Biodiversity, Natural Capital and the Economy: A Policy Guide for Finance, Economic and Environment Ministers

Report prepared by the OECD for the G7 Presidency of the United Kingdom, 2021

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EXECUTIVE SUMMARY

Biodiversity underpins all economic activities and human well-being. It provides critical life-supporting ecosystem services, including the provision of food and clean water, but also largely invisible services such as flood protection, nutrient cycling, water filtration and pollination. Yet humanity is destroying natural capital at an unprecedented rate, posing significant but often overlooked risks to the economy, the financial sector and the well-being of current and future generations. The emergence of infectious diseases such as COVID-19, of which land-use change and wildlife exploitation are key drivers, is just one example of the various risks associated with humanity's mismanagement of natural capital.

As Professor Sir Partha Dasgupta's Review notes, we have failed to manage our global portfolio of assets sustainably, accumulating produced (physical) and human capital largely at the expense of our most important asset – natural capital. Our dominant development paradigm, narrowly focussed on GDP growth, is not sustainable. While global GDP per capita increased by more than 60% between 1992 and 2014, natural capital stocks per capita declined by nearly 40%, undermining future economic growth and well-being. One million plant and animal species now face extinction. This is in part due to the characteristics of nature that make it easy to ignore: largely silent, invisible and mobile. These characteristics result in nature being undervalued or unvalued in markets, and mean that our impacts on nature largely go unaccounted for. The current imbalance between our demands on nature and its capacity to regenerate urgently needs to be addressed.

The UK's 2021 G7 Presidency comes at a crucial juncture. Strong leadership from the G7, through ambitious domestic action and international co-operation, is critical to address the multiple, interlinked crises we face: biodiversity loss, climate change, novel infectious diseases and their severe consequences for human well-being and the economy. G7 countries have an opportunity to drive change, with trillions of dollars mobilised through COVID-19 recovery packages, and UN CBD COP15 (where the post-2020 Global Biodiversity Framework will be adopted) and UNFCCC COP26 on the horizon. This Policy Guide, prepared by the OECD at the request of the UK G7 Presidency, is intended for Leaders as well as Finance, Economic and Environment Ministries. Based on the urgent case for action on biodiversity put forward in the Dasgupta Review (2021) and the OECD's 2019 report to the G7 Environment Ministers, among others, it provides the latest findings and policy guidance in four key areas: measuring and mainstreaming biodiversity; aligning budgetary and fiscal policy with biodiversity; embedding biodiversity in the financial sector; and improving biodiversity outcomes linked to international trade.

Measuring and mainstreaming biodiversity

Key messages

- GDP is an important measure of short run macro-economic performance and is correlated with some key determinants of well-being such as jobs and incomes. However, it was not designed to provide insights on all the different economic, social and environmental outcomes that matter for human well-being and sustainability. National measurement frameworks are needed that better integrate information on economic production, human well-being and environmental sustainability, such as the OECD Well-being Framework and inclusive wealth accounts.
- Natural capital accounting is essential for integrating biodiversity considerations into measures of national performance and policy appraisal, and integral to inclusive wealth accounts. At least 89 countries have implemented accounts consistent with the UN SEEA, the international standard for natural capital accounting. However, the majority of accounts are incomplete and only 34 countries

have developed ecosystem accounts. Furthermore, natural capital is not given equal weight to economic data, highlighting the need to increase both the supply of and demand for natural capital accounts.

- Efforts by governments have not yet been sufficient to halt and reverse biodiversity loss. Despite some incremental progress, biodiversity has not been mainstreamed in national economic planning, budgets and other policies and practices that affect biodiversity. When biodiversity is included in national strategies and plans, it is often limited to a generic mention or strategic direction, rather than clear targets and actions which are needed to bring about real change. Finance, economic and sectoral ministries must play a greater role.
- Synergies and trade-offs exist among biodiversity goals and other Sustainable Development Goals, for example, between the use of bioenergy for climate mitigation and its implications for land use change, food security and biodiversity. However, it is not common practice to systematically assess the alignment of different policy objectives. Furthermore, the lack of consistent and comparable data and indicators across countries to monitor biodiversity mainstreaming actions undermines transparency, accountability and the exchange of lessons learned.

Policy recommendations

- Implement a multi-dimensional measurement framework to assess national performance, including measures on the environmental dimensions of human well-being and the stocks of natural capital that underpin current and future well-being.
- Support the development and use of comprehensive natural capital accounts globally, for example under the SEEA, including through international co-operation and increased investment in data on biodiversity, ecosystem services and natural capital more broadly.
- Mainstream biodiversity into all relevant strategies and plans (e.g. national economic plans, national budgets, low-emission development strategies, national risk assessments, and development co-operation strategies), systematically integrate biodiversity and natural capital into programmes, policies and projects, and promote policy coherence by strengthening inter-ministerial co-ordination and setting clear time-bound targets, roles and responsibilities. Develop indicators that are consistent and comparable across countries to monitor progress on mainstreaming.
- Draw on the full suite of regulatory (e.g. pollution standards), economic (e.g. taxes, biodiversity offsets) and information (e.g. ecolabelling) instruments to internalise the external costs (and benefits) from firms and households. Setting and enforcing absolute limits on natural resource use or extraction (e.g. protected areas, tradable permits, quotas) is particularly important where ecosystems could face tipping points or are of considerable ecological or cultural significance.

Aligning budget and fiscal policy with biodiversity

Key messages

- Evaluating and improving the alignment of budget and fiscal policy with biodiversity objectives is a critical step for addressing biodiversity loss. While an increasing number of countries are implementing elements of green budgeting, few countries have assessed the potential positive and negative impacts of their domestic and international spending on biodiversity. Few, if any, public development banks have done this either.
- Taxes, fees, payments for ecosystem services and other economic instruments are vital for incentivising more sustainable consumption and production, and can also raise revenue or mobilise finance. These instruments are often underutilised. Biodiversity-relevant taxes amount to only 0.9% of the revenue generated from all environmentally-relevant taxes in OECD countries, which in turn accounts for just 5.1% of total tax revenue.
- Governments continue to incentivise the destruction of nature through environmentally harmful support, including budgetary and fiscal transfers, encouraging unsustainable production across

multiple sectors. To date, relatively few countries have undertaken national level assessments to systematically identify their public subsidies harmful to biodiversity or the environment more generally.

- Integrating biodiversity considerations into COVID-19 economic recovery measures can provide immediate jobs and boost longer-term economic resilience, human health and societal well-being. Ignoring biodiversity in economic recovery packages could increase the risk of future pandemics and economic shocks. However, recent OECD analysis finds that green measures are a small proportion (17%) of overall stimulus, and estimates that only 7% of green stimulus supports biodiversity.

Policy recommendations

- Align budgets and fiscal policy of governments and public development banks with biodiversity objectives by quantifying biodiversity-related expenditures, assessing spending that is harmful to biodiversity, and using other green budgeting tools such as cost-benefit analysis to nature-proof the economy.
- Scale up the use and ambition of economic instruments (such as biodiversity-relevant taxes, fees and charges, tradable permits, biodiversity offsets, payments for ecosystem services) to reflect the true costs of natural capital loss on the economy and human well-being.
- Identify and reform or remove environmentally harmful budgetary and fiscal support to agriculture, fisheries and fossil fuels, prioritising the most environmentally harmful and market distorting types of support.
- Urgently integrate biodiversity measures such as incentives for ecosystem restoration and sustainable land-use into COVID-19 economy recovery packages – and screen recovery measures for potential negative impacts – to create jobs while reducing the health, financial and macro-economic risks of biodiversity loss.

Embedding biodiversity in the financial sector

Key messages

- Nature-related risks for companies, and their financiers and investors, are pervasive but poorly understood and largely invisible and mispriced. These include the dependency of company profitability on nature as well as the adverse impacts of business activities and financial decisions on nature. Nature-related dependencies, impacts and risks remain almost entirely uncompensated by the financial sector and investee corporations. This leads to capital misallocation, exposure of the financial sector to biodiversity-related risks, and adverse nature-related impacts that undermine societal well-being. Less than 1% of business models of the 3,500 companies representing 85% of global market capitalisation align with SDGs 14 and 15.
- Aligning finance flows with biodiversity goals requires policy makers, regulators, standard setters, investors and finance providers to pay greater attention to the biodiversity impact of finance. Embedding biodiversity in financial decision-making is necessary to reduce finance flows to harmful activities while increasing investment in nature-positive activities This requires consideration of both the (i) financial materiality of nature-related financial risks resulting from dependencies on nature, and (ii) adverse environmental impacts resulting from financial decisions. Both financial dependencies and risks *and* biodiversity impacts will change over time. Yet most financial companies do not assess, manage or disclose their material financial risks related to biodiversity. Furthermore, few assess and address the biodiversity-related impacts of their investment decisions on people and the planet. The initiative to create a Task Force on Nature-related Financial Disclosures (TNFD) is an encouraging step in mainstreaming biodiversity impacts, dependencies and risks in the financial sector.
- Biodiversity-related risks are complex, context-dependent and are difficult to model due to e.g. uncertainties related to tipping points and regime shifts, future policy trends and complex transmission channels. To reflect these characteristics, continued efforts are needed to address associated measurement, data and modelling issues.

- Embedding biodiversity in the financial sector can also provide significant investment opportunities. This includes investment opportunities in activities to support a transition to more sustainable practices (the global ecotourism market for instance could reach USD 334 billion by 2027, up from USD 181 billion in 2019); it also requires unlocking investment in activities dedicated to biodiversity protection. Scaling up private investment in nature-positive activities faces outstanding barriers. Further efforts are needed to address systemic failures to view biodiversity as material to decision-making, lack of enabling conditions and pipelines of bankable projects, and data and measurement issues.

Policy recommendations

- Mainstream biodiversity risks, dependencies and impacts in the financial sector. Concrete steps include: (i) support the development of guidance for companies on better valuing natural capital in economic decision-making; (ii) embed biodiversity considerations into due diligence risk management processes to assess biodiversity impacts in line with the recommendations of the *OECD Guidelines for Multinational Enterprises;* and (iii) welcome and engage with the TNFD and its aims, including to enhance assessment, management and disclosures of biodiversity considerations and strengthen measurement, data standards and modelling.
- Better understand, assess and manage nature-related financial risks, and assess implications for financial stability, especially for central banks and financial supervisors. Given the complexity of nature-related risks, central banks could share emerging innovative practices and may wish to consider adopting a "precautionary" approach.
- Scale up private investment in nature-positive activities. Concrete actions include: (i) strengthen enabling conditions, apply investment policy principles while respecting local ownership rights, align incentives in domestic policy frameworks to improve the risk-return profile of projects supporting biodiversity goals; (ii) create pipelines of bankable biodiversity projects, gathering data on the returns and impacts of biodiversity projects; and (iii) collaborate with multilateral development banks, other development finance institutions and investors to establish suitable financial instruments, vehicles and funds. Blended finance is needed both for small-scale conservation or restoration projects that may not be readily profitable, as well as larger or more bankable projects that need to be scaled up.
- Embed biodiversity more broadly and foster systems innovation. This includes: embedding biodiversity goals in core public finance institutions and policy, including in climate finance facilities and national planning; and building digital infrastructure and harnessing digital finance and financial education to raise funding from and mobilise citizens.

Improving biodiversity outcomes from international trade

Key messages

- International trade can lead to both positive and negative impacts for biodiversity. Positive impacts can come from increased efficiency of production, which reduces demand for land and other natural resources, and from increased availability of environmentally friendly goods, services and technologies. Negative impacts can arise from production shifts exacerbating pressures such as land use change and pollution, the introduction of alien species and trade in environmentally sensitive goods (e.g. timber and wildlife).
- The impacts of international trade on biodiversity are context dependent and difficult to track in global supply chains. Businesses and governments require better information and data on where and how a traded product is produced, how it is transported and patterns of consumption, in order to understand their impacts on biodiversity and to help guide buyers and end-consumers towards sustainable consumption patterns.
- The biodiversity impacts of trade predominately stem from the location and process of production with negative impacts exacerbated by environmentally harmful support. Government support currently incentivises unsustainable production across multiple sectors. Across 54 economies, USD 345 billion

per year in agricultural support (2017-19 average) was provided in ways that undermine the sector's sustainability. In 2019, 81 economies provided USD 478 billion in support to fossil fuels, also incentivising unsustainable production and consumption.

- Illicit wildlife trade is valued at USD 7-23 billion globally and services consumer demand. It has adverse impacts on biodiversity, driving protected species population declines and extinction. Unsustainable wildlife trade can also negatively impact rural livelihoods, cause the loss of culturally valuable species and increase the risk of zoonotic diseases. Lack of prioritisation by governments and competent authorities, legal loopholes and gaps in implementation of laws at a national level mean illegal wildlife trade often goes unpunished, while weaknesses in the financial systems mean the proceeds flow across borders. Corruption at maritime ports, airports and at land border crossings provides channels for the entry of a range of illicit products.

Policy recommendations

- Reform or remove environmentally harmful support to agriculture, fisheries and fossil fuels to improve the sustainability of production and reduce the negative impacts of trade on biodiversity, prioritising the most market distorting and environmentally harmful types of support e.g. in agriculture, market price support, payments based on output and payments based on unconstrained variable inputs; and in fisheries, payments that reduce the costs of inputs, especially fuel.
- Tackle illegal wildlife trade by closing legal loopholes, addressing corruption, improving the prosecution of environmental crimes, combatting the associated financial flows (e.g. through stronger beneficial ownership transparency) and fostering co-operation among law enforcement authorities, locally and internationally. Work with key countries and expert bodies to design interventions that address the underlying issues of consumer demand for illegal wildlife trade products.
- Improve the traceability and sustainability of supply chains including by facilitating uptake of technology (e.g. remote sensing, block chain and geospatial data) and implementing Responsible Business Conduct standards and instruments, such as the OECD FAO Guidance on Responsible Agricultural Supply Chains. This will help guide businesses and end consumers towards sustainable consumption patterns.
- Assess (qualitatively and quantitatively) the impacts of Free Trade Agreements on biodiversity ex ante to inform and help shape the design of FTAs as well as identify 'pressure points' where additional consideration or policy interventions may be required, such as reforming or removing harmful support or increasing international assistance.

1 The urgent need to act on biodiversity

Key messages

- Biodiversity loss is among the top global risks to society. All economic activities both depend on and affect nature. An estimated USD 44 trillion of economic value generation – over half of global GDP – is moderately or highly dependent on nature. Human destruction of biodiversity therefore poses significant macroeconomic and financial risks. It also threatens the health and well-being of current and future generations.
- The world has accumulated produced (physical) and human capital at the expense of its most important asset, natural capital. The accounting value of produced capital per head doubled and human capital per head increased by 13% from 1992 to 2014, while the value of natural capital stocks per head declined by 40%, owing to unsustainable rates of natural resource extraction, environmental degradation and pollution.
- Global biodiversity is declining at an unprecedented and accelerating rate, undermining the ecosystem services upon which humanity depends. Populations of vertebrates declined on average by 68% since 1970, while vast areas of terrestrial, marine and other aquatic ecosystems were destroyed or degraded. Twenty-five percent of the world's remaining species are now threatened with extinction.
- Urgent and transformative action is required to halt and reverse biodiversity loss. This entails, for example, adapting measures of economic performance to better reflect natural capital, reforming fiscal and economic policy to mainstream biodiversity in decision-making, transforming the financial system so that it systematically accounts for biodiversity-related impacts and risks, and integrating biodiversity in trade policy. G7 leadership through ambitious domestic action and international co-operation is critical.

The global context

Over the past 70 years, the global population has risen from 2.5 billion to over 7.7 billion. Concurrently, humanity achieved unprecedented technological change and economic growth, raising average living standards and reducing absolute poverty across the globe. However, these achievements largely came at the expense of the world's most important asset – natural capital. Furthermore, the benefits of economic growth based on natural capital have not been equally shared across countries and societies, and poorer people depend more in relative terms on the natural capital that has been diminishing (Dasgupta, 2021[1]). Unsustainable patterns of production and consumption, combined with systemic inefficiencies and waste, have driven widespread declines in biodiversity (species, ecosystems and genetic diversity), and the ecosystem services it provides. Evidence presented in the Dasgupta Review illustrates a growing gap or "impact inequality" between humans' aggregate demands and nature's supply. One estimate, for example, indicates that 1.6 Earths would be required to meet current levels of human demand on a sustainable basis (Global Footprint Network, 2021[2]). And the pressures on nature continue to rise.

The global economy is embedded in and ultimately bounded by nature (Dasgupta, 2021[1]). All economic activities both depend on and affect natural capital. The destruction of nature therefore poses

macroeconomic and financial risks, and could result in severe economic shocks. Moreover, declines in the quantity and quality of nature threaten the health and well-being of both current and future generations. The emergence of infectious diseases such as COVID-19, of which land-use change and wildlife exploitation are key drivers, is just one example of the various risks – and the massive economic and human costs – associated with society's mismanagement of nature.

Strong leadership from the G7, through ambitious domestic action and international co-operation, is critical in addressing the impact inequality. The UK's G7 Presidency in 2021 takes place at a crucial time both in terms of the recovery from the COVID-19 crisis and international efforts to address the interlinked biodiversity and climate challenges. Immediate opportunities for action include: i) comprehensively integrating biodiversity considerations into domestic and international COVID-19 recovery packages; ii) forging an ambitious Post-2020 Global Biodiversity Framework with specific and measurable targets at COP15 of the UN Convention on Biological Diversity, scheduled for October 2021; and iii) advancing the agenda on nature-based solutions for climate change at COP26 of the UN Framework Convention on Climate Change, scheduled for November 2021.

The G7 2019 French Presidency played a key role in establishing the economic and business case for biodiversity action, and outlined commitments in the Metz Charter on Biodiversity[1]. The 2021 UK Presidency of the G7 is an opportunity to reaffirm the G7's leadership and commitment to accelerate and intensify its efforts to halt and reverse biodiversity loss. Biodiversity loss cannot be addressed in isolation from other issues. It is integral to other thematic areas on the 2021 G7 agenda, including sustainable finance, climate change, the global health system and the economic recovery from COVID-19.

