding their effectiveness is lacking (Box 6.2). Data provided by countries to the OECD PINE database on the use of positive incentives (i.e. economic instruments) such as biodiversity-relevant taxes, fees and charges, tradable permits systems are also incomplete (Chapter 7).

Box 6.2. Data and assessment of protected areas (PAs)

Achieving the "effectively and equitably managed, ecologically representative and well connected systems of protected areas" called for in Aichi Target 11 implies monitoring multiple dimensions of the PA systems, many of which are currently not monitored in a comprehensive way. For example, while some countries, such as European Union Member States and the United States, assess the status of biodiversity in protected areas regularly, this is not the case globally, particularly in hyper-diverse tropical countries. Table 6.3 summarises the various PA dimensions and the current status of data.

Table 6.3. Potential dimensions of PAs that can be monitored and current status of data

	Indicator status	Data source	Nationally applicable	Globally comparable	Notes
Extent of PA	Tier 1	World Database on Protected Areas, OECD	Yes	Yes	Accepted as indicator of progress towards Aichi Targets and SDGs
Connectivity	Tier 1 (terrestrial only)	Protected area connectedness index	Yes	Yes	Accepted indicator to track progress on Aichi Targets
Ecological representation	Tier 1 (terrestrial only)	Protected area representativeness index	Yes	Yes	Accepted indicator to track progress on Aichi Targets
Management effectiveness	Tier 2	Global database on Protected Area Management Effectiveness	Yes	No	Data not collected routinely and multiple methodologies, making comparisons challenging
Ecological effectiveness	Tier 3	n/a	No	No	Multiple ad-hoc studies available, but standard methods challenging, owing to multiple dimensions of effectiveness

Biodiversity mainstreaming[44] across both the public and private sectors is essential for effective action (Redford et al., 2015[181]). However, the plurality of institutions and policy frameworks at the national level makes the creation of internationally comparable indicators more challenging (OECD, 2018[182]). This is also true for the private sector (Chapter 4).

Linking policy responses to the pressures on biodiversity is key to effective interventions. Model-based indices, such as Biodiversity Habitats Index (CSIRO, n.d.[171]) and the Biodiversity Intactness Index (Newbold et al., 2016[172]), have been developed to address this issue. However, the complicated modelling used to derive these type of indices is essentially a "black box", making their interpretation challenging and undermining their utility for policy making.

[44] The Global Environmental Facility defines mainstreaming as "The process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally."

6.5. Addressing data and indicator gaps

Improving the coverage of existing databases, both in terms of geographic and informational range, is key for addressing data and indicator gaps. Some initiatives are underway, e.g. to expand the coverage of the OECD PINE database to include information on payments for ecosystem services and biodiversity offsets. Considerable opportunity exists to scale up data and assessments for biodiversity at a relatively low cost. Juffe-Bignoli (2016[183]) estimates that USD 114 million (US dollars) in investment is required to reach an initial baseline for four globally important biodiversity-knowledge products[45] (including the International Union for Conservation of Nature [IUCN] Red List of Threatened Species), a fraction of the USD 5-7 billion required to monitor global climate for the United Nations Framework Convention on Climate Change (WMO, 2010[184]). Ongoing developments in environmental accounting, emerging technologies and innovation (Box 6.3) provide further opportunities for filling data gaps, and improving the quality and efficiency of data collection. Finally, the development, application and harmonisation of methodologies and standards to measure the biodiversity impacts embodied in trade, such as the UNEP/SETAC (2016[185]) Life Cycle Assessment guidance and the EU Environmental Footprint standards (EC, 2013[186]) is helpful in this regard.

Conversely, mobilising national data-collection efforts to track progress internationally would benefit from better co-ordination of the national agencies responsible for data collection with international data aggregators, such as the OECD PINE database and the GBIF. Many countries (including in the Group of Seven [G7]) have extensive biodiversity-monitoring programmes (e.g. the UK Biodiversity Indicators programme and the US National Parks Service Vital Signs monitoring programme). Sharing best-practice insights from these programmes – possibly through peer learning, to facilitate knowledge exchange between national-level institutions – could benefit countries with less-developed programmes.

Finally, a commitment to open data by all relevant institutions (where possible), both nationally and internationally, is essential in order to address data gaps, enhance accountability, and improve the design and implementation of policies for biodiversity (OECD, 2019[187]). A powerful example of the impacts open data can have is the NASA Earth Observation Systems Data and Information Systems, which provides free access to over 11 000 unique data products. These data products now underpin many of the global-scale indicators available today. Further initiatives to facilitate the open source nature of data will likely help close data gaps without the need for additional expensive data collection by ensuring more effective use of existing data.

[45] The IUCN Red List of Threatened Species, the IUCN Red List of Ecosystems, Protected Planet and the World Database of Key Biodiversity Areas.

Box 6.3. Role of innovation in addressing data gaps

The rapid development of technology has led to an explosion in the volume and types of data that can be collected across many sectors of the economy, society and environment (OECD, 2019[187]). Biodiversity is no different. Several novel, emerging or developing technologies have the potential to support traditional data collection by diversifying the types of data that can be collected and the way existing data can be used by the public sector, the private sector and private individuals. In some cases, these impacts are being felt already. Emerging artificial intelligence techniques, for example, combined with remote data collection from camera traps and acoustic monitoring, has already proved a powerful tool for identifying species and even individual animals (Kwok, 2019[188]). Further, nanopore DNA sequencing can be used fight illegal wildlife trade and block chain to provide end-to-end transparency of supply chains, while mobile phone applications have already increased role of citizen scientists in monitoring biodiversity. Finally, the emergence of new technologies represents a major opportunity for new business: Earth observation from space, for example, was worth USD 7.5 billion a year in 2015 (PricewaterhouseCoopers, 2019[189]). The G7 can play a key role in leading the development and implementation of innovations for biodiversity (see Annex for more information: oe.cd/bio-fin-econ-case4action).