This Policy Guide presents G7 countries with key considerations and policy recommendations for halting and reversing global declines in biodiversity, to safeguard the natural capital upon which current and future generations depend. It focuses on key areas where Finance, Economic and Environment Ministers can, together, drive change. The remainder of this section presents the links between biodiversity, natural capital and the economy, and describes current biodiversity trends. Section 2 underscores the importance of adapting measures of economic performance and mainstreaming biodiversity into national decision making. Section 3 highlights the role of budget and fiscal policy for addressing biodiversity loss, including in the context of the COVID-19 economic recovery. Section 4 discusses why and how biodiversity must be embedded into the financial sector and Section 5 discusses key issues pertaining to trade and biodiversity loss.

Biodiversity and natural capital: the foundation of the economy and human well-being

Nature is an asset or capital stock (i.e. natural capital), like produced (physical) and human capital. Natural capital provides goods and services that contribute directly or indirectly to a country's economic output and human well-being. But it is much more than an economic good; nature also holds intrinsic value. Natural capital is the most important of all capital stocks, as it provides fundamental life-support functions. It sets the ecological boundaries for socio-economic systems. Yet humans have accumulated produced and human capital largely at the expense of natural capital. The accounting value of produced capital per head doubled and human capital per head increased by 13% from 1992 to 2014, while the value of natural capital stocks per head declined by 40% (Managi and Kumar, 2018[3]). The global decline of nature can therefore be thought of as a global asset management problem (Dasgupta, 2021[1]).

Biodiversity refers to the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems (i.e. life on land and life below water). It encompasses the diversity within species, between species and of ecosystems. Forests, wetlands, coral reefs and other ecosystems provide multiple ecosystem services. These include the provisioning of goods such as food, fuel and clean water; cultural services such as recreation and spiritual values; and also critical, yet often invisible, regulatory and supporting services such as nutrient cycling, pollination, climate regulation and protection from natural

hazards. The genetic diversity represented in the planet's living organisms also represents a global public good, providing valuable future options for life in changing conditions.

While all economic activities depend on biodiversity and the ecosystem services it provides, some sectors are particularly dependent. For example, the WEF (2020[4]) estimates that USD 44 trillion of economic value generation – over half of global GDP – is moderately or highly dependent on nature. Food and beverages, agriculture and fisheries, and construction industries exhibit the highest dependence and therefore are most exposed to biodiversity loss. Despite their invaluable contribution to society, the majority of ecosystem services are not priced in the market because they are public goods, leading to externalities. As a result, producers and consumers have insufficient economic incentives to conserve, sustainably use and restore biodiversity. Those ecosystem services that are priced (e.g. provisioning and some cultural services), are often distorted by subsidies or uncompetitive markets.

Biodiversity contributes to the resilience of nature, helping it to maintain its flow of ecosystem services when disturbed by climate variability and change, disease and other stresses. As with produced capital, natural capital can depreciate, if misused or overused. While ecosystems can self-regenerate if given the chance, this depends on the extent to which they are degraded and can take a long time. Ecosystems that are pushed too far can collapse abruptly and irreversibly, posing a severe risk to the economy and human well-being (Box 1.1).

Box 1.1. Ecosystem non-linearity and tipping points

Ecosystems can only absorb pressure such as natural resource extraction, climatic events or pollution up to a certain threshold. Beyond this threshold, further disturbance of natural processes can lead to a large, often abrupt, change in an ecosystem's structure and function. Examples include fisheries collapse, the shift from forest to savannah and coastal dead zones. Such abrupt regime shifts tend to be irreversible (or partially reversible at a significant cost), and can have substantial negative environmental, economic and social consequences. Owing to the interconnectivity of nature, regime shifts in one ecosystem can have knock-on effects on other ecosystems and natural processes, at a regional and global scale. For example, if the Amazon were to cross a critical threshold, which some scientists believe could happen, it would dramatically affect local livelihoods and biodiversity, while also altering the global carbon cycle and regional precipitation patterns.

Marine, freshwater and terrestrial ecosystems are being pushed closer to thresholds and tipping points as a result of 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. One way this is achieved is through functional redundancy, where different species perform similar ecosystem functions, but are affected by disturbance in different ways.

Sources: Folke et al. (2004[5]), Regime Shifts, Resilience, and Biodiversity in Ecosystem Management, *Annual Review of Ecology, Evolution, and Systematics*, Vol 35. No 1; Leadley et al. (2014[6]), Interacting Regional-Scale Regime Shifts for Biodiversity and Ecosystem Services, *Bioscience,* Vol 64 No 8; Iverson and Perrings (2012[7]) Precaution and proportionality in the management of global environmental change, *Global Environmental Change,* Vol 21, No 1; Lovejoy and Nobre (2018[8]), Amazon Tipping Point, *Science Advances,* Vol 4 No 2.

The global decline in biodiversity and ecosystem services

Biodiversity is declining across all three of its dimensions: species, genes and ecosystems. The current rate of species extinction is estimated to be tens to hundreds of times higher than the natural background

(pre-human) rate, and it is accelerating. Twenty-five percent of remaining plant and animal species are threatened with extinction, many in the coming decades (IPBES, 2019[9]). Populations of vertebrates (mammals, birds, reptiles, amphibians and fish) have shrunk on average by 68% since 1970 (WWF, 2020[10]), while significant losses in insect populations have also been recorded (Sánchez-Bayo and Wyckhuys, 2019[11]). It is not only threatened species that are experiencing population declines, but also species considered to be common (EBCC et al., 2020[12]; Stanton, Morrissey and Clark, 2018[13]). Declines in species richness and abundance negatively affect ecosystem function, productivity and resilience (Cardinale et al., 2018[14]; Valiente-Banuet et al., 2014[15]; Oliver et al., 2015[16]).

Diversity within species (i.e. genetic diversity) is also declining, undermining nature's ability to adapt to climate change, disease and other disturbances and compromising evolutionary processes. The speed and scale of these declines is less well-known. However, available data suggests genetic diversity within populations of wild species declined by at least 1% per decade since the mid-19th century (Leigh et al., 2019[17]). The number of local varieties and breeds of domesticated plants and animals has also declined, with significant negative consequences for the resilience of agriculture. For example, 9% of domesticated breeds of mammals used for food and agriculture went extinct by 2016 (IPBES, 2019[9]).

Many of the world's terrestrial, freshwater and marine ecosystems have been destroyed or degraded. Humans have significantly altered 75% of land cover and 66% of the ocean is subject to increasing cumulative impacts (IPBES, 2019[9]). Since 1990, primary forests[2], which are some of the most biodiverse habitats on the planet, declined by over 80 million hectares (FAO and UNEP, 2020[18]). While the rate of global forest loss has slowed since 1990, an estimated 10 million hectares of forest were cut down per year from 2015-2020 (FAO and UNEP, 2020[18]). Freshwater ecosystems are experiencing some of the highest rates of decline, with 0.8% of wetlands being lost per year from 1970 to 2008 (IPBES, 2019[9]). The extent of seagrass meadows decreased by over 10% per decade from 1970 to 2000 (Waycott et al., 2009[19]), while live coral cover has declined by an average of 4% per decade since 1990 (IPBES, 2019[9]).

Declines in biodiversity are compromising the flow of ecosystem services to society. For example, the IPBES (2019[9]) Global Assessment asserts that 14 out of 18 assessed categories of ecosystem services have declined since 1970. While ecosystems' provision of food from fish harvests and agriculture, bioenergy and other materials increased over the past decades (with the assistance of fertilisers, pesticides and other technology), this has largely been at the expense of regulatory, supporting (maintenance) and cultural services and the multiple benefits they provide.

The costs of inaction on biodiversity loss are high and are anticipated to increase. For example, between 1997 and 2011, the world lost an estimated USD 4-20 trillion per year in ecosystem services owing to land-cover change (Costanza et al., 2014[20]). More specifically, biodiversity loss can result in reduced crop yields and fish catches, increased economic losses from flooding, erosion and climate-related 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). The destruction of marshes, mangroves and seagrasses, for instance, releases an estimated 0.15-1.02 gigatonnes of carbon dioxide (CO_2) per year, resulting in annual economic damages of USD 6-42 billion (Pendleton et al., 2012[21]). 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[22]). The overall welfare costs would be orders of magnitude higher and likely catastrophic, as 85% of the world's flowering plants are pollinated by animals (Ollerton, Winfree and Tarrant, 2011[23]) and their decline would disrupt the structure and function of many of the world's terrestrial ecosystems.

Human pressures on biodiversity

Human pressures on nature stem from all sectors of the economy. The largest pressure on biodiversity is land- and sea-use change, which has particularly affected old growth forests (particularly in the tropics), wetlands and grasslands. Agriculture expansion is the main cause of land-use change, with over a third of

land now dedicated to livestock and crop farming. The expansion of urban areas (which have doubled in size since 1990) and transport, energy, water and other infrastructure has also taken a toll. Overharvesting, and unsustainable logging, hunting and fishing is the second largest pressure on terrestrial and freshwater biodiversity, and the largest driver of marine biodiversity loss (IPBES, 2019[24]). More than a third of fish stocks are currently being exploited at biologically unsustainable levels (FAO, 2020[25]), while seabed trawling is destroying irreplaceable deep water habitats.

Climate change is putting increasing pressure on biodiversity, while pollution from run-off and pesticides from agriculture, untreated waste, industry and mining pollutants, oil spills and plastics continue to pose a significant – and in some areas growing – threat to terrestrial, freshwater and marine biodiversity (IPBES, 2019[9]). The ocean is affected not only by ocean-based sources of pollution, such as ghost nets, but also by land-based sources. For example, reactive nitrogen and phosphorous from excess fertiliser and sewage disposal creates anoxic conditions or "dead zones" in marine ecosystems, which have increased considerably since 1960, affecting more than 400 ecosystems and 245 000 square kilometres of ocean by 2008 (Diaz and Rosenberg, 2008[26]). In addition, an estimated 1.15-2.41 million tonnes of plastic waste is transported from rivers to the ocean each year (Lebreton et al., 2017[27]). The introduction of invasive alien species, linked to travel and trade, is threatening native species, ecosystem function and ecosystem services. In the last 50 years, the number of alien species doubled (IPBES, 2018[28]).

The pressures on biodiversity interact, often synergistically, and can have a cumulative impact on biodiversity. For example, the construction of roads through tropical forests can lead to habitat fragmentation (land-use change), while also facilitating access for illegal logging and hunting (overexploitation). Ecosystems that have been degraded due to land-use change, overexploitation or climate change, are often more susceptible to invasive alien species.

Biodiversity loss and climate change

Biodiversity loss and climate change are inextricably connected, and must be addressed together. Marine and terrestrial ecosystems are natural carbon sinks, with an annual gross sequestration equivalent to about 60% of global anthropogenic emissions (IPBES, 2019[9]). However, biodiversity loss is reducing ecosystems' natural capacity to store carbon, aggravating climate change. Deforestation alone accounts for an estimated 10% of anthropogenic greenhouse gas emissions. Conserving, restoring and improving the management of forests, grasslands, wetlands and agricultural lands could deliver an estimated 23.8 gigatonnes of cumulative CO_2 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[3] (Griscom et al., 2017[29]). Furthermore, investing in nature can also help protect people from floods, drought, storms and other climate-related hazards. The role of nature-based solutions for climate change mitigation and adaptation has gained increasing political attention and is an important focus at the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change.

Reciprocally, action on climate change is fundamental to addressing biodiversity loss. Climate change is a primary (and the fastest-growing) driver of biodiversity loss. Climate change has already resulted in shifts in species distribution, disrupted species interactions, and led to mismatches in the timing of migration, breeding and food supply. These and other effects have contributed to population declines. Climate trends and extremes are pushing marine and terrestrial ecosystems closer to thresholds and tipping points (Harris et al., 2018[30]). Crossing these could have catastrophic implications for biodiversity and climate change, and by extension, the economy and human well-being.

While synergies between climate and biodiversity action exist, some actions to mitigate and adapt to climate change may negatively affect biodiversity (e.g. the large-scale expansion of bioenergy, renewable energy infrastructure, and the construction of dams and seawalls), and therefore require careful planning and management. The mitigation pathways countries choose will determine the extent of potential trade-

offs between climate and biodiversity action. For example, scenarios with higher levels of future energy demand show lower levels of CO_2 emissions reductions to 2030 and rely to a much greater extent on the use of bioenergy with carbon and capture storage for negative emissions (BECCS) later in the century. Under a 1.5°C scenario, some models require as much as 7 million km^2 of land to be dedicated to BECCS by 2050 (for comparison, Australia's landmass is 7.7 million km^2) (IPCC, 2019[31]). Conversely, climate mitigation scenarios where peak emissions are reached early due to lower energy and materials demand and reduced consumption of GHG-intensive foods such as meat, would entail fewer trade-offs and considerable benefits for biodiversity.

Transformative action to halt and reverse biodiversity loss

The accelerating loss of biodiversity is driving up costs and risks to the economy, the financial sector, and ultimately, the well-being of society. While governments have made some progress in addressing biodiversity loss, it has been incremental and insufficient. For example, since the adoption of the CBD in 1993 an estimated 21-32 birds and 7-16 mammals were saved from extinction, yet 10 bird and 5 mammal species are suspected to have gone extinct during this same period (Bolam et al., 2020[32]). Governments have significantly extended the coverage of marine and terrestrial protected areas, but many lack effective management and protected area coverage is not yet representative of the diversity of ecosystems on the planet (OECD, 2017[33]; SCBD, 2020[34]). Of the CBD's 20 Aichi Targets, only six were partially achieved by 2020; none were fully achieved (SCBD, 2020[34]). Particularly poor performance was in areas such as eliminating incentives, including subsidies, harmful to biodiversity (target 3), reducing the rate of natural habitat loss and fragmentation (target 4), implementing plans for sustainable production and consumption and keeping the impacts of use of natural resources well within safe ecological limits (target 7).

Halting and reversing biodiversity loss will require nothing less than transformative change across economic, social and technological factors (IPBES, 2019[9]). This entails, for example, enhanced measures of economic performance that also reflect natural capital, reforming fiscal and economic policy to reflect the true value of nature in decision-making, transforming the financial system so that it systematically accounts for biodiversity-related impacts and risks, and mainstreaming biodiversity in trade policy. Technology can – with the right incentives – be harnessed to reduce humans' impact on nature, by increasing the efficiency of production (e.g. precision agriculture) and resource use (e.g. energy efficiency), and reducing pollution (e.g. through re-use and recycling). However, technological advances alone will not suffice; fundamental, system-wide changes in production and consumption patterns are needed to re-balance humanity's demand with nature's supply (Dasgupta, 2021[1]; Leclère et al., 2020[35]). Such changes demand a concerted effort from the whole of government, the financial sector, businesses and citizens – all of who depend and impact on biodiversity. They also require bold action to overcome policy inertia and vested interests (OECD, 2017[36]).

With an area of land 20 times the size of France currently in a degraded state (Gibbs and Salmon, 2015[37]), greater efforts are also needed to restore ecosystems and the stock of natural capital. While it is generally cheaper to protect biodiversity than to restore it, evidence shows that the benefits of restoration often outweigh the costs – particularly when the full range of ecosystem service values are accounted for. For example, a synthesis of restoration case studies with available data found that benefit-cost ratios were greater than 1 for inland wetlands, tropical forests, temperate forest, woodlands and grassland, and as high as 35 in grasslands (even with only partial estimates of benefits) (De Groot et al., 2013[38]). For coastal wetlands (e.g. mangroves), average cost-benefit was found to be 100 (Blignaut, Aronson and de Groot, 2014[39]). Ecosystem restoration can also provide a more cost-effective approach than hard infrastructure for delivering some infrastructure services. For example, an analysis of options for improving water quality in Portland, United States, found that green infrastructure would be 51-76% cheaper (USD 68-72 million cheaper) than water-filtration plant upgrades and would bring co-benefits (e.g. salmon habitat and carbon sequestration), estimated conservatively at USD 72-125 million (Talberth et al., 2012[40]).

In addition to reducing risks and costs to society, the conservation, sustainable use and restoration of biodiversity can also support jobs. For example, approximately 40 jobs are created, on average, for every USD 1 million invested in nature-based solutions. This is equivalent to around 10 times the job creation rate of investments in fossil fuels (Levy, Brandon and Studart, 2020[41]). The World Economic Forum (2020[42]) estimates that nature-positive business opportunities could generate 395 million jobs by 2030, while adding up to USD 10.1 trillion in annual business value.

2 Measuring and mainstreaming biodiversity

Key messages

- GDP is an important measure of short run macro-economic performance and is correlated with some key determinants of well-being such as jobs and incomes. However, it was not designed to provide insights on all the different economic, social and environmental outcomes that matter for human well-being and sustainability. National measurement frameworks are needed that better integrate information on economic production, human well-being and environmental sustainability, such as the OECD Well-being Framework and inclusive wealth accounts.
- Natural capital accounting is essential for integrating biodiversity considerations into measures of national performance and policy appraisal, and integral to inclusive wealth accounts. At least 89 countries have implemented accounts consistent with the UN SEEA, the international standard for natural capital accounting. However, the majority of accounts are incomplete and only 34 countries have developed ecosystem accounts. Furthermore, natural capital is not given equal weight to economic data, highlighting the need to increase both the supply of and demand for natural capital accounts.
- Efforts by governments have not yet been sufficient to halt and reverse biodiversity loss. Despite some incremental progress, biodiversity has not been mainstreamed in national economic planning, budgets and other policies and practices that affect biodiversity. When biodiversity is included in national strategies and plans, it is often limited to a generic mention or strategic direction, rather than clear targets and actions which are needed to bring about real change. Finance, economic and sectoral ministries must play a greater role.
- Synergies and trade-offs exist among biodiversity goals and other Sustainable Development Goals, for example, between the use of bioenergy for climate mitigation and its implications for land use change, food security and biodiversity. However, it is not common practice to systematically assess the alignment of different policy objectives. Furthermore, the lack of consistent and comparable data and indicators across countries to monitor biodiversity mainstreaming actions undermines transparency, accountability, and the exchange of lessons learned.

Policy recommendations

- Implement a multi-dimensional measurement framework to assess national performance, including measures on the environmental dimensions of human well-being and the stocks of natural capital that underpin current and future well-being.
- Support the development and use of comprehensive natural capital accounts globally, for example under the SEEA, including through international co-operation and increased investment in data on biodiversity, ecosystem services and natural capital more broadly.
- Mainstream biodiversity into all relevant strategies and plans (e.g. national economic plans, national budgets, low-emission development strategies, national risk assessments, development co-operation strategies), systematically integrate biodiversity and natural capital into programmes, policies and

projects, and promote policy coherence by strengthening inter-ministerial co-ordination and setting clear time-bound targets, roles and responsibilities. Develop indicators that are consistent and comparable across countries to monitor progress on mainstreaming.

- Draw on the full suite of regulatory (e.g. pollution standards), economic (e.g. taxes, biodiversity offsets) and information (e.g. ecolabelling) instruments to internalise the external costs (and benefits) from firms and households. Setting and enforcing absolute limits on natural resource use or extraction (e.g. protected areas, tradable permits, quotas) is particularly important where ecosystems could face tipping points, or are of considerable ecological or cultural significance.

Measuring national performance

Going beyond GDP

Governments require three complementary and inter-related perspectives to navigate the economic recovery from the COVID-19 pandemic, while also taking transformational action to tackle biodiversity loss. These are the economic production, the human and the environmental perspectives. No single indicator can cover all aspects of these three perspectives. Discourse about national performance is dominated by a focus on GDP growth, an indicator of aggregate production in a given time period. While important for macroeconomic analysis, GDP was not designed to measure people's current well-being or a country's capacity to sustain societal well-being over time (Stiglitz, Fitoussi and Durand, 2018[43]).

In the context of biodiversity, GDP has two primary limitations.[4] First, GDP is not designed to provide information on the full range of material and non-material benefits important to societal well-being, or how these are distributed across society. For example, GDP only captures flows of ecosystem services traded in the market (e.g. provisioning services such as timber or fish sales). It ignores flows of non-marketed ecosystem services important to societal well-being, particularly regulatory, supporting and cultural services such as soil retention, carbon sequestration and flood protection; nutrient and water cycling; and spiritual and religious values. Second, GDP does not account for depreciation (or appreciation) of the stocks of capital assets upon which current and future well-being depend: economic, human, social and natural capital. Indeed, economic growth in recent decades has largely come at the expense of natural assets. While global GDP per capita increased by more than 60% between 1992 and 2014, the accounting value of natural capital stocks per capita declined by nearly 40% (Managi and Kumar, 2018[3]), owing to unsustainable rates of natural resource extraction, environmental degradation and pollution.

Given these and other limitations, governments need to broaden their scope beyond a narrow focus on GDP. In this regard, it is important to acknowledge that the system of national accounts (the framework from which GDP is derived) includes much more information than just GDP, providing insight on important aspects of material well-being, such as net national income, household disposable income, household wealth and the stock of natural assets in an economy, Furthermore, several satellite accounts have been developed linked to the central framework of the system of national accounts that provide more detailed insight in specific topics, such as environmental economic accounts (other noteworthy examples are those capturing information on health accounts, human capital accounts and distributional accounts). A lot of this information will be embedded in the central framework of the national accounts in 2025 (as part of the update of the macroeconomic statistical manuals) to put more emphasis on well-being and sustainability (AEG, 2020[44]).

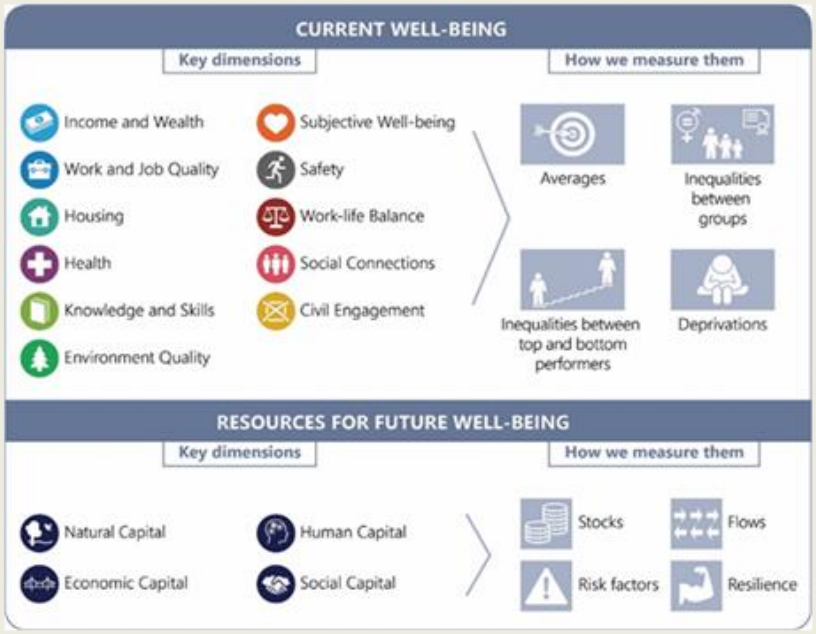
The OECD's Well-being Framework (Box 2.1) has also been an important initiative to address certain data gaps in relation to well-being and sustainability. The framework comprises a dashboard of indicators covering eleven dimensions of current well-being, including environmental quality (OECD, 2020[45]), together with measures of their distribution. In addition, it emphasises that sustainability requires governments to maintain or grow the economic, social, human and natural assets (including biodiversity) that underpin well-being. Similarly, the Dasgupta Review concludes that economic performance should ultimately be judged not on GDP growth, but on a country's "inclusive wealth" (comprehensive wealth),

which is defined as the accounting value of a country's produced (economic), human and natural capital[5]. Inclusive wealth is the means and intergenerational well-being the end; an increase in one corresponds to an increase in the other (Dasgupta, 2021[1]). The World Bank's Changing Wealth of Nations and the UN Environment Inclusive Wealth Index (UNEP, 2018[46]) are concrete efforts towards assessing changes in a countries' inclusive wealth.

Box 2.1. The OECD Well-being Framework

The main features of the OECD Well-being Framework are that it:

- Focuses on people, rather than on the economic system;
- Concentrates on outcomes, rather than inputs and outputs;
- Looks at the distribution of well-being across a population, rather than only country-averages;
- Considers both objective and subjective aspects of well-being; and
- Considers sustainability from a cross-cutting perspective, to assess how humanity's imprint today on a range of assets will impact well-being in the future.



Source: OECD (2020[45]) How's Life? 2020 https://dx.doi.org/10.1787/9870c393-en

Countries require a suite of indicators to evaluate the environmental dimensions of well-being and economic production. OECD's Green Growth initiative, for example, has developed indicators around four key areas: i) the environmental and resource productivity of the economy (e.g. environmentally-adjusted multifactor productivity growth[6]); ii) the natural asset base, covering not only subsoil assets but also species and ecosystems; iii) the environmental dimension of the quality of life (e.g. air quality); iv) economic opportunities arising from environmental protection, and policy responses to foster environmental sustainability (e.g. environmentally-related taxes and expenditure) (OECD, 2021[47]). As discussed below, further investment in the underlying data – particularly biodiversity data – and widespread implementation of consistent accounting frameworks, such as SEEA, are imperative for analytically sound and effective indicators.

In addition to developing complementary indicators, going beyond GDP requires a recognition that the economy is embedded in – and therefore ultimately bounded by – nature (section 1). Furthermore, it demands a conscious effort to shift the focus from growth in economic production towards improved well-

being, which is not necessarily always associated with GDP growth. Applying a well-being lens to policy decisions can help governments take a systematic approach to the sustainability challenge that addresses both the supply and demand side simultaneously, and identifies potential synergies and trade-offs across different dimensions of well-being. It does this by defining societal goals in terms of well-being outcomes, and focusing on policies that can restructure systems to deliver well-being outcomes by design (Buckle et al., 2021[48]; OECD, 2019[49]).

An increasing number of countries are taking steps to go beyond GDP. For example, several countries have implemented the system of environmental economic accounting (SEEA), are compiling distributional results in line with national accounts' totals and have applied a well-being framework. Well-being frameworks have been used to design, monitor and evaluate national development strategies, engage stakeholders, and inform budgetary processes (e.g. France, Germany Italy, Netherlands, New Zealand and Sweden) (Exton and Shinwell, 2018[50]). A particularly advanced example is New Zealand's Living Standards Framework, which includes measures of wellbeing and inclusive wealth (including measures of biodiversity and natural capital), and was used to implement the world's first Well-Being Budget in 2019 (New Zealand Treasury, 2019[51]).

China's Gross Ecosystem Product (GEP) indicator provides another example of how a country is placing greater emphasis on natural capital in performance assessment (Ouyang et al., 2020[52]). The GEP, which is analogous to GDP, was developed to assess and communicate nature's contributions to well-being and economic development. GEP provides a single, aggregate value of ecosystem service benefits (most of which are not captured in GDP but are included in the environmental economic accounts), based on market prices or surrogate market prices. A pilot application in Qinghai Province covering a subset of ecosystem services found that GEP was comparable to GDP in size. Like GDP, GEP is a flow and complementary work is therefore underway to track changes in natural capital, which would provide a better indication of sustainability. GEP helps respond to national requirements for local governments to include ecological considerations in the evaluation of local governments' performance.

Strengthening national accounting frameworks and data

Natural capital accounting is an important step for making nature visible in measures of national performance and policy appraisal. It is also a prerequisite for assessing changes in inclusive wealth. Natural capital accounts organise biophysical and economic data on the stock of natural resources and the flows of resources and ecosystem services that support the economy. The UN System of Environmental-Economic Accounting (SEEA), for example, provides countries with a common framework for natural capital accounting. The SEEA applies the accounting principles of the System of National Accounts (SNA) to facilitate the integration of environmental and economic statistics.

The SEEA comprises two complementary parts: a Central Framework (CF), adopted as an international standard in 2012, and Ecosystem Accounting (EA), adopted as an international standard in March 2021. Both parts include biophysical and monetary values (Box 2.2). The SEEA-CF accounts for stocks and flows of individual environmental assets (e.g. mineral resources, timber, energy, fish) that provide material benefits (i.e. ecosystem provisioning services), and the environmental impacts of their extraction and use. It also includes Environmental Activity Accounts (e.g. environmental protection expenditure and tax and subsidy accounts).

The SEEA-EA provides a framework for organising spatially explicit information on the extent and condition of ecosystems, the flow in physical and monetary terms of both the material (provisioning services) and non-material benefits (regulating and cultural services) provided by ecosystems, and information on changes in stocks of ecosystem assets in monetary terms. The SEEA-EA also facilitates the development of thematic accounts for land, water, carbon and biodiversity[7]. Abiotic resources (e.g. energy and mineral resources) covered in the SEEA-CF are outside the scope of the SEEA-EA (Obst, 2019[53]; UNDESA, 2021[54]; United Nations, 2020[55]). A recent focus of the SEEA-EA has been on improving the coverage of

biodiversity in natural capital accounting, notably by more effectively capturing non-material ecosystem service benefits (e.g. existence values, and religious and spiritual values), and biodiversity at the species and genetic level (not just the ecosystem level) (see King et al. (2021[56]) and UNDESA, (2021[54]) for a discussion).

Box 2.2. Valuation and natural capital accounting

Valuation of ecosystem services and assets in monetary units is of primary importance to make consistent comparisons between SEEA natural capital accounting and standard economic measures, such as GDP or produced assets, as recorded in the system of national accounts (SNA). To that end, the SEEA-EA applies the concept of exchange values, which are the market prices of goods and services exchanged in the markets, or the assumed transaction prices for goods and services that have no market. The SEEA EA, however, does not include all potential economic values, in particular consumer surplus and non-use values, and acknowledges that alternative valuation concepts, such as welfare values and total economic values, may be better suited to some policy contexts such as for cost-benefit analysis. Furthermore, the SEEA-EA emphasises that care is needed when analysing large, non-marginal changes, such as the permanent loss of water resources. In such cases, it is important that analyses incorporates the assessment of physical changes in stocks in relation to appropriate thresholds. No matter the valuation approach, a pragmatic and necessary first step is to develop robust accounts of biophysical stocks and flows.

Source: (UNDESA, 2021[54]) System of Environmental-Economic Accounting—Ecosystem Accounting: Final Draft; (Turner, Badura and Ferrini, 2019[57]), Natural capital accounting perspectives: a pragmatic way forward; (Badura et al., 2017[58]) Valuation for Natural Capital and Ecosystem Accounting. Synthesis report for the European Commission

Continued investment is needed in national statistics and the implementation of natural capital accounts, particularly ecosystem accounts. In 2020, approximately 89 countries were implementing accounts in line with SEEA (a 29% increase from 2017), while an additional 27 countries planned to start compiling accounts. However, many of the existing accounts are incomplete or unpublished and gaps remain. The majority of countries with SEEA accounts have compiled accounts following the SEEA-CF. Only 34 having compiled ecosystem accounts – which are particularly important for biodiversity – and mainly on an experimental basis (UNCEEA, 2020[59]). A separate analysis found only nine (non-G7) countries[8] had compiled specific (national or subnational) thematic accounts for biodiversity by the end of 2019 (Hein et al., 2020[60]).

Significant advances have been made in ecosystem mapping, ecosystem service modelling, and spatial data on biodiversity in the past decade, which is critical for informing policy, but data gaps and challenges remain. Digital technologies such as artificial intelligence and earth observation can be leveraged to improve the granularity and timeliness of data, and to support the compilation of natural capital accounts. For example, ARtificial Intelligence for Environment and Sustainability (ARIES)[9], has developed a tool combining remote sensing and artificial intelligence to facilitate a quicker and cheaper compilation of ecosystem accounts. The Group on Earth Observations' Earth Observation for Ecosystem Accounting initiative is developing and testing methods and tools to better harness Earth observation technology to drive the development of ecosystem accounts.[10] Other examples include the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) tool, Co$ting Nature and Spatial Evidence for Natural Capital Evaluation (SENCE) (for an overview of these and other tools see Ecosystems Knowledge Network (2021[61])).

Development finance and technical assistance can play an important role in supporting the compilation of comprehensive natural capital accounts in developing countries, and building capacity to apply natural capital accounts to decision making (Pirmana et al., 2019[62]; Dasgupta, 2021[1]). Recent and ongoing initiatives include: the World Bank-led partnership *Wealth Accounting and the Valuation of Ecosystem Services (WAVES)*[11] supported by multiple donors, *Natural Capital Accounting and Valuation of*

Ecosystem Services (NCAVES)[12] funded by the European Union, and *Enhance Natural Capital Accounting Policy Uptake and Relevance (EnhaNCA)*[13] funded by Germany.

Mainstreaming biodiversity in national-level decision making

Halting and reversing biodiversity loss requires systematically embedding biodiversity considerations in the policies, practices and economic activities that affect or depend on nature and its services, a process referred to as mainstreaming (Huntley and Redford, 2014[63]). It requires collective efforts from national and local governments, business, the finance sector, civil society organisations and citizens. Governments acknowledged the importance of mainstreaming with the adoption of the CBD 2011-2020 Strategic Plan for Biodiversity at COP10 and the subsequent Cancun Declaration on Mainstreaming the Conservation and Sustainable Use of Biodiversity for Well-being at the COP13 (COP13, 2016[64]). Despite important – yet often piecemeal – progress, biodiversity mainstreaming remains insufficient.

Entry points for mainstreaming biodiversity exist across all levels of government and in various sectors. Mainstreaming at the national level is important, as this is where governments form medium to long-term priorities and take budgetary decisions, both of which steer national action in sectors or policy areas. Key strategies and plans relevant to biodiversity mainstreaming at the national level include National Economic or Development Plans, National Trade or Export Plans, Nationally Determined Contributions (NDCs), long-term Low Emissions Development Strategies (LEDS), National Risk Assessments, Agricultural Development Plans, Infrastructure Plans and Development Co-operation strategies. Recent OECD work has identified key opportunities and lessons learned for biodiversity mainstreaming, which can help guide country efforts (OECD, 2020[65]; OECD, 2018[66]).

Adopting a long-term national vision for biodiversity with clear targets and indicators

Establishing a long-term national vision for biodiversity and setting clear biodiversity targets can help provide direction for policy makers and galvanise action. A global vision for 2050 already exists under the CBD[14], which countries can adopt or tailor to their national circumstances. The development of a post-2020 Global Biodiversity Framework provides an important opportunity to set ambitious global targets that are specific and measurable, which countries can then translate into their national policy. One of the shortcomings of the previous global biodiversity framework was the ambiguity, complexity and lack of measurability of the 20 Aichi targets (Butchart, Di Marco and Watson, 2016[67]). For discussion of the importance of specific, measurable targets for the Post-2020 Global Biodiversity Framework together with headline indicators using data that is consistent and comparable across countries, see OECD (2019[68]) and OECD (2019[69]).

Developing coherent national strategies and plans

Ensuring policy coherence across national strategies and action plans is essential for achieving biodiversity and broader sustainable development goals. Synergies and trade-offs exist across policy objectives, which need to be identified and explicitly addressed. For example, effectively designed nature-based solutions can deliver climate mitigation, adaptation, biodiversity and other well-being benefits (Box 2.3) (OECD, 2021 Forthcoming[70]). However, the practice of planting monoculture forests and expanding bioenergy to mitigate climate change can be detrimental to biodiversity (Gasparatos et al., 2017[71]; Lewis et al., 2019[72]; Hof et al., 2018[73]).

To promote policy coherence, national strategies and plans should be prepared in a coordinated manner, with active participation and consultation of relevant ministries and other stakeholders. This would help to identify and manage potential synergies, trade-offs and misalignments across policies. While countries are increasingly considering biodiversity across various national strategies and action plans, its inclusion is often limited to a generic mention or general strategic direction. Few national strategies and plans beyond NBSAPs include specific (quantified) targets for biodiversity, and even fewer include indicators against

which to monitor progress (OECD, 2020[65]; OECD, 2018[66]). Integrating specific and measurable targets for biodiversity and other policy objectives into national strategies and plans also enables policy makers to better identify potential misalignments.