7. GLOBAL BIODIVERSITY FINANCE: A PRELIMINARY UPDATE

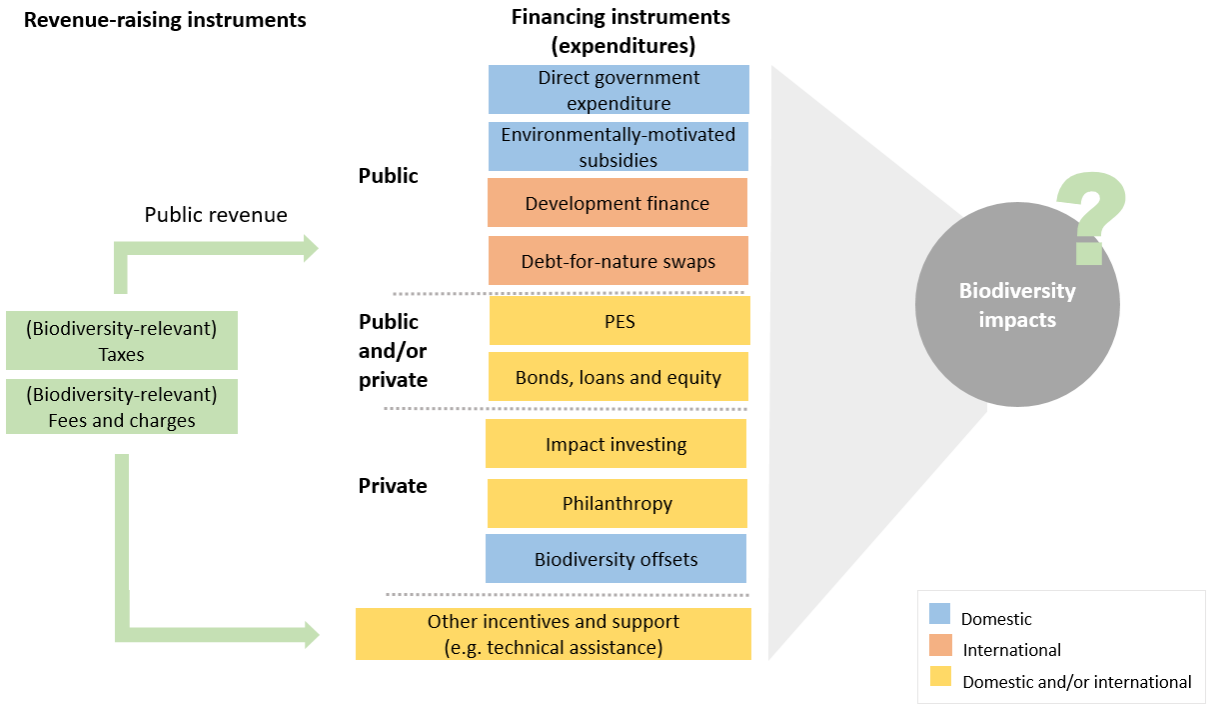
7.1. A conceptual framework for biodiversity finance flows

The global finance needed to meet the 20 Aichi Biodiversity Targets by 2020 has been estimated at about USD 150-440 billion (US dollars) per year (CBD High-Level Panel, 2014[190]). Global finance flows for biodiversity were estimated at about USD 52 billion in 2010 (Parker et al., 2012[191]). While acknowledging some uncertainties in these estimates, it is clear that a major gap in the finance needed to halt biodiversity loss exists.

The finance for biodiversity stems from several sources, both public and private, and can be domestic or international (Figure 7.1). Governments can influence both public and private finance flows for biodiversity, including through economic instruments such as payments for ecosystem services and biodiversity offsets. Figure 7.1 depicts the revenue-raising instruments available to government (e.g. taxes, fees and charges), as well as the financing instruments for biodiversity available to the public and private sectors.

Revenue-generating instruments such as biodiversity-relevant taxes, fees and charges also provide incentives for biodiversity conservation and sustainable use. If earmarked for biodiversity purposes, such revenue can also create finance flows for biodiversity.

Figure 7.1. An initial conceptual framework for biodiversity finance and other types of incentives and support



Note: Biodiversity-relevant bonds can include both private and public finance (if the issuer is public, e.g. sovereign bonds), and can also be a subset of impact investing.

Data reported to the OECD Policy Instruments for the Environment (PINE) database indicates that biodiversity-relevant taxes (such as taxes on pesticides) generate revenue estimated at USD 7.4 billion annually (2012-16 average) in OECD countries (OECD, 2018[192]). While some countries included information on whether or not the revenue from these taxes is earmarked for biodiversity-relevant purposes, the data are not currently comprehensive enough to provide robust estimates of finance flows from such taxes to biodiversity.

Revenue raised from biodiversity-relevant fees and charges, as reported to the OECD PINE database, is estimated at USD 2.29 billion annually (2012-16 average) (OECD, 2019[193]). Of the total number of biodiversity-relevant fees and charges that are currently reported in the PINE database, 42% also include data on revenue. These instruments include entrance fees to natural parks, and hunting and fishing permit fees. Based on a preliminary assessment, a large proportion of this revenue is likely to be channelled towards biodiversity-related activities.

The OECD PINE database also tracks information on biodiversity-relevant tradable permits, such as individually transferable quotas for fishing. Tradable permits that are auctioned, and whose revenue is earmarked for biodiversity-relevant purposes, also constitute a finance flow for biodiversity. Existing data in PINE is currently limited and will be extracted in the OECD follow-up work to this report.

7.2. Finance flows for biodiversity

The multiple data sources currently available on finance flows for biodiversity are non-comprehensive and sometimes overlapping. Moreover, data for various types of finance flows are not yet collected and reported in a consistent and comparable way. With these important caveats in mind, this preliminary analysis provides estimates on biodiversity finance flows, based on the categories in Figure 7.1. Section 7.2.1 discusses the data available on finance flows to biodiversity as reported to the CBD Clearing House Mechanism, whereas section 7.2.2 examines the data available based on other data sources identified. A summary of the estimated finance flows for biodiversity identified here is provided in Table 7.4 below.

7.2.1. Finance flows as reported to the Convention on Biological Diversity Clearing House Mechanism

Parties to the Convention on Biological Diversity (CBD) are requested to report on their finance for domestic biodiversity-related activities. According to data available in the CBD Clearing House Mechanism (CHM), annual financial support provided to domestic biodiversity-related activities, based on reporting from 74 governments, amounted to USD 48.96 billion in 2015 (SCBD, 2019[194]).[46]

This finance estimate does not include the European Union, which allocated EUR 11.2 billion to biodiversity-related activities in 2015, covering central government budgets, and including both direct and indirect expenditures. Further analysis is needed to determine whether this finance flow is not also reflected in the data reported by individual EU Member States to the CBD CHM. The domestic finance estimates reported in the CBD CHM also do not include Ireland, which recently conducted a National Biodiversity

[46] This aggregate number reflects a correction from Austria (personal communication with the CBD National Focal Point).

Expenditure Review.[47] Biodiversity expenditures are estimated at EUR 1.49 billion over 2010-15, i.e. EUR 250 million per year (Morrison and Bullock, 2018[195]).[48]

There exist some important considerations and caveats in terms of what the data reported to the CBD CHM does – and does not – include. Domestic biodiversity expenditures include finance received by international sources (referred to as extra-budgetary; see Table 7.1), but not finance provided to other countries. The data reported may include finance from all sources (including private/market) but must include, at a minimum, central government. Italy, for example, includes government budget from both the central and state/provincial levels, and covers both direct and indirect expenditures. Canada includes data from a broader number of sources, including private finance. The estimates for private finance cover user fees (e.g. park fees and licences) as well as business expenditures. The data reported are therefore not consistent and comparable across countries.[49] Reporting rates are also still low (40% of all Parties to the CBD) (CBD, 2018[196]).