High-level leadership (e.g. from the office of the President / Prime Minister or cabinet), and the development of inter-ministerial committees that include finance and relevant sectoral ministries, can facilitate a coherent policy response. The roles and responsibilities of different institutions should also be clearly defined, to ensure transparency, accountability and effective implementation of policies (OECD, 2020[65]; OECD, 2018[66]).

Box 2.3. Scaling up nature-based solutions

Nature-based solutions (NbS) present opportunities to harness synergies between biodiversity, climate change and broader human well-being objectives. While NbS can form an effective complement (hybrid grey-green approaches) or alternative to grey infrastructure, their uptake remains limited. NbS have fundamental characteristics and requirements that differentiate them from grey infrastructure. Traditional institutional, regulatory and financial frameworks, which were designed with grey infrastructure in mind, can inhibit the use of NbS. Decisions around planning, implementing, operating, financing, and stakeholder engagement for infrastructure development may need to be adapted if NbS are to be applied consistently and considered on an equal footing as grey measures. Furthermore, to ensure NbS benefit nature and are resilient over time, approaches that promote local species and species diversity should be prioritised over simplistic monoculture approaches. Some countries have taken steps to facilitate the uptake of NbS:

- In Canada, both nature-based and grey infrastructure projects are eligible for funding as structural prevention measures under the 1.6 billion CAD Disaster Mitigation and Adaptation Fund, aimed at helping communities manage risks from floods, droughts and other hazards.
- In the United Kingdom, the Department for Environment, Food and Rural Affairs (Defra) has invested GBP 15 million into natural flood management schemes, while environmental agencies across the three countries have worked with the Environment Agency (EA) to publish the Working with Natural Processes to Reduce Flood Risk directory.
- In the United States, the Environmental Protection Agency (EPA) has developed technical assistance for local governments on how to design, promote and implement NbS for effective storm water management. In addition, The US Army Corps of Engineers has streamlined the permitting process for living shorelines to incentivise NbS and correct for the comparative advantage held by hard infrastructure projects of shorter permitting times.

Sources: OECD (2020[74]), Nature-based solutions for adapting to water-related climate risks, OECD Environment Policy Papers, No. 21, OECD Publishing, Paris, https://doi.org/10.1787/2257873d-en; (Dasgupta, 2021[1]), The Economics of Biodiversity: The Dasgupta Review.

Integrating biodiversity into the appraisal of programmes, policies and projects

While advances in biodiversity data, national ecosystem assessments and natural capital accounting can support evidence-based decision-making, they do not in themselves, lead to policy change. Further efforts are required to integrate biodiversity into appraisal processes, for example by fully accounting for biodiversity and ecosystem services in cost-benefit analyses, assessing impacts on natural capital stocks (i.e. long-term sustainability), and increasing accountability. For example, the UK Treasury's "Green Book: Appraisal and Evaluation in Central Government" was updated in 2018 to provide guidance[15] on assessing the impacts of natural capital stocks (including cumulative impacts). However, a 2020 evaluation suggests that further steps may yet be required to ensure the effective implementation of the guidance, including e.g. "red rating" and further scrutiny of proposals that lead to net loss of natural capital or lack evidence of

natural capital impacts; and further development of valuation tools and models (Natural Capital Committee, 2020[75]).

Implementing an effective mix of policy instruments

An effective response to biodiversity loss will require a mix of policy instruments including regulatory instruments (e.g. protected areas; spatial planning; quantity-based restrictions on pollution and natural resource extraction), economic instruments (e.g. taxes; payments for ecosystem services; subsidy reform), and information or other instruments (e.g. eco-labelling and voluntary agreements). The appropriate mix of policies is context specific, and depends on the biodiversity issue as well as the social, cultural, political and economic context. For instance, protected areas and (temporary) bans may be most appropriate where ecosystems are at risk of reaching tipping points or are of particular ecological, social or cultural significance. In other cases, taxes or other economic instruments may be a more cost-effective approach to achieving a biodiversity objective.

Key policy instruments for mainstreaming biodiversity at the national level (i.e. cross-sectoral measures) include clear and secure land tenure, land-use and marine spatial planning, strategic environmental assessment (SEAs) and fiscal and other economic instruments (see section 3). Spatial planning provides a framework for reconciling the multiple social, economic and environmental demands placed on land or on the ocean. Including specific biodiversity criteria in spatial plans can help avoid land-use conversion of areas of particular importance for biodiversity (e.g. Key Biodiversity Areas), or ecosystem service provision (e.g. watersheds), and minimise impacts of production activities. Fiscal and other economic instruments can also serve to provide incentives (both penalties and rewards) for sustainable production and consumption. Given the multiple threats on biodiversity, it is important to establish a clear understanding of the key pressures at national level, prioritise responses to address these pressures, and consider the types of policy measures likely to be most effective in terms of environmental impact as well as cost (OECD, 2018[66]). Effective monitoring and enforcement of policies is also important.

Aligning financial resources with biodiversity objectives

Effective mainstreaming of biodiversity requires financial resources commensurate with the ambition of biodiversity targets, and their importance to the economy and human well-being. Recent analysis by OECD estimates biodiversity finance to be USD 78-91 billion per year (2015-2017 average) (OECD, 2020[76]). While it is difficult to assess global biodiversity finance needs, a funding shortfall clearly exists. For example, one estimate finds that extending protected areas to 30% of land and sea, and ensuring their effective management, would cost USD 103 to 178 billion per year (Waldron et al., 2020[77]). The study also estimates this would lead to an overall gross economic output of USD 64 to 454 billion per year higher by 2050 than in the counterfactual of no expansion of Protected Areas. Going beyond protected areas to effectively mainstream biodiversity (e.g. at national and sectoral level) could require significantly more finance. A recent analysis puts the biodiversity finance gap at USD 598 to 824 billion per year (Deutz et al., 2020[78]). To effectively close the biodiversity finance gap, the volume of public (section 3) and private finance (section 4) flowing in support of biodiversity must be increased, and harmful finance flows decreased. Improving the effectiveness of biodiversity finance can also play an important role in closing the gap.

While an increasing number of countries are collecting information on their biodiversity-related expenditures, only a small minority have assessed their biodiversity finance needs (or the finance and policies that are negatively affecting biodiversity – see section 3). Thirty-five predominantly developing countries, for example, are assessing their biodiversity finance needs with the support and methodology of the UNDP Biodiversity Finance Initiative (BIOFIN) (UNDP, 2018[79]). Costing of National Biodiversity Strategies and Action Plans or other biodiversity plans can inform budget decisions and the development of biodiversity finance plans to ensure that efforts to mainstream biodiversity are adequately resourced.

Monitoring and evaluating biodiversity mainstreaming

Further progress is needed in monitoring and evaluating biodiversity mainstreaming. This requires indicators that cover the full range of responses, including inputs (e.g. finance and staff), processes (e.g. existence of inter-ministerial commissions), outputs (e.g. new data and assessments such as on green budgeting including biodiversity), outcomes (e.g. new policies such as the introduction of pesticide taxes), and impacts (e.g. improved state of biodiversity) (OECD, 2018[66]; OECD, 2019[80]). There is a lack of consistent and comparable data across countries on a range of indicators that would enable monitoring and evaluation of the outcomes and impacts of biodiversity mainstreaming interventions. Progress in this regard will require concerted efforts from finance, economic, environment and other sectoral ministries both within and across countries.

3 The role of fiscal policy and economic instruments for biodiversity

Key messages

- Evaluating and improving the alignment of budget and fiscal policy with biodiversity objectives is a critical step for addressing biodiversity loss. While an increasing number of countries are implementing elements of green budgeting, few countries have assessed the potential positive and negative impacts of their domestic and international spending on biodiversity. Few, if any, public development banks have done this either.
- Taxes, fees, payments for ecosystem services and other economic instruments are vital for incentivising more sustainable consumption and production, and can also raise revenue or mobilise finance. These instruments are often underutilised. Biodiversity-relevant taxes amount to only 0.9% of the revenue generated from all environmentally-relevant taxes in OECD countries, which in turn accounts for just 5.1% of total tax revenue.
- Governments continue to incentivise the destruction of nature through environmentally harmful support, including budgetary and fiscal transfers, encouraging unsustainable production across multiple sectors. To date, relatively few countries have undertaken national level assessments to systematically identify their public subsidies harmful to biodiversity or the environment more generally.
- Integrating biodiversity considerations into COVID-19 economic recovery measures can provide immediate jobs and boost longer-term economic resilience, human health and societal well-being. Ignoring biodiversity in economic recovery packages could increase the risk of future pandemics and economic shocks. However, green measures are a small proportion of overall stimulus, and recent OECD analysis estimates that only 7% of green stimulus supports biodiversity.

Policy recommendations

- Align budgets and fiscal policy of governments and public development banks with biodiversity objectives by quantifying biodiversity-related expenditures, assessing spending that is harmful to biodiversity, and using other green budgeting tools such as cost-benefit analysis to nature-proof the economy.
- Scale up the use and ambition of economic instruments (biodiversity-relevant taxes, fees and charges, tradable permits, biodiversity offsets, payments for ecosystem services) to reflect the true costs of natural capital loss on the economy and human well-being.
- Identify and reform or remove environmentally harmful budgetary and fiscal support to agriculture, fisheries and fossil fuels, prioritising the most environmentally harmful and market distorting types of support.
- Urgently integrate biodiversity measures such as incentives for ecosystem restoration and sustainable land-use into COVID-19 economy recovery packages – and screen recovery measures for potential

negative impacts – to create jobs while reducing the health, financial and macro-economic risks of biodiversity loss.

Biodiversity and green budgeting

Budgetary and fiscal policy is an important tool for resourcing and implementing measures to conserve, sustainably use and restore biodiversity and reforming existing measures that lead to biodiversity loss. The process and arrangements for allocating public funds, and raising revenue through taxes, can strongly influence biodiversity outcomes. Globally, governments spend an estimated USD 68 billion domestically per year to protect biodiversity, which accounts for approximately three-quarters of total biodiversity spending (OECD, 2020[81]), yet at the same time other budgetary and fiscal policy decisions have the opposite effect, driving biodiversity loss. For example, government support, including through market barriers, that is potentially harmful to biodiversity is equivalent to more than USD 800 billion per year[16] (see section 5).

Green budgeting is a systematic approach to examine and improve the alignment of government spending and fiscal policy with environmental objectives. This implies understanding both the positive and negative impacts of budgetary and fiscal decisions on the environment. Green budgeting can help to mainstream biodiversity and other environmental issues across policy domains, enhance transparency around government action for parliamentarians and civil society, and support efforts to monitor environmental progress. It could, therefore, provide an important contribution to the forthcoming Post-2020 Global Biodiversity Framework[17], the Paris Climate Change Agreement and broader Sustainable Development Goals.

Green budgeting is an evolving practice. While countries have been tracking development activities targeting environmental objectives since the introduction of the Rio Markers in 1998 (Box 3.1), applying green budgeting approaches to domestic spending is not yet standard practice. Less than half of OECD countries surveyed practise some form of green budgeting (14 out of 35 country responses), while five intend to introduce green budgeting. Thirteen of the countries with some form of green budgeting plan to further develop their practices (OECD; European Commission, 2020[82]). To date, only France has completed a comprehensive assessment of its budget to identify all positive and negative environmentally-related expenditure (see below).

Box 3.1. OECD Rio Markers and greening development finance

The OECD Development Assistance Committee (DAC) monitors development finance targeting the objectives of the Rio Conventions on biodiversity, climate change and desertification. For each activity reported to the CRS, providers apply the Rio DAC marker methodology to indicate whether the activity targets the objectives of the CBD as a "principal" or "significant" objective, or not at all. Activities scored "principal" are funded specifically for that policy objective; activities scored "significant" have other primary objectives, but have been formulated or adjusted to help meet biodiversity objectives. The Rio marker approach includes biodiversity-related finance from all sectors, not just the environmental sector.

Thirty Development Assistance Committee (DAC) members are now tracking and reporting bilateral development cooperation activities that intend to benefit biodiversity, using the Rio Marker methodology. Further efforts are needed, however, to address inconsistencies in how the Rio Markers are applied and interpreted by countries.

Considerable data gaps and inconsistencies exist in the tracking and reporting of multilateral development finance for biodiversity. For example, only 4 out of the 37 multilateral agencies and funds that reported to the DAC in 2018 applied the biodiversity Rio Marker to their activities. Addressing this data gap would strengthen transparency and enable progress on biodiversity to be more effectively tracked.

In addition, while development projects and programmes are regularly evaluated, and often screened for their negative environmental impacts (e.g. using SEAs and EIAs), it is not common practice to comprehensively assess the volume of development finance that is potentially environmentally harmful. This would be a useful next step, for public development banks and governments, as part of broader green budgeting efforts.

Source: (OECD, 2021[83]), OECD Statistics on External Development Finance Targeting Environmental Objectives Including the Rio Conventions http://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/rioconventions.htm

Most domestic-level green budgeting efforts have focussed on climate change, with much less attention given to biodiversity. While synergies exist among climate change mitigation, adaptation and biodiversity, so do trade-offs. Furthermore, climate change is only one of five key pressures on biodiversity, which means a climate-focused evaluation of budgets will not capture all expenditure potentially harmful or beneficial to biodiversity. It is therefore important for governments to adopt a coherent green budgeting approach, looking across multiple environmental domains to identify potential trade-offs and synergies.

Various tools, methodologies and governance approaches are emerging for assessing the alignment of budget and fiscal policies with biodiversity. Of the few countries that have applied green budgeting to biodiversity, the focus has been predominantly on identifying expenditure or tax revenues that support biodiversity. Some countries have also taken steps to identify harmful financial flows. Both of these are key components of green budgeting. Remaining challenges of green budgeting include how to define and assess "green" and deal with trade-offs among environmental objectives, what scoring system to use, where to set the limits of green budgeting analyses, and comparability over time and across countries. Exchange among governments through platforms such as OECD's Paris Collaborative (Box 3.2), can help to identify lessons learned and good practices, encourage convergence and drive improvements in green budgeting. Furthermore, it could facilitate uptake of green budgeting by other countries.

Box 3.2. Paris Collaborative on Green Budgeting

The Paris Collaborative on Green Budgeting was launched by the OECD Secretary-General at the One Planet Summit in Paris on 12 December 2017, with the support of the governments of France and Mexico. The Paris Collaborative is the first cross-country and cross-sectoral initiative designed to support governments to "green" their fiscal policy and embed climate and other environmental commitments. It aims to design new, innovative tools to assess and drive improvements in the alignment of national expenditure and revenue processes with climate, biodiversity and other environmental goals. The Paris Collaborative is convened by the OECD, working in close partnership with a range of governments around the world to develop agreed definitions, tools, methodologies and guidelines that will allow countries and citizens to track progress on green budgeting both nationally and internationally.

Source: OECD (2021), Paris Collaborative on Green Budgeting, https://www.oecd.org/environment/green-budgeting/

Examples of green budgeting efforts with a biodiversity focus are outlined below:

- ***European Union:*** The EU developed a climate and biodiversity tagging methodology to track progress in its budget, under its 2014-2020 EU Multi-annual Financial Framework (MFF). The tagging methodology builds on the OECD Rio markers methodology, distinguishing between expenditure for which biodiversity or climate is a principal objective (to which the EU applies a 100 per cent weighting factor), a significant objective (to which the EU applies a 40 per cent weighting factor) or not an objective (0 per cent weighting factor). The methodology was used to assess whether the EU met its commitment to allocate 20% of its budget to climate change mitigation and adaptation under its 2014-2020 MFF. Under the 2021-2027 MFF, the EU has set spending targets for both biodiversity and climate change. Of the total EU annual budget, 7.5% must be spent on biodiversity from 2024, and 10% from 2026. A minimum of 30% of the total budget must support climate objectives. Work is now underway to assess and strengthen the budget tagging methodology.
- ***France:*** France's "Green Budget for 2021", presented at the same time as its Finance Bill for 2021, enables parliamentarians and the public to evaluate the compatibility of France's public finance trajectories with the Paris Agreement, biodiversity and other environmental goals. It helps respond to demands for improved transparency and accountability in the aftermath of the Gilets Jaunes crisis. The analysis is based on the green budgeting methodology presented by the IGF/CGEDD in 2019 (IGF-CGEDD, 2019[84]). It spans the entirety of state expenses as well as 475 fiscal expenses. The analysis assesses budgetary impacts on biodiversity and five other environmental objectives, inspired by the EU Taxonomy Regulation (2020/852)[7]. The approach tags expenditure as favourable to the environment, neutral, unfavourable or mixed (i.e. favourable for at least one environmental objective such as climate, but simultaneously unfavourable for one or more other objectives such as biodiversity) (Gouvernement de France, 2020[85]; Gondjian and Merle, 2020[86]).
- ***Ireland:*** Ireland undertook a National Biodiversity Expenditure Review in 2018. Three key parameters defined Ireland's NBER methodology (Morrison and Bullock, 2018[87]). First, the definition of 'biodiversity expenditure' adopted which defines the scope and scale of the study. Second, the approach taken to categorising or tagging expenditure against national and international biodiversity objectives. Third, the identification of the proportion of each programme or activities' expenditure that is attributable to biodiversity based on their relevance (direct or indirect) for conservation. Different coefficients (0, 5, 25, 50, 75, 100%) were applied to expenditure depending on the relevance of the activity to biodiversity. This builds on the methodology outlined by the UNDP BIOFIN initiative and applied by thirty-five (mainly developing) countries (UNDP, 2018[79]).
- ***Mexico:*** Mexico has made significant efforts to align its budget to the Sustainable Development Goals. In 2018, Mexico began a process of aligning its budget parameters with the SDGs, focussing on five priority areas for implementation: SDG 1 (no poverty), SDG 10 (reduced inequalities), SDG 13 (climate

action), SDG 15 (biodiversity: life on land) and 16 (peace, justice and strong institutions) (SHCP Mexico, 2020[88]). Positive (direct and indirect) and negative impacts were assessed for each commitment using indicators linked to the nationally determined contributions, SDG indicators and OECD indicators on green growth. The new cross-cutting green budget will evaluate changes in a given year, report to what extent the budget converges (positively or negatively) with environmental goals, and develop benchmarks for each of the four environmental goals to allow international comparisons.

Governments embarking on green budgeting efforts for biodiversity and other environmental areas could be guided by OECD's green budgeting framework, which identifies four mutually reinforcing building blocks:

- **A strong strategic framework:** This involves the establishment of clear strategic priorities and objectives, e.g. through National Biodiversity Strategies and Action Plans and their accompanying targets, which should also be reflected in other national plans (e.g. national economic development plans), see section 2.
- **Tools for evidence generation and policy coherence:** This can build on the existing public financial management framework and include e.g. biodiversity tagging of budget measures; environmental impact assessments and social cost-benefit analysis for new budget measures; pricing of environmental externalities; and integration of biodiversity considerations into spending reviews or budgetary performance objectives.
- **Reporting to facilitate accountability and transparency:** Green Budgeting Statements accompanying the budget help provide an overall picture of how well the budget is aligned with biodiversity and other environmental objectives, and whether trade-offs exist across environmental objectives.
- **An enabling budgetary governance framework:** This involves ensuring strong links and well-designed sequencing between strategic planning and budgeting, multi-annual budget envelopes, outcome and evidence-based budget processes, along with close engagement with parliaments and civil society. Strong political leadership, together with clearly defined roles and responsibilities within government is fundamental to generate accountability. The development of capacity and expertise among civil servants may also be required.

Biodiversity, fiscal policy and other economic instruments

Tracking and scaling up economic instruments for biodiversity

A suite of economic instruments can be used to conserve and sustainably use biodiversity, ranging from taxes, which are based on the polluter pays principle, through to payments for ecosystem services, which are based on a beneficiary pays approach (Table 3.1). Environmentally-motivated economic instruments provide price signals to producers and consumers to behave in a more sustainable way, and serve to correct externalities that arise due to market failures. They deliver continuous incentives to achieve biodiversity objectives more cost-effectively. Instruments such as taxes, fees and charges and auctioned tradable permits have the added advantage of raising government revenue, which could be used to finance additional biodiversity measures, address any potentially regressive distributional impacts of policy measures or reduce fiscal burden.

The role of economic incentives to promote the conservation and sustainable use of biodiversity was recognised by Parties to the Convention on Biological Diversity's Strategic Plan 2011-2020 and Aichi Target 3[18]. Economic incentives also feature in the draft targets and indicators for the Post-2020 Global Biodiversity Framework.[19] As noted above and in the Dasgupta Review, quantity restrictions such as tradable permits (or regulatory instruments such as protected areas, bans, and quotas) may be most

appropriate where ecosystems are approaching tipping points or are of particular ecological, social or cultural significance.

Table 3.1. Summary of fiscal and other economic instruments for biodiversity

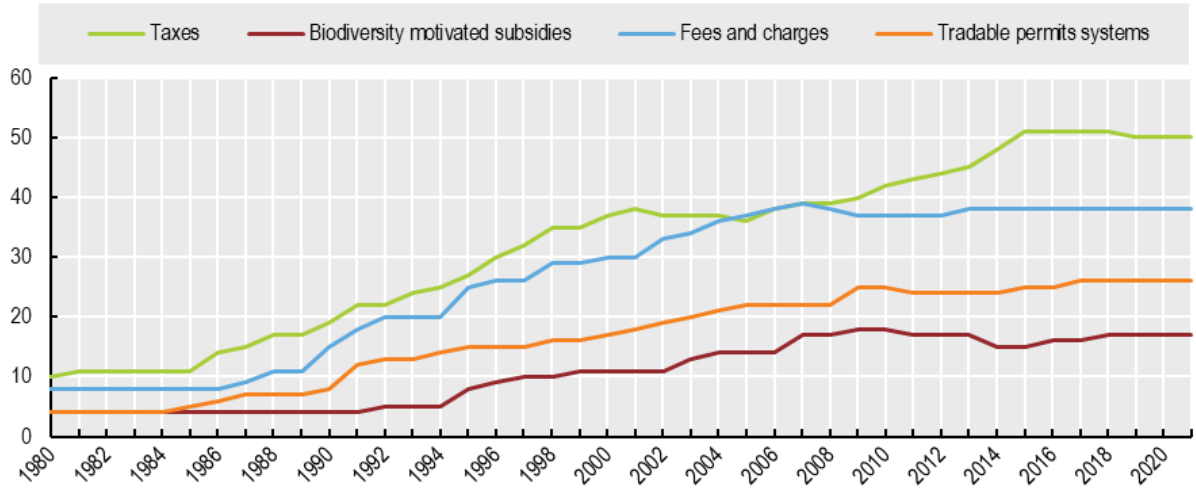
Economic instruments	Description	Biodiversity-relevant examples
Taxes	Taxes place an additional cost on the use of a natural resource or the emission of a pollutant, to reflect the negative environmental externalities that they generate. A tax is a compulsory unrequited payment.	Taxes on pesticides, fertilisers, forest products and on timber harvests (e.g. tax on logging, British Columbia, Canada; tax on pesticides, France).
Fees / charges	A charge is a requited payment to general government, meaning that the payer of the charge gets something in return, more or less in proportion to the payment made.	Entrance fees to national parks, fees on hunting licenses, charges for groundwater abstraction and biodiversity-relevant non-compliance fines (e.g. subnational water abstraction charges Germany; coastal protection fees, Texas, US).
Tradable permits	Set a limit on total amount of a natural resource that can be exploited, and then allocate individual permits to users that they can also trade. The allocation of these permits can be grandfathered (i.e. allocated to existing users of the resource free of charge, typically in perpetuity) or auctioned. If auctioned, tradable permits can generate revenue.	Individual transferable quotas (ITQs) for fisheries; tradable development rights; and tradable hunting rights (e.g. tradable development rights for pinelands management, US; tradable fishery quotas, UK).
Biodiversity offsets	"Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken." Biodiversity offsets take one of three forms: one-off offsets by the developer or a third party; payments-in lieu; and biobanking.	Restoration, creation, or enhancement of wetlands to compensate for impacts on wetlands at other locations resulting from e.g. agriculture or infrastructure development. (e.g. US Wetland Compensatory Mitigation).
Biodiversity-motivated subsidies	Subsidies that support the conservation, sustainable use or restoration of biodiversity. A subsidy is biodiversity-motivated if it reduces directly or indirectly the use of something that has proven, specific negative impact on biodiversity.	Subsidies for forest management and reforestation, subsidies for organic, environmentally friendly agriculture or pesticide-free cultivation, and subsidies for land conservation. (e.g. subsidies for reforestation, Canada).
Payments for ecosystem services (PES)	Based on the beneficiary pays approach, PES are voluntary transactions between ecosystem service users and providers, that are conditional on agreed rules of natural resource management, for generating offsite services	Payments from a downstream beverage company or local government to upstream landholders to incentivise them to protect or restore the watershed. (e.g. Vittel (Nestlé Waters) watershed payments, France; US Grassland reserve programme).

Source: Authors based on: (OECD, 2020[89]; BBOP, 2009[90]; Wunder, 2015[91]; Wunder and Wertz-Kanounnikoff, 2009[92])

While the use of biodiversity-relevant economic instruments has increased since 1980 (Figure 3.1), there has been a general plateau since 2010 and they remain underutilised (OECD, 2020[89]). Based on OECD's Policy Instruments for the Environment (PINE) database, which covers data from 122 countries, a total of 232 biodiversity-relevant taxes are in force today, spanning 62 countries. Biodiversity-relevant fees and charges in force today total 195 and span 50 countries, while 37 tradable permit systems are in operation across 26 countries. Biodiversity-relevant positive subsidies total 151, and are active in 26 countries. A complementary analysis focussed on the agricultural sector found only a handful of countries provide targeted payments to promote biodiversity and other environmental public goods in agricultural systems, and these policies represent a small share of total support for agriculture (OECD, 2020[93]).

Figure 3.1. Biodiversity-relevant economic instruments – country coverage

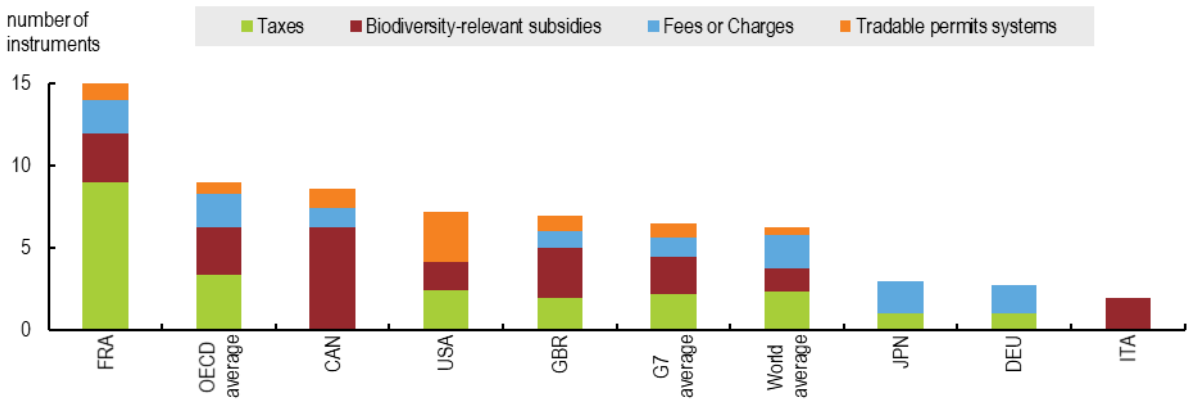
Number of countries with biodiversity-relevant economic instruments in force



Note: Countries are not included in this figure if the start date of their instrument is unknown.
Source: OECD PINE database. Accessed Mar 21 2021.

All G7 countries have at least one type of biodiversity-relevant economic instrument in force (Figure 3.2). Considerable variation exists in the type of instruments each country employs. Of the G7 countries, only France and the United Kingdom employ all four types of biodiversity-relevant economic instruments for which data are available. Biodiversity-relevant taxes are the most common instrument in France, and are applied in four other G7 countries. Biodiversity-relevant subsidies (e.g. for reforestation) are the dominant instrument in Canada and Italy. Fees or charges are used by all G7 countries, and are the dominant instrument in Japan and Germany. Tradable permit systems are particularly common in the United States. The average number of biodiversity-relevant economic instruments in G7 countries is higher than the world average (based on data from 82 countries), but lower than the OECD average.

Figure 3.2. Biodiversity-relevant economic instruments in force in 2021, by country



Note: These counts include national and sub-national instruments in force as of January 1, 2021. The number of sub-national instruments are weighted by the number of large regions (territorial level 2) for every country.
Source: OECD Policy instruments for the Environment (PINE) database March 2021 extraction.

In OECD countries in total, biodiversity-relevant taxes generate approximately USD 7.6 billion a year (average 2017-2019) in revenue. However, biodiversity-relevant taxes amount to only 0.9% of the revenues from all environmentally relevant taxes in OECD countries, which in turn account for just 5.1% of total tax revenue. Across the five G7 countries for which data are available for the period 2017-2019, total biodiversity-relevant tax revenues amount to USD 2.2 billion per year on average (Table 3.2). Scope exists to increase revenues generated from biodiversity-relevant taxes, by increasing their use and ensuring that tax rates reflect as accurately as possible the marginal costs to society of biodiversity loss. Increasing taxes on activities that harm biodiversity could help to offset the costs of increased government spending and reductions in labour tax revenue resulting from the COVID-19 induced economic crisis.

Table 3.2. Revenue generated from biodiversity-relevant taxes in G7 countries (2017-2019 average)

Country	Biodiversity-relevant tax revenue	Biodiversity-relevant tax revenues as percentage of environmentally-relevant taxes	Environmentally-relevant tax revenue as percentage of total tax revenue	Environmentally-relevant tax revenue as a percentage of GDP
France	USD 1.6 billion	2.6%	5.1%	2.4%
Germany	USD 9.9 million	0.02%	4.5%	1.7%
Italy	USD 0	0%	7.8%	3.3%
Japan	USD 7.2 million	0.01%	5.1%	1.3%
United Kingdom	USD 521 million	0.8%	7.0%	2.3%
Canada*	-	-	-	-
United States*	USD 788 million	0.6%	2.8%	0.7%

Note: *Data for this period are not yet available for Canada and the United States. Data presented for United States are for 2016.
Source: OECD.Stat Environmentally Related Taxes Revenues. Data extracted 5 March 2021

Over 100 countries have policies that enable or specify the need for biodiversity offsets. Thirty-seven countries (including all G7 countries) require biodiversity offsets for project permitting in some contexts, while 64 countries have policies that enable voluntary biodiversity offsets (IUCN, TBC and DICE, 2021[94]). An estimated USD 4.8 billion in mitigation bank credits and financial compensation were transacted in 2016 (Bennett, Gallant and Ten Kate, 2017[95]). This estimate covers 99 regulatory biodiversity offset programmes in over 30 countries.[20]

Ongoing OECD work to track payments for ecosystem services (PES) through country surveys has so far identified 107 PES schemes[21] in operation, spanning 36 countries. The total finance mobilised and allocated through PES schemes in eight countries with major PES programmes is USD 18.2 billion per year (2017-2019 average).[22] PES can been used to secure the provision of various ecosystem services, such as habitat provision, carbon sequestration/storage and watershed ecosystem services. They can be applied at the local, national and also the international level (e.g. such as Reducing Emissions from Deforestation and Degradation) when the ecosystem services provide regional or global benefits.

Scaling up economic instruments can play an important role in tackling biodiversity loss; as with all policy instruments, they must be effectively designed and implemented, and sufficiently ambitious in order to achieve the desired environmental impact (OECD, 2013[96]). For example, agri-environmental payments have the potential to deliver "win-win" outcomes for both environmental and economic performance, yet evidence suggests their success has been patchy and shows significant room for improvement (DeBoe, 2020[97]). Similarly, while biodiversity offsets can help address the residual biodiversity impacts from developments, their effectiveness can be undermined if the mitigation hierarchy (avoid, minimise and then offset) is not respected (OECD, 2016[98]) Only 10 of 37 countries where offsetting is mandatory require robust application of the mitigation hierarchy and provide guidance on technical design based on good practice principles (IUCN, TBC and DICE, 2021[94]).[23]

Evaluating the impact and cost-effectiveness of biodiversity policy instruments is crucial for maximising biodiversity outcomes, particularly given resource constraints. However, OECD work finds little attention has been placed on assessing the effectiveness of biodiversity policy responses (Karousakis, 2018[99]). Strengthened monitoring and evaluation would help governments to improve the design of their instruments, projects and investment strategies, and better deliver on biodiversity objectives. Impact evaluation studies (whereby a policy intervention is assessed against a counterfactual) is a key tool for this and is not being applied to biodiversity (or environment) interventions at scale. Despite the fundamental role that biodiversity and ecosystem services play in the global economy and human wellbeing, the number of biodiversity-relevant impact evaluation studies are negligible in comparison to the number of impact evaluation studies in the field of mainstream economics and, for example, medicine.

Reforming environmentally harmful support: budgetary transfers

Reforming environmentally harmful government support has long been recognised as an important pathway for achieving sustainable production and addressing market distortions in the agriculture (OECD, 2020[93]) and fisheries (OECD, 2020[100]) sectors, while reforming fossil fuel support will also help reduce consumption and fight climate change, a key driver of biodiversity loss[24] However, progress has been slow and considerable opportunity remains for reform (OECD/IEA, 2019[101]; OECD, 2020[100]; OECD, 2020[93]). Some of this reform involves reforms to, or removal of, budgetary transfers.

To reduce the biodiversity impacts of agriculture production, for example, reforms should target payments based on output and payments based on unconstrained variable inputs, which have also been found to encourage negative environmental outcomes (DeBoe, 2020[97]; Henderson and Lankoski, 2019[102]). These can take the form of budgetary transfers. See section 5 for further discussion of the range of market distorting and environmentally harmful support (which amounts to more than USD 800 billion annually in agriculture and fossil fuels support alone) as well as the need for, and design of, reform.

Very few countries have undertaken national level assessments to systematically identify their public subsidies harmful to biodiversity or the environment more generally. France, Germany and Italy are examples of G7 countries that have done this. Several countries have also undergone fossil fuel subsidy peer reviews under the auspices of the G20, including the United States, Germany and Italy. Identifying budgetary transfers harmful to biodiversity, or the environment more broadly, is a necessary step to implement reform.

Biodiversity in economic recovery packages

The case for integrating biodiversity considerations into the COVID-19 economic recovery

The COVID-19 pandemic has led to widespread human and economic losses. To respond to the social and economic crisis caused by COVID-19, governments have announced trillions of dollars in stimulus to reignite the economy and create jobs. A key challenge for governments is to ensure that the policy measures they introduce effectively address immediate social and economic needs, while promoting longer-term resilience, human health, well-being and sustainability. With this in mind, many countries have publicly committed to a “green recovery” through their stimulus packages. Other actors, from multilateral institutions and civil society to business leaders, have also stressed the need for a green recovery.

Nature proofing and integrating biodiversity measures into recovery packages, as part of a broader green recovery, is fundamental to drive the transformative changes needed to halt and reverse biodiversity loss. A suite of measures is required to conserve and restore biodiversity, and to incentivise economy-wide transitions to more sustainable patterns of production and consumption (OECD, 2020[100]). Economic recovery packages that fail to account for nature will increase the likelihood of future pandemics (Box 3.3), and increase the risk of economic shocks as ecosystems are pushed to their tipping points.

Investing in biodiversity is not only about risk management; it can also create immediate socio-economic benefits, such as jobs. Activities such as ecosystem restoration, reforestation, and environmental monitoring tend to be labour intensive and quick to implement, because worker-training requirements are relatively low and projects often have minimal planning and procurement requirements (Hepburn et al., 2020[101]). Furthermore, past experience shows that such projects can have an economic multiplier effect. For example, ecosystem restoration in the United States was found to provide direct employment for 126 000 workers and generate USD 9.5 billion in economic output annually, while creating a further 95 000 indirect jobs and USD 15 billion in household spending (BenDor et al., 2015[102]).