Table 7.1. Domestic expenditure sources and categories reported in the CBD CHM

	Number of countries	
Number provided covers	Expenditures directly related to biodiversity	Expenditures indirectly related to biodiversity
Government budgets – central	70	41
Government budgets – state/provincial	25	17
Government budgets – local/municipal	22	14
Extra-budgetary	24	15
Private/market	16	10
Other (non-governmental organisations, foundations, academia)	30	17
Collective action of indigenous and local communities	6	3

Source: (SCBD, 2019[194]).

7.2.2. Finance flows as reported in other data sets

Subsidies beneficial to biodiversity

According to the currently available data in the OECD PINE database, biodiversity-relevant positive subsidies amount to USD 0.89 billion per year (2012-16 average, current prices). Of the total number of biodiversity-relevant positive subsidies reported in the database, only 57% also provide information on the finance flows associated with these subsidies (OECD, 2019[193]).

A subset of government domestic expenditure is government support to agriculture that is considered potentially beneficial to biodiversity, totalling an estimated EUR 2.6 billion per year in OECD countries (OECD, 2018[197]).[50] The data are reported in a consistent and comparable manner. This amount includes support provided through the US Conservation

[47] Following the approach of the United Nations Development Programme (UNDP)'s Biodiversity Finance Initiative (BIOFIN) (UNDP, 2018[226]).

[48] Another source of data that may be useful for domestic biodiversity-relevant expenditures is the Classification of Functions of Government (COFOG), which includes a category for "biodiversity and landscape".

[49] An initial review of the data provided to the CBD CHM indicates that only about half of the countries provide specific information for each of the finance categories they include. It is therefore not possible to identify which fraction of the total finance reported is due only to domestic government budget, for example.

[50] This is a proxy, which focuses on two categories of government support – namely, support with environmental constraints that is for long-term retirement of resources and specific non-commodity outputs (this does not include cross-compliance).

Reserve Programme (which is also included in the estimate of finance flows from selected payments for ecosystem services [PES] provided in Table 7.2 below, and therefore leads to double-counting).[51]

Official development assistance and other flows

The OECD also tracks data on official development assistance (ODA) from its OECD Development Assistance Committee members through the Creditor Reporting System (CRS). The most recent estimates are provided below (OECD, 2019[198]).

It is important to note that the bilateral biodiversity-related ODA is likely to be different from what the Parties have reported as "extra-budgetary" in their domestic biodiversity-relevant activities (Table 7.1). For example, the data below are commitments (rather than disbursements). In addition, these funds could presumably be used to provide technical assistance to partner countries (for example), rather than to add to partner government resources that are spent and accounted for in national budgets.

- ODA: bilateral biodiversity-related ODA amounted to USD 7.83 billion in 2017 (commitments, current prices).
- ODA: Multilateral biodiversity-related ODA amounted to USD 2.57 billion in 2017 (commitments, current prices). This estimate is based on reporting from EU institutions, the Global Environmental Facility and the International Development Association.
- Multilateral development banks (MDBs): data on finance for biodiversity from MDBs, such as the European Bank for Reconstruction and Development, the European Investment Bank, the World Bank, the International Finance Corporation and the Asian Development Bank, are not yet reported in a consolidated manner available (unlike, for example, finance for climate change).
- Other official flows (OOF) amounted to USD 146 million in 2017 (commitments, current prices). This estimate is based on reporting from two members.

Debt-for-Nature Swaps

Debt-for-Nature swaps are another way that – in effect – mobilise finance for biodiversity. According to Sommer, Restivo and Shandra (2019[199]), US debt-for-nature swaps cancelled approximately USD 1.8 billion owed by 21 low- and middle-income nations, and generated USD 400 million for conservation. In comparison, debt-for-nature swaps carried out by all other high-income nations totalled USD 1 billion of debt cancelled and generated about USD 500 million for conservation. Further analysis is needed to determine whether the finance mobilised and reported by (Sommer, Restivo and Shandra, 2019[199]) would constitute double counting with the data reported to the OECD CRS database on bilateral biodiversity-relevant ODA.

[51] There may also be double counting of data on PES by Costa Rica; this is not clear, however, owing to the way in which the data have been reported to the OECD PSE database.

Philanthropy

According to the most recent estimates, finance flows from philanthropy (i.e. private foundations) for biodiversity-related activities totalled USD 380 million in 2017 (commitments, current prices). This estimate is based on data reported to the OECD CRS database by 17 foundations, including the Arcus Foundation, the C&A Foundation, the Children's Investment Fund, the David & Lucile Foundation, the Ford Foundation and the MAVA Foundation.

Private finance flows for biodiversity

In addition to public finance flows, achieving transformative change for biodiversity action will require mobilising private finance flows for biodiversity action at pace and scale. Economic instruments, such as PES and biodiversity offsets, are one way to engage the private sector directly in biodiversity conservation and sustainable use. Biodiversity offsets mobilise an estimated USD 4.8 billion per year (2016 data), globally (Bennett, Gallant and Ten Kate, 2017[200]).

Finance for biodiversity channelled through ten large national PES schemes alone are estimated at approximately USD 12 billion per year (Table 7.2).[52] These larger PES schemes highlighted in Table 7.2 generally combine both public and private finance for biodiversity. It is estimated, however, that more than 300 PES schemes are in place globally, including many privately financed programmes. The OECD is currently working to incorporate PES schemes into the OECD PINE database in order to better track finance from PES schemes, including whether the source of finance is public, private, or a combination of both.

Other opportunities to mobilise private finance flows are also available. For example, OECD institutional investors alone manage USD 55 trillion in assets (OECD, 2018[201]).[53] Governments are keen to leverage private capital, notably from institutional investors, to support the climate goals under the Paris Agreement. What is needed now is more ambitious action to mobilise financial actors[54] to steer private finance flows towards biodiversity action.

A variety of investment strategies are available for investors and other financial organisations to mainstream biodiversity considerations across asset classes and investment types (e.g. listed or unlisted equity, loans, fixed income – including bonds – and infrastructure) and investment management strategies (e.g. passive index investing or active management). Available investment strategies include: active ownership and engagement, divestment, exclusionary screening in the due diligence process, best-in-class investing tailored to biodiversity, investment in thematic funds, or direct investment in sustainable businesses that have a positive impact on biodiversity and ecosystem services (e.g. in natural infrastructure), including through impact-investing strategies.[55]

[52] The OECD is currently developing a survey to obtain additional information on PES schemes and the finance they channel, to circulate to OECD and partner countries. Initial results are expected in late 2019 or early 2020. The data will eventually be integrated into the OECD PINE database.

[53] Including asset owners (pension funds, pension reserve funds and insurance companies), but excluding asset managers and investment funds. Information derived from data gathered from OECD global pension statistics, institutional investor asset databases, and data collected through the survey (for the total investment in reserve funds).

[54] Including asset owners, asset managers, investment funds, banks, capital markets, financial regulators and supervisors, international financial institutions and investee corporations.

[55] See Annex A.4.4 in the Annexes available online here oe.cd/bio-fin-econ-case4action for more information on the available investment strategies.

According to Hammrick (2016[202]), the total private capital committed to conservation investments between 2004 and 2015 amounted to USD 8.2 billion. Hammrick (2016[202]) defines conservation investing as "intentional investments in companies, funds, and organisations with the goal of generating both a financial return and a measurable environmental result".

Table 7.2. Finance mobilised by ten large Payment for Ecosystem Services programmes

Country	Name of programme	Year introduced	Objectives	Finance mobilised
Australia	Environmental Stewardship Programme	2007	Biodiversity conservation, habitat restoration, nationally threatened species	USD 5.19 million per year (2007-17 average)
Brazil	Green Grants programme *(Bolsa Verde)*	2011	Sustainable use of protected areas, improved environmental management and poverty reduction	USD 33.8 million (2011-13 average)
China	Sloping Land Conversion Programme (Grain for Green)	1999	Reducing soil and water erosion by targeting and converting marginal farmland to forest or grassland	USD 4.9 billion per year on average (USD 69 billion by end of 2014)
China	Natural Forest Conservation Programme	1998	Protection and restoration of natural forests	USD 4.7 billion in 2015
Costa Rica	*Pago por Servicios Ambientales*	1996	Carbon storage, hydrological services, protection of biodiversity and landscapes	USD 42.4 million in 2012
Ecuador	*Socio Bosque*	2008	Forest conservation, carbon storage	USD 7.9 million per year (2015)
Mexico	Biodiversity PES	2003	Forest conservation, biodiversity conservation	USD 22.3 million in 2016
Mexico	Payments for Hydrological Services	2003	Forest conservation, hydrological services	USD 28.2 million in 2016
United States	Conservation Reserve Programme	1985	Wildlife-habitat benefits, water-quality benefits, on-farm soil-retention benefits	USD 1.8 billion in 2015
United States	Catskills	1997	Hydrological services, habitat restoration, environmentally friendly farming	USD 167 million per year

Note: Finance for PES can include both private and public finance. Data on PES, including finance flows, are not yet collected in a consolidated way. The OECD is currently working to incorporate PES into the OECD PINE database. The new information will be available in the second phase of the OECD work for the G7.
Source: See (OECD, 2018[192]).

Impact investing strategy

Although still a niche investment strategy, impact investing has been gaining momentum, contributing to the effort to achieve the Sustainable Development Goals and address social, environment and governance issues. According to Principles for Responsible Investment data, more than 450 investors allocated USD 1.3 trillion to impact investments worldwide in 2016 (UNEP Finance Initiative and United Nations Global Compact, 2018[203]).

The Annual Impact Investor Survey 2018 identified USD 6.98 billion in finance for "conservation", based on 226 investor responses. Total impact-investments assets (across all categories) are estimated at USD 228 billion (Mudaliar, Bass and Dithrich, 2018[204]).

Biodiversity-relevant bonds

While investors have yet to mainstream biodiversity and broader environmental considerations across all asset classes and investment types (despite progress in finance for

climate change), bonds are another potential source of private finance for biodiversity.[56] Since the inception of the green bond market, annual green bond issuance has grown rapidly at the global level, from USD 37 billion in 2014 to USD 168 billion in 2018, thanks to the diversification of issuer sectors, countries and targeted projects such as the 2019 Climate Bonds Initiative. In fact, cumulative green bond issuance over the past ten years has passed the USD 500 billion mark.

While green bonds are rapidly scaling up, they focus primarily on climate change and seldom include biodiversity-relevant finance. The finance flows from biodiversity-relevant bonds are, however, a tiny fraction of climate-relevant bonds. Sustainability bonds, environmental bonds and impact bonds may also be relevant to biodiversity. A preliminary review and analysis of the publicly available information (through websites) suggests which bonds may be relevant to biodiversity (Table 7.3).

Table 7.3. Examples of biodiversity-relevant bonds

	Company	Finance
Green bond	Klabin, Brazilian paper company	Claims USD 53 million for Sustainable Forest Management (SFM) (forestry); USD 61.3 million SFM (certification); USD 5.6 million (native forests); USD 2.6 million (ecological parks)
Green bond	Stora Enso, Finland	Published a Green Bond Framework which includes projects related to Forest Stewardship Council and Programme for the Endorsement of Forest Certification-certified forests among its eligible categories, signalling its intention to enter the market
Green bond	France (government)	16% of EUR 9.7 billion for biodiversity conservation (outstanding at the end of 2017) Sovereign Green OAT, i.e. EUR 1.55 billion
Environmental impact bond	Louisiana Coastal Master Plan (project)	USD 40 million for coastal-protection investment
Environmental impact bond	DC Water	USD 25 million for building storm-water run-off infrastructure
Social and sustainable bond	Danone	EUR 300 million partly for "sustainable" agriculture
Sustainable bond	PT Royal Lestari Utama (Barito Pacific and Michelin)	USD 95 million "sustainable" rubber-joint venture in Indonesia
Sustainability awareness bond	European Investment Bank (EIB)	EUR 500 million for sustainable water projects

Sources: (Klabin, 2018[205]) (Enso, 2018[206]) (Agence Trésor France, 2017[207]) (EDF, 2018[208]) (TLFF, 2018[209]) (EIB, 2018[210]).

Other biodiversity funds

A number of biodiversity-relevant funds also exist, which mobilise finance from the public and private sector. The OECD has started initial work to develop a biodiversity fund inventory (OECD Biodiversity Fund Inventory [BFI] database). To date, more than 120 funds intended for the conservation of species and ecosystems have been identified. Another 20 funds or so are climate funds that also target biodiversity-relevant aspects (e.g. directly or through the Reducing Emissions from Deforestation and Forest Degradation initiative). The publicly available data are not sufficient to provide a robust estimate of the finance flows for biodiversity at this time.

[56] Note that bonds can be issued as part of various investment strategies, including impact investing.

7.3. Overview of estimated finance flows for biodiversity

Given the lack of comparable and consistent data on the subject, and based on the review conducted to date, it would be premature and misleading to provide an aggregate estimate of global finance flows for biodiversity. A summary of the estimates discussed above, however, is provided in Table 7.4.