Measures that incentivise and support industries to transition to more sustainable production patterns could also create jobs and add value to businesses. The Future of Nature and Business, for example, illustrates how 15 transitions across three systems (food, land and ocean; infrastructure and the built environment; and extractives and energy) could generate up to USD 10.1 trillion in annual business value and create 395 million jobs by 2030 (World Economic Forum (WEF), 2020[42]). Beyond job creation, integrating biodiversity considerations into recovery packages can provide other co-benefits such as climate change adaptation and mitigation (see section 1).

Box 3.3. Biodiversity loss and the risk of pandemics

Nearly all pandemics and the majority of emerging infectious diseases have their origins in microbes that are present in wildlife. Anything that increases the contact between humans, livestock and the reservoirs of novel microbes in wildlife that have the potential to jump species can increase the risk of zoonosis emergence and outbreaks. Ecosystem degradation may lead to increased preponderance of species that are more able to transmit the pathogen, increasing emerging human infectious disease and pandemic risk. Key drivers of zoonosis include land-use change (including deforestation) due e.g. to agricultural or urban expansion, mining and the expansion of transport infrastructure into remote ecosystems, and (legal and illegal) wildlife consumption and trade (both domestic and cross-border) – many of the same drivers responsible for biodiversity loss. These in turn are underpinned by indirect drivers such as population growth and changes in consumption patterns.

Much of the focus has been on addressing outbreaks of disease once they happen, rather than on preventing them. However, the costs of actions to help prevent future zoonotic pandemics (e.g. combatting deforestation, improving wildlife trade and improving disease surveillance in wild and domestic animals) are estimated to be less than 2% of the cost of pandemics. Effective prevention requires a One Health approach – a holistic, interdisciplinary approach that takes into account the interconnections between people, domestic animals, wildlife and their shared environment.

Source: OECD (2020[100]) Biodiversity and the economic response to COVID-19: Ensuring a green and resilient recovery; Gibb et al. (2020[103]) Zoonotic host diversity increases in human-dominated ecosystems; IPBES (2020[104]), Workshop Report on Biodiversity and Pandemics; Dobson et al. (2020[105]), Ecology and economics for pandemic prevention

The greenness of the COVID-19 recovery

Green recovery measures feature in most countries' stimulus packages, but they remain a relatively small component. Preliminary analysis based on the OECD Green Recovery Database[25], identified USD 340 billion of environmentally positive recovery measures (USD 690 billion including 30% of the Next Generation EU fund[26]) announced or implemented by countries by the beginning February 2021 (OECD, 2021[106]). While this represents a significant investment in the environment, it is only about 17% of recovery spending.

Furthermore, OECD analysis suggests the volume of stimulus that is harmful or mixed for the environment is likely to be more than the volume of stimulus that is environmentally-positive (OECD, 2021[106]). Similar conclusions can be drawn from the "Greenness of Stimulus Index" developed by Vivid Economics with the support of the Finance for Biodiversity Initiative. The version of the index released in February 2021 shows a net negative impact on the environment in 30 of the 40 countries covered by the index (Vivid Economics, 2021[107]).

Green recovery discourse and action thus far has largely focussed on climate change mitigation, with much less attention to biodiversity. Climate change mitigation accounted for 90% of funding allocated to environmentally-positive measures identified by the OECD in 43 countries and the EU, while biodiversity accounted for just 7%. Yet biodiversity loss and climate change are challenges of a similar magnitude and urgency. They are also fundamentally interlinked. Biodiversity and climate change must therefore be addressed together as part of a green and inclusive recovery.

Examples of COVID-19 recovery measures that are likely to benefit biodiversity are presented below. For further discussion of biodiversity and the COVID-19 recovery see (OECD, 2020[100]).

- *Colombia* - Colombia has set a target of planting 180 million trees through incentives for silvopastoralism and agroforestry with community support (Government of Colombia, 2020[108]).
- *France* - France has committed EUR 250 million (USD 276 million) for 2021-2022 to support biodiversity, including projects to restore terrestrial and freshwater ecosystems, strengthen protected areas and promote coastal protection in the face of climate change (Government of France, 2020[109]).
- *Germany* - Germany has committed EUR 700 million (USD 772 million) to maintain and promote sustainable forestry management, including through the digitisation of forestry sector and support to investments in modern machinery (German Ministry of Finance, 2020[110]).
- *India* - As part of the INR 20 trillion (USD 0.27 trillion) recovery package, the Indian government is channelling INR 60 billion (USD 0.8 billion) through its Compensatory Afforestation Fund Management and Planning Authority to provide jobs for tribal communities in forest management, wildlife protection and other related activities (BFSI News, 2020[111]).
- *Italy* - Italy established a EUR 40 million (USD 44 million) fund aimed at supporting micro, small and medium enterprises that operate in "economic-environmental zones" (e.g. national parks) and that carry out "eco-friendly" activities. EUR 40 million (USD 44 million) (Government of Italy, 2020[112]).
- *New Zealand* - As part of its NZD 50 billion (USD 33 billion) Response and Recovery Fund, the New Zealand government has launched a NZD 1.3 billion (USD 0.9 billion) "jobs for nature" programme. The programme aims to provide up to 11 000 jobs controlling invasive species (e.g. wilding pines, wallabies and stoats), and protecting and restoring habitat on private and public conservation land (New Zealand Treasury, 2020[113]) (New Zealand Ministry for the Environment, 2020[114]).
- *United Kingdom* - The UK has launched a GBP 40 million (USD 51 million) "green recovery challenge fund", designed to help charities and local authorities to protect 2 000 jobs and create an additional 3 000 short- and long-term jobs in tree planting, habitat restoration and green space creation. The programme intends to provide a pipeline of shovel-ready nature projects that protect species, provide recreational opportunities and help combat climate change among other things (UK Government, 2020[115]).

Development finance in support of a green recovery COVID-19 recovery

Developing and emerging economies are among the hardest hit socially and economically by the COVID-19 pandemic, with significant implications for biodiversity. Many of these countries, including some of the most biodiversity-rich countries in the world, were already struggling to finance biodiversity prior to the pandemic and had growing debt (IMF and World Bank, 2019[116]). The COVID-19 pandemic is exacerbating the situation as countries increase spending to finance health measures, support households and firms, and invest in the recovery, while sources of domestic revenue (e.g. tax revenues) and external private

finance wane.[27] Furthermore, many developing countries are highly dependent on ecotourism revenues for funding biodiversity protection, which have been significantly reduced due to travel restrictions (Waithaka, 2020[117]; IUCN, 2020[118]).

Official development assistance (ODA) has been an important resource and countercyclical flow (i.e. counteracts fluctuations in the economy) in previous crises, and could play role in protecting biodiversity and supporting local livelihoods in developing countries during and after the COVID-19 crisis. In the short-term, ODA could help address immediate priorities, such as ensuring the effective management of protected areas, supporting local communities who depend on ecotourism revenues, and maintaining monitoring and enforcement activities. For example, Germany's International Climate Initiative (IKI) is implementing a EUR 68 million Corona Response Package that will provide, among other things, financial support for the conservation of nature reserves in IKI partner countries to address the immediate impact of COVID-19 (Platform 2020 Redesign, 2020[119]).

In the longer term, ODA could support increased efforts to tackle deforestation and illegal domestic and cross-border wildlife trade (drivers of both infectious disease emergence and biodiversity loss), as well as broader efforts to transition to nature-positive production and consumption. To have a lasting impact, ODA should aim to strengthen the enabling environment in recipient countries, for example, by building organisational and institutional capacity, promoting effective governance arrangements, and improving biodiversity-relevant data. ODA can also be used to support the development of new biodiversity funding models that are diversified and therefore more resilient to shocks such as COVID-19.

In the face of impending debt crises, sovereign debt restructuring and debt swaps could present an opportunity to reduce a country's debt, while also delivering on biodiversity objectives that provide domestic and global benefits (IIED, 2020[120]). This could be achieved by lenders offering lower interest rates and principal repayments in return for increasing biodiversity protection (IIED, 2020[120]; Finance for Biodiversity Initiative, 2020[121]; Finance for Biodiversity Initiative, 2020[122]). A recent example is the 2016 partial buyback by Seychelles of debt from Paris Club creditors at a discount, in exchange for a commitment to improve marine conservation and climate adaptation efforts. While debt-for-nature swaps can be effective in reducing foreign currency debt while improving biodiversity outcomes, they can face a range of challenges and risks that need to be carefully considered and addressed, such as high transaction costs and long timeframes (IIED, 2020[120]; Cassimon, Prowse and Essers, 2011[123]).

Enhanced biodiversity outcomes and transparency through ex ante and ex post assessments

Governments could put green budgeting tools and approaches, such as budget tagging and environmental impact assessment, to good use as they continue to develop and implement their recovery packages. Screening measures for potential positive and negative impacts prior to their implementation would help governments to evaluate and communicate the "greenness" of their economic recovery programmes, and to re-consider measures that could potentially have a significant negative impact on biodiversity. Ensuring that cost-benefit analyses adequately account for the full range of social and economic benefits provided by nature could also help inform a more sustainable and resilient response. As of June 2020, five OECD countries had already applied *ex ante* environmental impact assessment to their COVID-19 recovery measures, while six countries had applied green budget tagging (OECD; European Commission, 2020[82]).

Monitoring and evaluating the measures that are implemented *(i.e. ex post)* can help policy makers to understand whether stimulus measures have achieved their macroeconomic, employment and environmental objectives, and to identify any unintended impacts. This information would allow any necessary adjustments to be made to the measures and could inform the design of future stimulus measures. Very few *ex-ante* and *ex-post* assessments of green stimulus packages were conducted following the 2007-2008 Global Financial Crisis (OECD, 2020[124]).

4 Embedding biodiversity in the financial sector

Key messages

- Nature-related risks for companies, and their financiers and investors, are pervasive but poorly understood and largely invisible and mispriced. These include the dependency of company profitability on nature as well as the adverse impacts of business activities and financial decisions on nature. Nature-related dependencies, impacts and risks remain almost entirely uncompensated by the financial sector and investee corporations. This leads to capital misallocation, exposure of the financial sector to biodiversity-related risks, and adverse nature-related impacts that undermine societal well-being. Less than 1% of business models of the 3,500 companies representing 85% of global market capitalisation align with SDGs 14 and 15.
- Aligning finance flows with biodiversity goals requires policy makers, regulators, standard setters, investors and finance providers to pay greater attention to the biodiversity impact of finance. Embedding biodiversity in financial decision-making is necessary to reduce finance flows to harmful activities while increasing investment in nature-positive activities This requires consideration of both the (i) financial materiality of nature-related financial risks resulting from dependencies on nature, and (ii) adverse environmental impacts resulting from financial decisions. Both financial dependencies and risks *and* biodiversity impacts will change over time. Yet most financial companies do not assess, manage or disclose their material financial risks related to biodiversity. Furthermore, few assess and address the biodiversity-related impacts of their investment decisions on people and the planet. The initiative to create a Task Force on Nature-related Financial Disclosures (TNFD) is an encouraging step in mainstreaming biodiversity impacts, dependencies and risks in the financial sector.
- Biodiversity-related risks are complex, context-dependent and are difficult to model due to e.g. uncertainties related to tipping points and regime shifts, future policy trends and complex transmission channels. To reflect these characteristics, continued efforts are needed to address associated measurement, data and modelling issues.
- Embedding biodiversity in the financial sector can also provide significant investment opportunities. This includes investment opportunities in activities to support a transition to more sustainable practices (the global ecotourism market for instance could reach USD 334 billion by 2027, up from USD 181 billion in 2019); it also requires unlocking investment in activities dedicated to biodiversity protection. Scaling up private investment in nature-positive activities faces outstanding barriers. Further efforts are needed to address systemic failures to view biodiversity as material to decision-making, lack of enabling conditions and pipelines of bankable projects, and data and measurement issues.

Policy recommendations

- Mainstream biodiversity risks, dependencies and impacts in the financial sector. Concrete steps include: (i) support the development of guidance for companies on better valuing natural capital in economic decision-making; (ii) embed biodiversity considerations into due diligence risk management processes to assess biodiversity impacts in line with the recommendations of the *OECD Guidelines for Multinational Enterprises;* and (iii) welcome and engage with the TNFD and its aims, including to

enhance assessment, management and disclosures of biodiversity considerations and strengthen measurement, data standards and modelling.

- Better understand, assess and manage nature-related financial risks, and assess implications for financial stability, especially for central banks and financial supervisors. Given the complexity of nature-related risks, central banks could share emerging innovative practices and may wish to consider adopting a "precautionary" approach.
- Scale up private investment in nature-positive activities. Concrete actions include: (i) strengthen enabling conditions, apply investment policy principles while respecting local ownership rights, align incentives in domestic policy frameworks to improve the risk-return profile of projects supporting biodiversity goals; (ii) create pipelines of bankable biodiversity projects, gathering data on the returns and impacts of biodiversity projects; and (iii) collaborate with multilateral development banks, other development finance institutions and investors to establish suitable financial instruments, vehicles and funds. Blended finance is needed both for small-scale conservation or restoration projects that may not be readily profitable, as well as larger or more bankable projects that need to be scaled up.
- Embed biodiversity more broadly and foster systems innovation. This includes: embedding biodiversity goals in core public finance institutions and policy, including in climate finance facilities and national planning; and building digital infrastructure and harnessing digital finance and financial education to raise funding from and mobilise citizens.

Mainstreaming biodiversity risks, dependencies and impacts in the financial system

Nature-related risks, dependencies and impacts are poorly understood and largely invisible. They remain systematically mispriced by the financial sector and investee corporations, leading to capital misallocation and exposure for the financial sector to financial-related risks (Smale, 2020[125]).[28] Investors' and businesses' awareness of biodiversity considerations (including dependencies, impacts and risks), and their commitment to addressing biodiversity loss, remain insufficient.[29] Less than 1% of business models of the 3,500 companies representing 85% of global market capitalisation align with SDG 14 (life below water) and SDG 15 (life on land) (S&P Global, 2021[126]) (S&P Global Market Intelligence, 2021[127]). This is despite efforts by some forward-thinking companies and recent initiatives to build momentum in the lead-up to UNCBD COP15.[30]

In 2019, the world's largest financial institutions provided more than USD 2.6 trillion worth of loans and underwriting services to sectors identified as primary drivers of biodiversity loss, including food, forestry, mining, and fossil fuels sectors (Portfolio Earth, 2020[128]) (Greenfield, 2021[129]). Without adequate data and reporting standards, risk management tools and due diligence processes to address the biodiversity impacts of investments, the financial sector will continue to drive biodiversity loss.

Biodiversity creates dependencies, impacts and risks for the financial sector

All financial and non-financial companies depend directly or indirectly on biodiversity and ecosystem services for the production of goods and services (OECD, 2019[80]). The WEF conservatively estimates that over half of the world's GDP is *moderately* or *highly dependent* on nature and its services, with the construction, agriculture, food and beverage sectors the largest nature-dependent industries (WEF, 2020[4]). For instance, USD 235-577 billion worth of annual global food production relies on the direct contribution of pollinators (IPBES, 2016[130]). The cosmetics industry also depends on the long-term supply of commodities that could be threatened by forest degradation such as shea butter (WEF, 2020[4]) (Dasgupta, 2021[1]).

Businesses' dependencies on biodiversity translate into dependencies for the financial sector. For example, the Dutch central bank DNB and Environmental Assessment Agency PBL estimate that

worldwide, Dutch banks, pension funds and insurers have EUR 510 billion in loans outstanding to companies with a high or very high dependence on ecosystem services (DNB and PBL, 2020[131]).

Financial actors' dependencies and impacts on biodiversity and ecosystem services can be financially material: they can create material risks to financial performance. Biodiversity- or nature-related financial risks include:

- *Ecological* or *physical risks,* i.e. operational risks related to biodiversity impacts and resource dependency, scarcity and quality (OECD, 2019[80]). These risks could affect production processes via supply chains, as well as balance sheets, and be associated with market or credit risks.[31]
- *Regulatory, reputational* and *market risks*, e.g. linked to stakeholders' pressures or preferences changes.[32] These risks can be considered as part of *transition risks* resulting, either directly or indirectly, from the process of adjustment towards a more sustainable economy (AXA and WWF, 2019[132]). Transition risks for biodiversity are likely more uncertain and harder to identify than those for climate change, despite a few recent signals of market and credit risks, along with rising consumer awareness (OECD, 2019[80]).[33]
- *Liability risks*, i.e. risk of legal suits. Biodiversity-related liability risks may come from environmental law claims and commercial, tort and other laws (Finance for Biodiversity, 2020[133]). The risk of legal suits resulting from biodiversity impacts may rise as disclosure of companies' biodiversity and environmental impact assessments increase, especially at the local site level (OECD, 2019[80]).[34]

The risk of environmental collapse resulting from biodiversity loss and natural capital depletion may create a systemic risk to the financial sector and broader financial stability, in addition to firm-level financial risks (Finance Watch, 2019[134]) (PwC and WWF, 2020[135]). This is due to the complex interdependencies within and between ecosystems, and the contagion risks to the financial sector (Finance Watch, 2019[134]).

In addition to material risks to financial and non-financial companies, companies' adverse impacts on biodiversity and ecosystem services through their operations, supply chains and investment decisions can create material risks to people and the planet (OECD, 2019[80]). Palm oil for instance, which is used in food, cosmetics, cleaning products and biofuel, can have significant adverse impacts on biodiversity, as it often replaces tropical forests and other species-rich habitats. Globally, palm oil production affects at least 193 threatened species, and oil palm expansion could affect 54% of all threatened mammals and 64% of all threatened birds globally (IUCN, 2021[136]). Similarly, the fashion industry is responsible for 20% of global wastewater (WEF, 2020[137]) (UNECE, 2018[138]). Companies' biodiversity impacts translate into impacts from financial institutions through their investment decisions, portfolio allocation, insurance and loans (DNB, 2020[139]). These impacts, in turn, can create reputational risks to firms, including financial risks and complex transmission channels to business models' dependency on biodiversity, with implications on micro-level financial risks (e.g. in terms of physical risks at operational, local level, and associated market or credit risks) and possibly macro-level financial stability.

Embedding biodiversity in financial decisions faces measurement and modelling challenges

Embedding biodiversity in the financial sector faces issues of measurement and data standards (OECD, 2019[140]). Unlike for GHG emissions, there is no single agreed metric for biodiversity to measure biodiversity impacts and dependencies. This is due to the complexity of biodiversity (e.g. multitude of species and ecosystems, complex interactions, and varying sensitivities to different pressures), sector-specific dependencies or impacts across supply chains, and the complex relationships between business activities and biodiversity impacts (Lammerant et al., 2019[141]). Nonetheless, several metrics, measurement approaches and accounting methodologies[35] are available for businesses and investors to measure their dependencies and impacts on biodiversity[36] (UNEP-WCMC, 2021[142]; Berger et al., 2018[143]; Lammerant et al., 2021[144]; Lammerant et al., 2018[145]). Half a dozen biodiversity measurement approaches are currently explored or used by, the financial sector, and meet the criteria of including all

main drivers of biodiversity loss and being scientifically robust (Finance for Biodiversity, 2021[146]).[37] The choice of approach depends on various factors including: organisational focus area (e.g. project and site level, sector, company, country, index level, portfolio or balance-sheet); business or finance application;[38] asset classes; scope (i.e. Scope 1, 2 or 3); coverage (impacts or dependencies); metric; and data type.[39]

Still, there is an urgent need to further standardise and harmonise biodiversity impact assessments and accounting tools, and improve accessibility by market participants (ACTIAM, 2020[147]). Efforts to enhance assessments of biodiversity dependencies and impacts face data gaps, e.g. geolocated data at company- or asset-level. According to a recent survey of institutional investors, 70% of respondents believe a lack of available data is a key barrier to investing in support of biodiversity (Responsible Investor & Credit Suisse |, 2021[148]). Significant work is needed to ensure data providers, credit ratings agencies and standard-setting bodies provide suitable biodiversity data metrics, reporting frameworks and standards. As a result of data accessibility, metrics and standardisation issues, biodiversity is not yet fully integrated in environmental, social and governance (ESG) benchmarks, despite a few recent initiatives.[40]

There is also a need to scale up firms' commitments in support of biodiversity through quantified targets and goals. Few companies have adopted biodiversity objectives and targets. Yet targets and goals are increasingly being considered, such as: the Science Based Targets for Nature Network (SBTN) (SBTN, 2020[149]) (SBTi, 2021[150]) (Lammerant et al., 2021[144]); new biodiversity targets as part of the expected Post-2020 Global Biodiversity Framework; and "No Net Loss" or "Net Positive Impact" goals (IUCN, 2015[151]) (OECD, 2019[140]).

Biodiversity-related risks are also complex and difficult to model, e.g. due to uncertainties related to tipping points and regime shifts, future policy trends, in addition to complex transmission channels (Dasgupta, 2021[1]). Biodiversity changes have been projected under different scenarios, though additional analysis and capacity building are needed to develop scenarios relevant for the financial sector, for it to assess biodiversity-related scenarios based on available goals, pathways, models and data, using forward-looking scenario analysis (Dasgupta, 2021[1]) (Kedward et al., 2020[152]). This may require developing severe or worst case scenarios to capture the complex system dynamics associated with biodiversity and ecological thresholds (Kedward et al., 2020[152]) (NGFS, 2020[153]).

Mainstreaming biodiversity in the financial sector requires considering both nature-related financial risks and adverse environmental impacts, using a due diligence approach

Reducing the financial sector's support to activities that harm biodiversity and ecosystem services, while managing biodiversity-related risks to financial performance, is fundamentally about making biodiversity material to financing decisions (F4B, 2020[154]). While good progress has been made worldwide on disclosing the risks that climate change poses for financial returns, progress to disclose biodiversity risks and impacts remains limited.[41] Financial companies and regulators need to better assess, manage and report on exposure to biodiversity-related financial risks across asset classes. This requires mainstreaming biodiversity in governance, strategy, risk management, metrics and targets. Central banks and financial supervisors have a critical role to play in better understanding, addressing and managing nature-related risks at micro-level (i.e. individual financial firms) and assessing macro-level implications for financial stability. They can help develop and mainstream the use of forward-looking scenario analysis and stress tests related to biodiversity risks (DNB and PBL, 2020[131]) (Elderson, 2020[155]) (Dasgupta, 2021[1]). In addition, climate change is one of the main drivers of biodiversity loss, while the degradation of ecosystems contributes to climate change, so financial institutions need to consider climate and biodiversity risks together (DNB and PBL, 2020[131]). Yet the financial sector's experience with climate change shows the limits of a pure financial risk-based, disclosure approach.[42] This is because addressing information gaps will not on its own suffice to address the systemic failure of the financial system to manage climate and biodiversity risks. As stressed by Mark Carney, disclosure efforts need to be complemented by both risk management and portfolio alignment (Carney, 2020[156]). Efforts to enhance biodiversity risks disclosures

by the financial sector are important, but will not suffice (F4B, 2020[157]). Aligning finance flows with the goals of the future Post-2020 Global Biodiversity Framework requires policy makers, regulators, standard setters, investors and finance providers to pay greater attention to the biodiversity impact of finance, as short-term financial risk disclosure and management may not suffice to ensure every financial decision takes biodiversity into account, in support of biodiversity goals. This requires mainstreaming biodiversity risks, dependencies and impacts in investment decisions. Financial and non-financial companies need to assess, manage and report both on material nature-related financial risks, resulting from dependencies on biodiversity loss and adverse impacts on nature- and the associated risks to people and the planet resulting from business and investment decisions. Assessing and managing adverse impacts on nature can be supported by due diligence approach as recommended by OECD standards under the *OECD Guidelines for Multinational Enterprises* (OECD, 2011[158]). Whether in setting disclosure standards, ESG benchmarks or green bond standards, integrating biodiversity will be central to achieve international biodiversity goals (e.g. SDGs 14 and 15 and targets under a Post-2020 GBF). It will also help address greenwashing risk.[43] In addition, biodiversity could become relevant for *enterprise value* and financial materiality (e.g. due to nature-related physical and liability risks); this is known as *dynamic materiality* (CDP et al., 2020[160]).

Environmental impact is increasingly considered as an important complementary lens through which to consider biodiversity and other sustainability factors, in order to ensure financial institutions deliver a positive social impact, as well as to address greenwashing and market integrity issues in the financial sector. Worldwide, key standard-setting institutions have published a shared vision towards more comprehensive sustainability corporate reporting that consider environmental factors.[44] The OECD also stressed the importance of considering both nature-related financial risk and adverse environmental and social impacts in its response to the IFRS Foundation's 2020 Consultation on Sustainability Reporting.[45] The EU's Non-Financial Reporting Directive (NFRD) has a "double materiality" lens, and the EU Taxonomy Regulation consider the environmental impact of economic activities.

The Task Force on Nature-related Financial Disclosures (TNFD) can contribute to mainstreaming biodiversity in the financial sector, by providing a framework for financial and non-financial companies to identify, assess, manage and report on their risks, impacts and dependencies on nature (Box 4.1). It can help appraising nature-related financial and non-financial risks and the redirection of global financial flows away from nature-negative towards nature-positive outcomes (Vivid Economics and Global Canopy, 2020[161]).

Box 4.1. The role of the Task Force on Nature-related Financial Disclosures (TNFD)

The future TNFD, scheduled to be launched in 2021, provides a unique opportunity to mobilise the financial sector in support of biodiversity action. Key priorities identified by the OECD include:

- Addressing both biodiversity-related financial risks and adverse impacts on nature across governance, strategy, risk management, metrics and targets. This can be supported by a due diligence approach as recommended by OECD standards.
- Including investee corporations in its membership to ensure applicability of recommendations.
- Collaborating with standard setting bodies to mainstream the TNFD framework in sustainability reporting standard-setting initiatives, ESG benchmarks and labels for green financial products.
- Collaborating with governments and ensuring that its governance and scope allow for ambitious and widely-adopted recommendations that go beyond a beyond a pure financial risk-based approach, by providing guidance to help companies actually manage risks through portfolio allocation and alignment with biodiversity goals. This requires setting environmental metrics and targets, developing pathways and forward-looking scenarios and addressing data and modelling challenges.

Sources: Vivid Economics and Global Canopy (2020), *The Case for a Task Force on Nature-related Financial Disclosures*, https://ipbes.net/global-assessment (accessed on 12 March 2021); TNFD (2021), *TNFD*, https://tnfd.info/ (accessed on 7 March 2021).

The TNFD could leverage existing international instruments for undertaking due diligence of adverse impacts on people and the planet, such as the *OECD Guidelines for Multinational Enterprises* and accompanying due diligence guidance (OECD, 2011[158]) (Box 5.2). Developing technical guidance, dialogue and capacity building to help financial and non-financial companies undertake due diligence aligned with expectations to address adverse biodiversity impacts can contribute to mainstreaming biodiversity in financial markets. Environmental due diligence is gaining traction across various jurisdictions, although it is very important to acknowledge that national circumstances differ on this issue. Examples of relevant policy initiatives include: UK Proposal for due diligence on forest risk commodities (UK DEFRA, 2020[162]); EU proposal for EU Mandatory Due Diligence Law, based on OECD Guidelines and due diligence guidance (RBC, 2020[163]); The French Duty of Vigilance Law (2017) (Assemblee Nationale, 2017[164]); the German Due Diligence Act (2021) (Lieferkettengesetz.de, 2021[165]); and Japan's guide for environmental due diligence (2020) (OECD, 2021[166]).

In order to systematically consider biodiversity in financial decisions, policy makers may wish to further embed biodiversity in financial sector's rules. While taking into account national circumstances and without prejudice to existing mandates, this could include setting mandatory due diligence, creating robust and decision-making useful data as discussed, and clarifying mandates of institutional investors, e.g. by defining minimum standards on performance *vis-à-vis* biodiversity objectives for investors to gauge the environmental impact of a corporate's activity (OECD, 2020[167]). Given the complex, systemic and non-linear characteristics of ecosystems, a conventional risk management approach may not suffice in addressing biodiversity risks. Central banks may wish to also consider taking a precautionary approach, e.g. by considering monetary policy tools not just for climate but also biodiversity (e.g. asset purchase programmes and collateral frameworks), although more research is needed in this area (Kedward et al., 2020[152]) (Monnin, 2020[168]) (NGFS, 2020[169]).

Box 4.2. Implementing due diligence of biodiversity impacts using OECD standards

The OECD *Guidelines for Multinational Enterprises* ("The Guidelines") are the only multilaterally agreed and comprehensive code of Responsible Business Conduct (RBC) that governments have committed to promoting, representing international consensus on the responsibility of businesses regarding impacts on society and the environment. The Guidelines and related guidance[1] focus primarily on potential adverse impacts on people, the environment and society. The Guidelines are adopted by all OECD members and 13 non-member countries. OECD guidance on due diligence is increasingly being integrated into government regulations. The OECD has also provided technical advice on aligning voluntary initiatives and legal expectations with international RBC standards, with a rising interest to apply OECD due diligence to biodiversity. Biodiversity explicitly falls under the scope of the Guidelines, yet no practical guidance has been developed yet to apply OECD due diligence for biodiversity specifically.

The OECD plans to support the TNFD by developing technical guidance to help financial and non-financial companies undertake due diligence in addressing adverse biodiversity-related impacts on society and the environment resulting from their portfolios, business or investment decisions, across governance, strategies, risk management, metrics and targets. The G7 Environment Ministers in 2019 already encouraged the OECD to apply the Guidelines to biodiversity impacts.[2]

Notes: [1] *OECD Due Diligence Guidance for Responsible Business Conduct* and *Responsible Business Conduct for Institutional Investors*. [2] The Communiqué of the G7 Environment Ministers' Meeting in May 2019 stressed a joint commitment to "continue to promote the implementation of the *OECD Guidelines for Multinational Enterprises* and encourage the use of the *OECD Due Diligence Guidance for Responsible Business Conduct* among business, and continue to collaborate with businesses to use this guidance to identify, prevent and address adverse impacts on biodiversity".
Sources: OECD (2011), *OECD Guidelines for Multinational Enterprises, 2011 Edition*, OECD Publishing, Paris, https://dx.doi.org/10.1787/9789264115415-en; OECD (2018), *OECD Due Diligence Guidance for Responsible Business Conduct*, OECD, http://mneguidelines.oecd.org/OECD-Due-Diligence-Guidance-for-Responsible-Business-Conduct.pdf (accessed on 30 March 2020). OECD (2017), *Responsible business conduct for institutional investors Key considerations for due diligence under the OECD Guidelines for Multinational Enterprises*, https://mneguidelines.oecd.org/RBC-for-Institutional-Investors.pdf (accessed on 30 March 2021); G7 Environment (2019), *G7 Environment Ministers' Meeting, Communique*, https://www.elysee.fr/admin/upload/default/0001/04/7d84becef82b656c246fa1b26519567ce3755600.pdf (accessed on 30 March 2021).

Mobilising private investment in nature-positive opportunities

At the same time as biodiversity creates risks, dependencies and impacts for the financial sector, it also provides opportunities. The conservation, sustainable use and restoration of biodiversity creates significant business opportunities and co-benefits (Dasgupta, 2021[1]) (IUCN, 2018[170]). Business opportunities and co-benefits include: long-term viability of business models (e.g. linked to dependencies on long-term provision of ecosystem services); increased market share (e.g. from customer loyalty or cost savings): new business models (e.g. in in sustainable farming, ecotourism, circular economy or ecosystem restoration); and better relationships with stakeholders (e.g. consumers or shareholders) (OECD, 2019[80]). The global organic food market is expected to reach USD 272 billion by 2027 (GlobeNewswire, 2020[171]). Despite the expected impact of COVID-19, ecotourism is expected to reach USD 334 billion by 2027, up from USD 181 billion in 2019 (AlliedMarketResearch, 2021[172]).

As a result, biodiversity can create significant investment opportunities in activities supporting a transition to more sustainable practices, e.g. in sustainable land-use (including sustainable agriculture and forestry), in support of biodiversity and other goals (such as land degradation neutrality (LDN)).[46] But biodiversity action also requires unlocking investment in activities dedicated to biodiversity restoration and conservation. A recent analysis puts the biodiversity finance gap at USD 598 to 824 billion per year (Deutz et al., 2020[78]). There is no shortage of globally available capital. Institutional investors in OECD and G20

countries alone have at least USD 64 trillion of assets under management.[47] However, based on currently available data, the OECD conservatively estimates that the private sector spends only USD 6.6 - 13.6 billion per year on biodiversity.[48] In 2019, a study identified only 34 funds and vehicles in impact and sustainable forestry, managing altogether only USD 9.4 billion in forestry and related assets (GIIN, 2019[173]). A recent survey suggests that institutional investors are struggling to identify biodiversity-related investment opportunities: 25% of respondents do not know how to take the first steps to make investments supporting biodiversity; 32% feel they lack the knowledge to do so; and 22% fear investments supporting biodiversity will hurt their financial performance (Responsible Investor & Credit Suisse |, 2021[148]).

Institutional investors already hold assets in key sectors relevant for biodiversity, such as agriculture, forestry, construction, textile or minerals. Yet despite potential and rising interest, private financing for biodiversity faces significant challenges. They include: misaligned economic incentives; poor enabling conditions and policy failures (Section 3); insufficient data and market information; lack of awareness, assessment, management and reporting of biodiversity risks and impacts (as discussed); lack of market clarity to define nature-positive projects; small scale and localised nature of biodiversity projects; low liquidity of projects (e.g. forestry management or farmland); limited access; and large off-market transactions (World Bank Group, 2020[174]) (Kaminker et al., 2013[175]).

Increasing the financial sector's and corporates' contribution to nature-positive activities requires strengthening domestic enabling conditions and policies for such investment, engaging with local and indigenous communities to ensure respect of both investment policy principles and local ownership rights, creating pipelines of bankable projects, and channelling institutional investment in nature-positive assets, including through financial instruments and institutions.

Strengthening domestic enabling conditions for nature-positive investment

As discussed in Section 2 and 3, policy makers, in co-operation with other public and private stakeholders, have a key role to play in strengthening domestic enabling conditions for attracting private investment in nature-positive projects and activities on the demand-side of finance (taking a supply chain approach). Key priorities include:[49]

- Setting coherent and strong biodiversity commitments, targets and goals at international (e.g. Post-2020 Global Biodiversity Framework) and domestic levels;
- Promoting investment policy principles such as non-discrimination, investor protection and transparency, while collaborating closely with indigenous and local communities to ensure legal ownership and use rights of such communities, e.g. on land ownership (Hajjar et al., 2021[176]) (Bayrak and Marafa, 2016[177]);
- Improving the coherence of investment promotion and facilitation measures, e.g. by sending predictable signals to the market through the use of economic instruments for biodiversity, e.g. to discourage deforestation;
- Reforming policies and regulations to enable nature-positive investment and addressing market and regulatory rigidities that favour business-as-usual versus sustainable practices, e.g. by setting moratoria on the conversion of primary forests and peatland or ensuring adequate implementation and compliance with environmental impact assessments;
- Improving policy planning and creating a pipeline of bankable projects, working with project developers, finance institutions and local communities;
- Enhancing co-ordination and public governance across and within levels of government (e.g. between environment, sectoral and investment authorities); and
- Establishing policies to encourage environmentally responsible business conduct across key supply chains, e.g. in agriculture, forestry or minerals (e.g. by setting due diligence guidance for responsible business conduct that consider biodiversity factors across agriculture or minerals supply chains).

In order to support implementation of these recommendations, the OECD could build on its extensive work on biodiversity policy and green finance and investment, as well as relevant OECD instruments such as the *Policy Framework for Investment*, to develop tailored guidance on key priorities to scale up private investment in nature-positive activities across supply chains (OECD, 2015[178]).[50] In addition, as discussed in previous chapters, policy makers can usefully embed biodiversity more broadly into core national public finance institutions and national and global policy, including in climate finance facilities and national policy planning (see Section 3).