Table 7.4. Estimated finance flows for biodiversity

Type of finance	Amount per year	Notes	Source/reference
Public			
Domestic budget	USD 48.96 billion in 2015	74 governments. Includes ODA in some cases. Methods are not harmonised.	(SCBD, 2019[194])
	Ireland: EUR 250 million per year (average 2010-15)		(Morrison and Bullock, 2018[195])
	European Union: EUR 11 billion in 2015	EU covers central budget (direct and indirect expenditures)	(EC, 2018[211])
ODA – bilateral	USD 7.83 billion in 2017	Commitments, current prices	(OECD, 2019[198])
ODA – multilateral	USD 2.56 billion in 2017	Commitments, current prices	(OECD, 2019[198])
OOF	USD 145 million in 2017	Bilateral and multilateral. Reporting is very limited (two members)	(OECD, 2019[198])
Multi-lateral Development Banks	Not available		
Debt-for-nature swaps	USD 900 million	Possible double counting with ODA?	(Sommer, Restivo and Shandra, 2019[199])
Philanthropy/foundations	USD 380 million in 2017	Commitments, current prices (biodiversity marker). Based on 14 foundations	(OECD, 2019[198])
(Other) Biodiversity funds		More than 120 biodiversity-relevant funds identified. Very little data available on finance	(OECD, forthcoming[212])
Biodiversity-relevant positive subsidies	USD 0.89 billion 2012-16 average	Current prices	(OECD, 2019[193])
Potentially beneficial flows from government support to agriculture	EUR 2.6 billion (OECD countries)	Includes U.S. CRP which is also included in the PES estimate below	(OECD, 2018[197])
Private			
PES	USD 12 billion	10 large PES programmes	(OECD, 2018[192])
Biodiversity offsets	USD 4.8 billion in 2016		(Bennett, Gallant and Ten Kate, 2017[200])
Biodiversity-relevant fees and charges	USD 2.29 billion (2012-2016 average)	Current prices	(OECD, 2019[193])
Impact investing for "conservation", i.e. conservation assets under management	USD 6.84 billion	Based on survey of 226 impact investors	(Mudaliar, Bass and Dithrich, 2018[204])
Private equity and debt finance	N/A	e.g. Mirova Althelia	

Notes: Adding these numbers would likely lead to significant double counting in some cases. *Green/blue bonds can be part of impact investment; bonds can also be issued by public issuers, i.e. sovereign bonds.

7.4. Potentially environmental harmful finance flows

Any estimates on finance flows for biodiversity should be considered together with the available estimates on potentially environmentally harmful flows. The estimates suggest high government support and subsidies to activities with significant environmental footprints (Table 7.5).

Table 7.5. Subsidies to activities with significant environmental footprints are large and costly

	Country coverage	USD billion per year	Source
Support measures for fossil fuels	Global	370 in 2015	(OECD, 2018[213])
Water use and treatments	Global	450 in 2012	(IMF, 2015[214])
Support to agricultural production potentially environmentally harmful	OECD countries	100 in 2015	(OECD, 2013[215])
Support to fisheries	OECD countries Global – including fuel subsidies	7 in 2018 35 (in 2009 dollars)	(OECD, 2017[216]) (Sumaila et al., 2016[217])

Based on conservative estimates of subsidies that are harmful to biodiversity (covering fossil-fuel subsidies, which contribute to climate change and thus indirectly to biodiversity loss, and government support to agriculture that is potentially environmentally harmful) finance flows for the conservation, sustainable use and restoration of biodiversity outweigh government support that is potentially harmful to biodiversity by a factor of 10.

Such support, including subsidies, can – and must – be reformed. Several countries have taken action in this regard. Switzerland, for example, has reformed its agricultural policy to ensure that current subsidies target more biodiversity-friendly purposes (OECD, 2017[83]). Chapter 8 discusses opportunities to scale up action for biodiversity.

8. OPPORTUNITIES TO SCALE UP ACTION ON BIODIVERSITY

Biodiversity and ecosystem services underpin human well-being and the ability to ensure sustainable development. The planet's ability to sustain people and prosperity can no longer be taken for granted. Addressing the multiple pressures on biodiversity requires actions across all fronts: government (national and subnational), the private sector, civil society and individuals. More co-ordinated, coherent and strategic approaches are needed to ensure that biodiversity and ecosystem services can continue to support all life on Earth. Ten priority areas have been identified where Group of Seven (G7) and other countries can focus their efforts.

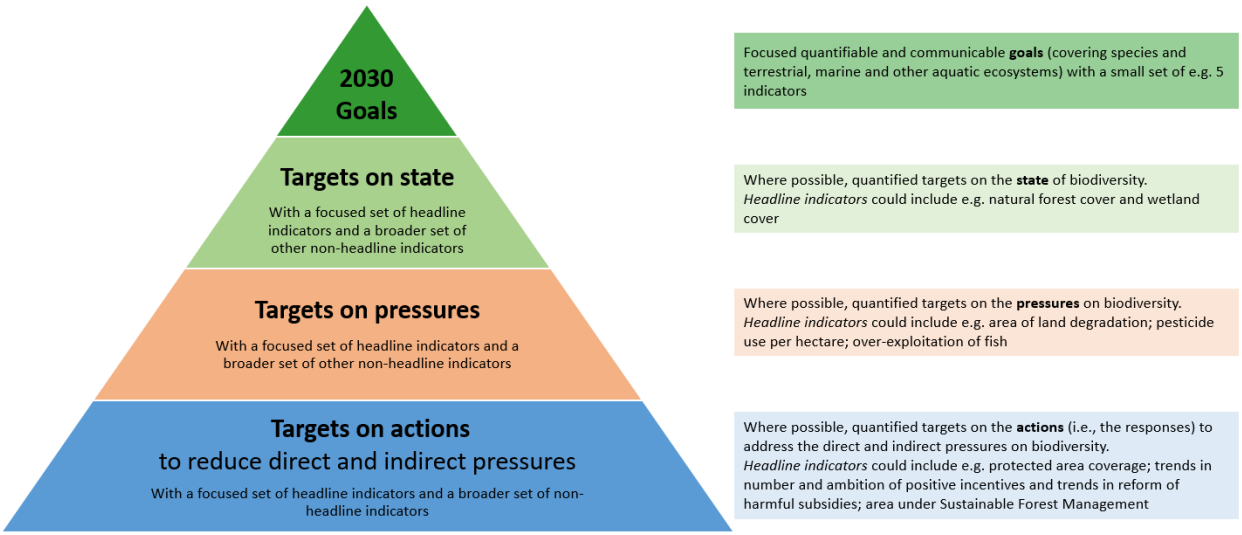
8.1. Pursue a robust post-2020 global biodiversity framework with specific, measurable and quantitative targets

The 15th meeting of the Convention on Biological Diversity (CBD) Conference of the Parties (COP 15), to be held in Kunming, China, in December 2020, represents a critically important opportunity to put in place the framework and supporting mechanisms to halt and reverse biodiversity loss, and to scale up the conservation, sustainable use and restoration of ecosystem services. A robust post-2020 global biodiversity framework, featuring specific and measurable targets, will be fundamental to galvanising action at the national level, across both the public and private sectors. Specific and measurable targets at the global level, together with associated indicators, will enhance clarity and transparency on the actions required at the global, regional and national levels, and enable the assessment of whether progress is being achieved.

An effective structure of the post-2020 global biodiversity framework can also help communicate and clarify the overarching goals and objectives to the public, and engage civil society. The current framework comprises a long-term 2050 vision for biodiversity, together with 5 overarching goals for 2011-20 and the 20 Aichi Biodiversity Targets. New structures are being considered for the post-2020 global biodiversity framework, including a pyramid structure featuring a quantifiable "apex" goal, below which are: (i) quantified objectives on the state of biodiversity; (ii) priority actions (not necessarily quantified); and (iii) the necessary supporting and enabling conditions (Conservation International et al., 2018[218]).

A few iterations of the elements within the pyramid structure have since evolved. Figure 8.1 provides an alternative proposal for the three elements under the "apex" goal, that aligns more closely with the existing Aichi Targets, and which cover the well-established categories of biodiversity-related pressures, state and responses (see Chapter 6). The responses are, in effect, the actions taken to address the pressures and indirect drivers of biodiversity loss. The proposal places stronger emphasis on the need for quantified objectives, not only for the state of biodiversity, but where possible also on the pressures and actions taken. Actions include those on policies, governance and finance, among others. The proposal also incorporates the concept of headline indicators for all of the objectives (see Chapter 6). Identifying the relevant headline indicators would need to be driven by the recognised importance of the associated targets for policy making. The identification of a smaller set of headline indicators would enable efforts to be prioritised to improve the data underlying these indicators, so as to ensure they are comparable and consistent across countries.

Figure 8.1. Possible elements of a post-2020 biodiversity framework, including headline indicators



Source: Adapted from (OECD, 2019[167]) (Conservation International et al., 2018[218]).

A post-2020 global biodiversity framework that includes the concept of headline indicators would strengthen the alignment between the indicators proposed through the global framework and indicators used at the national level (Box 8.1). This would enhance transparency, accountability and comparability of data across countries (see also Chapter 6).

Box 8.1. Stronger alignment between post-2020 national and international indicators for biodiversity through headline indicators

There currently exist about 98 indicative indicators under the CBD framework, which countries are encouraged to use to monitor progress on achieving the Aichi Biodiversity Targets. The Biodiversity Indicators Partnership (BIP) currently covers 64 indicators (see Chapter 6). Uptake of the BIP indicators at the national level remains limited, however, rendering it difficult to: (i) assess whether the national commitments, when aggregated at the global level, are sufficient to meet the 2011-2020 Aichi Biodiversity Targets; and (ii) monitor national progress in a comparable way across countries. A more robust monitoring and reporting framework, using indicators in a more consistent and comparable way across countries at the national, regional and global scales, is therefore essential to track progress towards the post-2020 biodiversity targets.

Agreement on a smaller set of key headline indicators that are quantitative, consistent and comparable across countries could help achieve this goal. A strong emphasis of the headline indicators on responses, including on inputs (e.g. finance), outputs (e.g. positive incentives and their level of ambition), and outcomes (e.g. increase in PA coverage) (see Chapter 6) would allow a quantitative comparison of the actions put in place. Should the need arise to ratchet up national biodiversity commitments over time so as to achieve any of post-2020 global biodiversity targets, it is the targets associated with these action headline indicators that would be the most important to revise, as these are most policy-relevant.

8.2. Mobilise non-state actors through the *Sharm El-Sheikh to Kunming Action Agenda for Nature and People* in the lead-up to COP15 in 2020

The *Sharm El-Sheikh to Kunming Action Agenda for Nature and People* was launched by the Governments of Egypt and China, in co-operation with the CBD Secretariat, to mobilise action in the lead-up to COP15 in 2020. It aims to enhance implementation of the Strategic Plan for Biodiversity 2011-20 and the Aichi Targets, advance on the SDGs and support the post-2020 global biodiversity framework, by collecting, coordinating, and celebrating actions in support of biodiversity conservation and its sustainable (CBD, 2019[219]). All stakeholders across all sectors are encouraged to send and display commitments and contributions to biodiversity on an online platform launched in April 2019, to map biodiversity efforts, estimate impact and help identify key gaps.

8.3. Promote policy coherence to harness synergies and reduce trade-offs for biodiversity

Action on biodiversity will involve trade-offs and synergies with other policy areas. Developing a long-term vision (e.g. to 2050) at the *national* level can be a useful first step to identify priority areas for action. The long-term national visions can draw on and align with the global biodiversity vision, adapted to the national-level context.

The long-term national vision can be used to inform the establishment of clear, national biodiversity targets, for example to 2030, and embedded in the post-2020 National Biodiversity Strategies and Action Plans. Similarly to the post-2020 global biodiversity framework, national targets should be as specific, measurable, ambitious, realistic and time-bound (SMART) (and thus quantitative) as possible, accompanied by indicators for measuring progress (OECD, 2018[182]). By using nationally appropriate SMART targets for biodiversity, governments can clearly identify where trade-offs and synergies with other policy areas (e.g. agriculture, mining or trade) exist, and develop appropriate strategies to address or harness them.

To help ensure that policies are coherent across various sectors and areas of the economy, biodiversity targets should be reflected and mainstreamed into other relevant national strategies, e.g. on economic growth and development, agriculture, fisheries, urban development, climate change and trade. These strategies should also incorporate clear biodiversity-relevant strategic objectives, targets and indicators, so as to monitor progress.

Co-ordinating national-level response to multilateral environmental agreements (e.g. the Sustainable Development Goals [SDGs], the CBD, the United Nations Convention to Combat Desertification, the United Nations Framework Convention on Climate Change and the Sendai Framework on Disaster Risk Reduction) is important for harnessing the potential of biodiversity to deliver on multiple goals. For example, nature-based solutions can be used to improve outcomes for biodiversity and simultaneously deliver on several other international environmental goals, such as clean water and air, resilience to climate change and job creation through ecosystem restoration.

More stringent environmental provisions in regional trade agreements (RTAs) and product-specific agreements can help reduce the impacts of trade on biodiversity (see Chapter 2). Although most RTAs contain environmental protections of some kind, these are often too weak to mitigate fully the impacts of trade or address the pressures causing biodiversity decline. Provisions that directly address biodiversity issues – such as in the EU-Canada Comprehensive Economic and Trade Agreement – or to address deforestation and product-

specific agreements – such as under the EU Forest Law Enforcement Governance Action Plan – can be used more frequently to mitigate the impacts of international trade on biodiversity.

8.4. Scale up policy instruments for biodiversity and get the economic incentives right

Governments will need to consider which mix of policy instruments is most likely to achieve their national post-2020 targets in the most environmentally and cost-effective manner. Table 8.1 summarises examples of possible policy instruments covering regulatory (command-and-control) approaches, economic instruments, and information and voluntary approaches. Other possible measures relate to research and development, and trade.

Table 8.1. Policy instruments for biodiversity conservation and sustainable use

Regulatory (command-and-control) approaches	Economic instruments	Information and other voluntary instruments
Restrictions or prohibitions on use (e.g. trade in endangered species and the Convention on International Trade in Endangered Species of Wild Fauna and Flora)*	Price-based instruments: Taxes (e.g. on groundwater extraction, pesticide and fertiliser use) Charges/fees (e.g. for natural-resource use, access to national parks, and hunting or fishing licence fees) Subsidies to promote biodiversity	Eco-labelling and certification (e.g. organic agriculture labelling schemes and labels for sustainably harvested fish or timber)
Access restrictions or prohibitions (e.g. protected areas and legislated buffer zones along waterways)	Reform of environmentally harmful subsidies	Green public procurement (e.g. of sustainably harvested timber)
Permits and quotas (e.g. for logging and fishing)	Payment for ecosystem services	Voluntary approaches (i.e. negotiated agreements between businesses and government for nature protection), e.g. voluntary offset schemes
Quality, quantity and design standards (e.g. commercial fishing net mesh-size specifications).	Biodiversity offsets/ bio-banking	Corporate environmental accounting
Spatial planning (e.g. ecological corridors)	Tradable permits (e.g. individual transferable quotas for fisheries)	
Planning tools and requirements (e.g. environmental impact assessments and strategic environmental assessments	Non-compliance fines	

Source: Adapted from (OECD, 2013[220]).

The full suite of available policy instruments are not implemented at the scale needed to halt and reverse biodiversity loss.[57] Protected areas (PAs), for example, have long been the cornerstone of biodiversity conservation policy. While countries have made considerable progress in increasing the coverage of their terrestrial and marine PAs (in line with Aichi Target 11), management effectiveness in many PAs needs to be improved. More consistent use of spatial planning to improve the ecological representativeness and connectivity of

[57] This includes action to counter illegal poaching and trade in biodiversity, as well as action to address the risks from invasive alien species.

PAs, also in light of ongoing climate change, and better monitoring of the effectiveness of the PA system in achieving the intended ecological impacts of PAs are essential.

Economic instruments, such as taxes, fees and charges, tradable permits and payments for ecosystem services, provide incentives for more sustainable production and consumption patterns, and can also generate revenue. These instruments must also be scaled up. Yet the revenue generated from biodiversity-relevant taxes only amounts to 1% of the total revenue generated from environmentally relevant taxes, suggesting substantial scope to scale up the use and ambition of biodiversity-relevant economic instruments. Such measures should also be accompanied by other policy reforms, such as lowering taxes on public goods. Improved tracking and reporting on the use of biodiversity-relevant economic instruments is also important for monitoring and evaluating country progress (e.g. towards Aichi Target 3), facilitating analysis of the effectiveness of biodiversity policy responses and supporting lesson-sharing among countries (Box 8.2).

Reviewing, evaluating and enhancing the effectiveness of existing policy instruments can help governments tailor policy responses and enhance their cost-effectiveness. A recent inventory of impact-evaluation studies relevant to terrestrial and marine biodiversity suggests there still exist very few rigorous evaluation studies applied to the field of biodiversity (in contrast to, for example, economic development and health). While such studies are costly to conduct, they allow deriving a better understanding of what works, what does not, and why, and are therefore crucial to designing and implementing effective policies for biodiversity. Undertaken strategically and selectively, such studies could enhance the cost-effectiveness of public and private interventions (Karousakis, 2018[221]).

Box 8.2. Improve reporting and tracking of biodiversity-relevant economic instruments (i.e. positive incentives) and the revenue they generate

Countries could step up their efforts to provide regular, up-to-date and accurate data on the policy instruments in place, their ambition, and – to the extent possible – their effectiveness. The OECD database on Policy Instruments for the Environment (PINE) is a tool to track progress on the implementation of biodiversity-relevant economic instruments (i.e. the positive incentives in Aichi Target 3). While more than 100 countries currently report to the PINE database – e.g. on finance generated or mobilised, and whether or not the finance generated (e.g. from biodiversity-relevant taxes) is earmarked, – it is not yet comprehensive (see Chapter 7). G7 countries could showcase their leadership in this area by committing to strengthening their reporting to the PINE database.

8.5. Scale up and align finance for biodiversity from all sources

Scaling up finance from all sources – both public and private – is critical. The finance needs to ensure biodiversity conservation and sustainable use have been estimated at USD 150-440 billion per year, yet the estimates available on finance flows to biodiversity suggest these are between three and 10 times smaller. Domestic public expenditure on biodiversity and biodiversity-related ODA is an important part of this, but it is not sufficient on its own.

Governments, in close co-operation with financial authorities, banks and investors, also need to help align private investment decisions with biodiversity objectives and the mobilisation of private financial flows towards biodiversity-friendly investment. To mobilise private financial flows, policy makers can: strengthen economic incentives to get the prices right; strengthen domestic enabling conditions to improve the attractiveness of

biodiversity-friendly investment, including by setting biodiversity-friendly policies and aligning broader investment conditions; encourage pipelines of biodiversity-friendly investment opportunities; and support de-risking instruments and transaction enablers and institutions, to provide channels for institutional investment and other sources of private finance towards biodiversity-friendly investment.

8.6. Establish consistent and comparable finance reporting and tracking frameworks, across countries and companies

Improving the consistency and comparability of finance reporting frameworks for both the public and private sector is important to track progress in scaling up biodiversity finance. While data availability on finance relevant to biodiversity is improving, a number of data gaps remain, and the available data are not always collected in a comparable and consistent way. For example, while data on bilateral biodiversity-relevant official development assistance are reported in a consistent way, data on finance flows from domestic public expenditures on biodiversity are generally not. The G7 could endorse France's call for the OECD to conduct follow-up work to produce a comprehensive update on global finance for biodiversity, and to develop recommendations on how to resolve data gaps and inconsistencies, including through improved reporting and tracking frameworks.

8.7. Reform subsidies harmful to biodiversity

In addition to scaling up biodiversity finance, it is equally important to accelerate the reform of subsidies harmful to biodiversity. Progress towards Aichi Target 3 on reforming subsidies harmful to biodiversity by 2020 has been very slow, and efforts on this front must be scaled up. As the basis for reform, it would be useful to expand internationally comparable information on subsidies to more countries and types of support, e.g. through peer review. Countries could also share experience and lessons learned from identifying, assessing and reforming subsidies harmful to biodiversity and, more generally, subsidy reforms.

Better understanding the domestic public expenditures that may harm the environment, in addition of those that contribute to environmental protection, is an objective of the Paris Collaborative on Green Budgeting.[58] The OECD launched the Collaborative at the One Planet Summit in 2017, with the support of France and Mexico. It aims to design new, innovative tools to assess and drive improvements in the alignment of government budgets and fiscal policy with environmental objectives, including on climate and biodiversity.

8.8. Facilitate mainstreaming of biodiversity by business and financial organisations

Policy makers need to commit to strengthening business incentives for action on biodiversity. International and co-ordinated efforts to this aim will also help ensure a level playing field. Multiple opportunities exist for policy makers to encourage business and financial organisations to scale up action on biodiversity, in co-operation with other stakeholders:

Political leadership (e.g. under the G7) could spur a consensus among stakeholders on a common approach for measuring and mainstreaming biodiversity factors across business and investment decisions. The G7 could notably create a multi-stakeholder advisory group

[58] For more information on the Paris Collaborative see: www.oecd.org/environment/green-budgeting/

on biodiversity, business and finance, to advise on the adoption of a common approach for measuring and mainstreaming biodiversity in business and investment decisions in support of post-2020 biodiversity goals. Such an approach could address biodiversity-related factors (i.e. impacts and dependencies, and associated risks and opportunities) and develop methodologies, metrics and guidelines relevant to business and investment activities. In particular, a common approach could be based on:

- A methodology for assessing biodiversity factors across operations, supply chains and portfolios: this would build on common ground across existing accounting approaches, to aggregate the measurement of biodiversity impacts at the corporate level and harmonise it at the portfolio level. A common protocol with harmonised metrics for measuring biodiversity factors is missing and more challenging to establish than metrics for greenhouse gas emissions. The advisory group could establish a few agreed metrics to start (e.g. ecosystem degradation, land-cover change, species loss, pollution or carbon footprint), before scaling up ambition and improving the measurement over time through learning-by-doing.
- A framework to mainstream biodiversity factors in business and investment decisions: this would apply not only to metrics and targets, but also to strategy, governance, risk management, due diligence and disclosure. Such a framework would need to consider business activities across supply chains and organisational levels. Most biodiversity impacts are generated in the supply chains (e.g. for the agriculture, food, beverage, garment and footwear sectors). Key organisational levels include product and service, project, site or facility, corporate, portfolio, supply-chain segments, and sectors.
- In particular, the advisory group could build on the *OECD Due Diligence Guidance for Responsible Business Conduct* to develop a set of practical actions on due diligence and biodiversity in support of efforts by businesses (OECD, 2018[91]). All G7 members have adhered to the guidance. They have committed to asking businesses to follow it in order to identify, prevent and address adverse impacts on biodiversity, and to regularly report on these efforts and their outcomes. The G7 could call on the OECD to develop this work as part of the proposed multi-stakeholder advisory group on biodiversity, business and finance, or independently.

Policy makers can also harness the momentum and visibility of the SDGs and climate action among business and financial organisations to raise awareness on biodiversity and ecosystem services. A multidimensional approach across policy areas (e.g. biodiversity, climate change and water) can be particularly important in sectors such as food and land-use, including forests (WBCSD, 2018[135]). The EU Action Plan on Sustainable Finance for instance looks at priorities to promote sustainable finance across a number of environmental and social areas. Linking biodiversity and climate change pressures in measurement approaches and reporting is particularly critical to avoid trade-offs between business investment decisions with climate-mitigation benefits and negative impacts on biodiversity (e.g. land-use impacts of biomass for fuels or plastic use).

8.9. Assess and communicate socio-economic dependencies and impacts on biodiversity at the national level

At the national level, all sectors and stakeholders – including the government, private sector and civil society – need to scale up action on biodiversity, and take steps to ensure more sustainable production and consumption patterns. The government in particular has a key role to play in developing the information and evidence base needed to inform policy, and in providing the regulatory and policy frameworks to maximise social welfare. A comprehensive, co-ordinated and strategic approach is needed to this end – one that is environmentally effective, cost-efficient and distributionally equitable, including across generations.

Governments can strengthen their policy responses by developing a clear understanding of socio-economic dependencies, pressures and impacts on biodiversity, and how these may evolve. Mapping, assessing and valuing ecosystems and their services, for example through national ecosystem assessments (NEAs), can increase the economic visibility of biodiversity and ecosystem services. Not only do analyses of existing NEAs highlight their potential utility in shaping policy, they also stress the importance of designing NEAs to respond to specific policy questions and communicate targeted messages to key stakeholders (e.g. agriculture, fisheries and other sectoral ministries). Sharing experiences on NEAs (e.g. objectives, scope, design and policy application) could help refine future NEAs and their ability to influence policy making.

Further efforts are also required to scale up and refine the use of natural capital accounting. Although an increasing number of countries are experimenting with natural capital accounting, few have comprehensive accounts. Furthermore, challenges remain in integrating non-market ecosystem service values and linking natural capital accounts to decision-making. G7 countries could continue to play a leading role in developing and refining tools and methodologies for integrating the values of ecosystem services and the costs of ecosystem degradation into national accounts. The ongoing revision of the System of Integrated Environmental and Economic Accounting provides an important opportunity to drive these efforts.

8.10. Ensure inclusive and equitable transformative change

Any actions to foster biodiversity conservation, sustainable use and restoration, should imperatively consider the distributional implications on more vulnerable groups of society and future generations. A package of policy measures is needed, including targeted measures to address potential regressive impacts on income distribution. The evidence suggests that the distribution of costs and benefits (real or perceived) can be fundamental in defining the ambition and pace of reforms, policy choice and design. Recycling the revenue from biodiversity-relevant taxes, for example, or putting in place transitional measures, can help minimise the cost to lower-income groups (OECD, 2017[83]).

Developing a robust evidence base – including on the costs and benefits of action and who stands to win or lose – is therefore essential to build support for reform and help anticipate and address any unintended impacts and consequences of policies. This is especially true for conservation and restoration actions in the developing world, where many vulnerable groups – particularly indigenous people – rely daily on biodiversity for food and fuel.

Targeted information and awareness-raising campaigns can also help stakeholders better understand how their everyday actions can have a positive impact. Digital technology –

including citizen-science platforms, online dashboards and communication channels – can help disseminate information rapidly, and maintain the connections between society and biodiversity (OECD, 2019[222]). Further digital technology, combined with processes such as deliberative polling can help better engage individuals, civil society and other stakeholders in the policy-making process, and facilitate efforts to reconcile trade-offs between environmental and economic concerns. Transformative change is needed to prevent further declines, and ensure the benefits of biodiversity and ecosystem services are equitably shared throughout society today and for many generations to come.

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Biodiversity: Finance and the Economic and Business Case for Action

The Convention on Biological Diversity's 15th Conference of the Parties (CBD COP15) in 2020 marks a critical juncture for one of the defining global challenges of our time: the loss of biodiversity and ecosystem services, which underpin nearly all of the Sustainable Development Goals (SDGs). Transformative changes are needed to ensure biodiversity conservation and sustainable use, and the delivery of the ecosystem services upon which all life depends. This report sets the economic and business case for urgent and ambitious action on biodiversity. It presents a preliminary assessment of current biodiversity-related finance flows, and discusses the key data and indicator gaps that need to be addressed to underpin effective monitoring of both the pressures on biodiversity and the actions (i.e. responses) being implemented. The report concludes with ten priority areas where G7 and other countries can prioritise their efforts.

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BETTER POLICIES FOR BETTER LIVES

OECD Environment Directorate,
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