The role of financial instruments and institutions to mobilise private investment in nature-positive assets

Several financial instruments, funds and facilities can be used to channel private – especially institutional – investment for projects or companies delivering positive biodiversity returns along with financial returns. They include:

- **Public finance and interventions from development finance institutions** (DFIs), including blended finance, risk mitigants, transaction enablers, capacity building and technical assistance by DFIs, including for nature-based solutions (NbS) (Röttgers, Tandon and Kaminker, 2018[179]), in addition to economic instruments (Section 3). DFIs also have a role to play in collaborating with private actors to set up public-private stakeholder coalitions, funds or facilities to attract private finance to nature-based solutions and conservation.[51] Efforts could also include working with multilateral development banks and other DFIs to develop nature-related debt facilities, including for sovereign debt (Finance for Biodiversity initiative, 2021[180]).
- **Green or nature bonds** can provide low-cost, long-term sources of debt capital, help finance or refinance investments, and allow for recycling of loans, despite challenges (OECD, 2017[181]). Yet only only 4% of the USD 258 billion global green bond market in 2019 has been issued to finance projects in areas supporting the integration of nature in economic sectors, such as sustainable agriculture or ecosystem conservation (Climate Bonds Initiative, 2019[182]; OECD, 2020[81]). Scaling up nature bonds or conservation green bonds face outstanding standards and labelling issues, as well as insufficient project pipelines (World Bank Group, 2020[174]). Policy makers and DFIs can help by harnessing innovative financing tools (e.g. distributed ledger technologies) to standardise bonds and reduce transaction costs, or setting additional revenue sources to repay the bonds (e.g. biodiversity offsets; Section 3).[52]
- **Sustainable finance taxonomies, definitions and metrics**, to improve market clarity and certainty on sustainability of economic activities or investments from a biodiversity lens, bring confidence to investors and facilitate the measurement and tracking of biodiversity finance flows (OECD, 2020[184]). The EU Taxonomy Regulation for instance aims to establish criteria for environmentally sustainable economic activities, including the protection and restoration of biodiversity and ecosystems (EU TEG, 2020[185]) (European Commission, 2019[186]). The UK will also implement a green taxonomy (HM Treasury, 2020[187]). Taxonomies could cover harmful activities for biodiversity to support transition to biodiversity-aligned portfolios.[53] Biodiversity metrics used across financial products and reporting standards can draw on taxonomies or other methodologies to consider environmental impact and alignment.
- **Certification and labelling schemes** for green financial products and underlying economic activities aligned with biodiversity objectives.[54]

Additional transformative levers can support systems innovation within the finance-nature nexus. Working closely with public and private stakeholders, G7 policy makers could consider transformative levers to scale up funding from citizens in support of a nature-position transition. In particular, policy makers could build digital infrastructure and harness digital finance and financial education to raise funding from citizens, and empower citizens and local communities in support of biodiversity action (e.g. in their savings). Digital finance can help aggregate projects, collect data, evaluate co-benefits and connect biodiversity with growing pools of citizen-led finance (Green Digital Finance Alliance, 2020[188]) (UN, 2020[189]).

5 Biodiversity and trade

Key messages

- International trade can lead to both positive and negative impacts for biodiversity. Positive impacts can come from increased efficiency of production, which reduces demand for land and other natural resources, and from increased availability of environmentally friendly goods, services and technologies. Negative impacts can arise from production shifts exacerbating pressures such as land use change and pollution, the introduction of alien species and trade in environmentally sensitive goods (e.g. timber and wildlife).
- The impacts of international trade on biodiversity are context dependent and difficult to track in global supply chains. Businesses and governments require better information and data on where and how a traded product is produced, how it is transported and patterns of consumption, in order to understand their impacts on biodiversity and to help guide buyers and end-consumers towards sustainable consumption patterns.
- The biodiversity impacts of trade predominately stem from the location and process of production with negative impacts exacerbated by environmentally harmful support. Government support currently incentivises unsustainable production across multiple sectors. Across 54 economies, USD 345 billion per year in agricultural support (2017-19 average) was provided in ways that undermine the sector's sustainability. In 2019, 81 economies provided USD 478 billion in support to fossil fuels, also incentivising unsustainable production and consumption.
- Illicit wildlife trade is valued at USD 7-23 billion globally and services consumer demand. It has adverse impacts on biodiversity driving protected species population declines and extinction. Unsustainable wildlife trade can also negatively impact rural livelihoods, cause the loss of culturally valuable species and increase the risk of zoonotic diseases. Lack of prioritisation by governments and competent authorities, legal loopholes and gaps in implementation of laws at a national level mean illegal wildlife trade often goes unpunished, while weaknesses in the financial systems mean the proceeds flow across borders. Corruption at maritime ports, airports and at land border crossings provides channels for the entry of a range of illicit products.

Policy recommendations

- Reform or remove environmentally harmful support to agriculture, fisheries and fossil fuels to improve the sustainability of production and reduce the negative impacts of trade on biodiversity, prioritising the most market distorting and environmentally harmful types of support e.g. in agriculture, market price support, payments based on output and payments based on unconstrained variable inputs; and in fisheries, payments that reduce the costs of inputs, especially fuel.
- Tackle illegal wildlife trade by closing legal loopholes, addressing corruption, improving the prosecution of environmental crimes, combatting the associated financial flows (e.g. through stronger beneficial ownership transparency) and fostering co-operation among law enforcement authorities, locally and internationally. Work with key countries and expert bodies to design interventions that address the underlying issues of consumer demand for illegal wildlife trade products.
- Improve the traceability and sustainability of supply chains including by facilitating uptake of technology (e.g. remote sensing, block chain and geospatial data) and implementing Responsible Business

Conduct standards and instruments, such as the OECD FAO Guidance on Responsible Agricultural Supply Chains. This will help guide businesses and end consumers towards sustainable consumption patterns.

- Assess (qualitatively and quantitatively) the impacts of Free Trade Agreements on biodiversity ex ante to inform and help shape the design of FTAs as well as identify 'pressure points' where additional consideration or policy interventions may be required, such as reforming or removing harmful support or increasing international assistance.

Understanding the environmental impacts of trade

International trade has been recognised as essential for sustainable development (SDG 17). In particular, access to international markets has generated economic growth and jobs, and bolstered development in a number of countries (Wacziarg, 2001[190]). At the same time, international trade can have mixed implications for biodiversity (Copeland, 2013[191]). Impacts can vary in nature and scale, depending on policy settings, and patterns of production and consumption, both domestically and globally.

International trade can have positive impacts for biodiversity. Global production and trade may allow goods to be produced where they can be most efficiently. For example, shifting agricultural production to a region with comparative advantage can enable higher yields with less habitat loss. International trade may also provide countries with access to goods and services they might otherwise lack (including environmental goods and services such as timber).

International trade may, however, also have negative impacts on biodiversity. Trade can exacerbate each of the five key drivers of biodiversity loss identified by the IPBES global assessment (2019[24]): changes in land and sea use, the direct exploitation of organisms, climate change, pollution and invasive alien species (Lenzen et al., 2012[192]). There are three main channels through which this can occur:

- **Shifts in production** under trade, where goods consumed in one country are produced in another, can exacerbate existing pressures on biodiversity if production of a good increases in a region with lower environmental standards or where the negative externalities of production are higher.55
- **Introduction of alien species** (intentional or accidental), such as in the bilge water of container ships, through movement of people, or through trade of plant and animal species. Such occurrences can have significant biodiversity and economic impacts (e.g. by outcompeting native species or causing disease in commercially important crops). For example, the damage and management costs of invasive alien species globally are estimated at USD 26.8 billion annually (Diagne et al., 2021[193]).
- **The trade in environmentally sensitive goods**, including wildlife products (i.e. wildlife trade) can have direct negative consequence on biodiversity (OECD, 2012[194]). Wildlife trade has resulted in severe depletion of wild populations of emblematic species such as the African Elephant (Wittemyer et al., 2014[195]) and the Javan Rhinoceros, which was hunted to extinction in Viet Nam (Brook et al., 2014[196]).

The potential impacts of international trade on biodiversity are highly context dependent and difficult to track in global supply chains. Understanding the biodiversity impact of a particular traded product depends on where and how it is produced, how it is transported and patterns of consumption, all of which can be difficult to assess. To measure the global level impacts of trade, understanding the counterfactual situation, in terms of alternative production and consumption, is essential. Governments trying to examine and address the impacts of trade on biodiversity, therefore, face a complex challenge.

Against this background, this section identifies four areas where there is scope for immediate action with positive impacts on biodiversity. It focuses first on areas where action can be taken to reduce harmful practices, and second, actions that can promote better biodiversity outcomes from trade.

Reforming environmentally harmful support

The biodiversity impacts of trade predominately stem from the location and process of production (beyond that destined for the local market). Understanding and reducing the environmental impacts of production are therefore, central to reducing the negative impacts of trade on biodiversity.

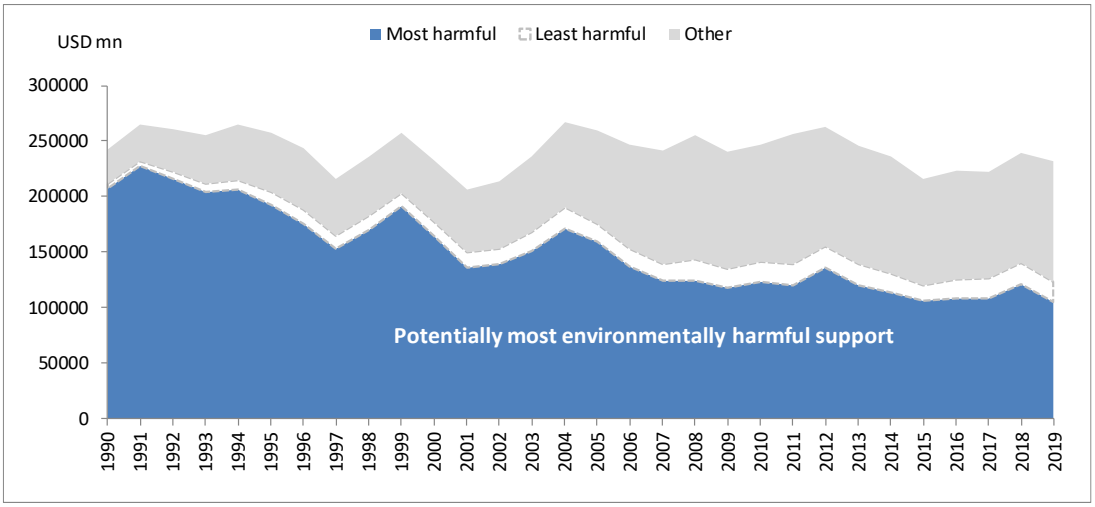
As noted in section 3, reforming environmentally harmful government support is an important pathway for achieving sustainable production and addressing market distortions in the agriculture (OECD, 2020[93]) and fisheries (OECD, 2020[100]) sectors, while reforming fossil fuel support will also help reduce consumption and fight climate change, a key driver of biodiversity loss. Progress has however been slow and considerable opportunity remains for reform across agriculture, fisheries and fossil fuels (OECD/IEA, 2019[101]; OECD, 2020[100]; OECD, 2020[93]).

To reduce the biodiversity impacts of agriculture production, reforms should target the most distorting types of support including, market price support, payments based on output and payments based on unconstrained variable inputs, which have also been found to encourage negative environmental outcomes (DeBoe, 2020[97]; Henderson and Lankoski, 2019[197]). In 2017-19, the 54 OECD and emerging countries covered by the OECD agriculture policy monitoring report provided USD 536 billion of support to agriculture producers annually. Of this support USD 253 billion was provided through budgetary spending to support various programmes and the remainder was market price support.[56] More than half the support to agricultural producers (USD 345 billion) is provided in ways that are most harmful to the sector's sustainability, while most of the rest does little to help (OECD, 2020[93]). In OECD countries, support deemed potentially most harmful to the environment averaged USD 112 billion from 2017-2019, which represents just under half of the support provided to producers (Figure 5.1). Reforms offer scope for win-wins, as environmentally harmful support is also found to have a negative impact on farm technical efficiency and productivity (DeBoe, 2020[198]). For example, governments can shift some of the environmentally harmful support elements provided in the form of budgetary expenditures towards the provision public goods that increase the sustainability and resilience of the sector as a whole (OECD, 2020[93]).

In fisheries there is significant scope to further re-allocate direct support to fisheries (OECD, 2020[200]). On average, between 2016-18, 39 countries and economies spent USD 3.2 billion annually on support that reduces the cost of inputs, the type of support most likely to lead to overfishing and illegal unreported and unregulated fishing (Martini and Innes, 2018[201]; OECD, 2020[200]). Support to fuel was the single largest direct support policy, accounting for 25% of total support to the sector – despite being most likely to lead to overfishing and least effective at transferring income to fishers. Instead, governments can move towards measures that help fishers to operate their businesses more sustainably, effectively and profitably (e.g. through education and training), or provide direct income support in a way that does not incentivise unsustainable fishing; such measures currently account for less than a third of spending to reduce the cost of inputs (USD 1.0 billion) (OECD, 2020[200]).

There are also opportunities for reforming government support to the production and consumption of fossil fuels which, according to OECD-IEA estimates, totalled USD 478 billion in 2019 (OECD, 2020[202]). This support can lead to increased consumption and support unsustainable production across multiple sectors (including agriculture and fisheries). However, the cross-cutting nature of fossil-fuel support measures, compared with support given to a specific sector, makes it difficult to assess their environmental impacts and consequently where reforms can be targeted (Elgouacem, 2020[203]).

Figure 5.1. Evolution of producer support in OECD countries by potential environmental impact



Note: Support to agricultural producers considered potentially most environmentally harmful consists of market price support; payments based on commodity output, without imposing environmental constraints on farming practices; and payments based on variable input use, without imposing environmental constraints on farming practices. Support considered potentially least harmful (or beneficial) consists of payments based on area/animal numbers/receipts/income with environmental constraints, payments based on input use with environmental constraints, and payments based on non-commodity criteria. "Other" refers to the remaining support that does not fit in either of these categories (i.e. miscellaneous). For explanation of the methodology, see Section 4 of the OECD (2013), Policy Instruments to Support Green Growth in Agriculture, OECD Green Growth Studies,OECD Publishing. http://dx.doi.org/10.1787/9789264203525-en
Source: OECD Secretariat calculations based on OECD (OECD, 2021[199]), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database), http://dx.doi.org/10.1787/agr-pcse-data-en.

Longstanding work on agriculture and fisheries has considered the distributional and political economy issues involved in successful reforms (OECD, 2020[200]; OECD, 2020[93]). Support polices often create a concentrated group of beneficiaries (e.g. certain farmers and fishers) many (or all) of whom stand to lose in the event of reforms, while, the costs of environmentally harmful support are often shared across society as a whole. Consequently, building support for reforms can be challenging if the individual benefits are low, even when the reforms might benefit society as a whole. Moreover, there can be a need to increase the availability of transparent information and analysis on the costs and impacts of support, including for sustainability, and the beneficiaries (which are not always the most in need). Basing support reforms on a robust evidence-base and finding win-wins between economic and environmental outcomes can help overcome these issues and facilitate policy change (OECD, 2017[36]; OECD, 2020[200]).

The distributional implications of reforming support to agriculture, fisheries and fossil fuels can be important, notably in developing countries, and may warrant accompanying compensatory measures. Governments, should carefully consider the potential winners and losers of reform and policies to address negative effects on vulnerable groups may be required (Elgouacem, 2020[203]). Taking a sequential approach to reforms can help governments to identify and address potential issues. Key steps include:

- Identify support measures, document their objectives and estimate their budgetary costs;
- Measure the relative impacts of the support, such as biodiversity loss or market distortion;
- Identify the winners and losers of proposed support reforms;
- Evaluate alternative policies to accompany the reforms and address distributional impacts.

There is a window of opportunity to reform harmful support that exacerbates biodiversity loss and climate change. The twin health and economic crises caused by the COVID-19 pandemic have placed unprecedented strains on public budgets, increasing the opportunity costs of harmful support, given

pressing needs for resources for health and social safety nets. Moreover, as governments look to implement ambitious stimulus packages to help society recover from the COVID-19 pandemic, reforming harmful support can both provide valuable resources and help governments to 'build back better' (OECD, 2020[204]). While reforms can be challenging, there is also considerable scope for win-win outcomes.

Countering illicit wildlife trade and improving the regulation of legal wildlife trade

Environmental crimes such as illegal wildlife trade, illegal extraction of minerals and oil, forestry crimes, and illegal fishing are valued at USD 110-281 billion globally and have adverse impacts on biodiversity, climate and land degradation, driving declines in protected species population, human migration and, weakening of security (Nellemann et al., 2018[205]). Illicit wildlife trade alone is valued at USD 7-23 billion (Wyler and Sheikh, 2013[206]), although these numbers need to be treated with some caution as lack of data means there is still a large degree of uncertainty (Dagupta, 2021[207]). Illicit wildlife trade can have negative impacts on biodiversity, leading to population declines (Morton et al., 2021[208]) and even extinction in extreme cases (Brook et al., 2014[196]). Wildlife trade can also negatively impact rural livelihoods and cause the loss of culturally valuable species. Further, proceeds of wildlife crime flow across borders and through financial systems globally raising questions regarding money laundering and financial integrity (OECD, 2019[209]).

Wildlife trade has large impacts on a subset of commercially valuable species, and around 24% of terrestrial bird, mammal, amphibian and reptile species are traded globally (Scheffers et al., 2019[210]). The impacts of trade are particularly important for species where other more diffuse threats, such as land-use change, are already placing populations under significant pressure (Symes et al., 2018[211]). Importantly, wildlife trade (both domestic and international) may also play a role in the emergence and transmission of infectious diseases (e.g. SARS and COVID-19) (Pavlin, Schloegel and Daszak, 2009[212]; Huang et al., 2020[213]). Addressing wildlife trade is therefore important from an environmental, economic and public health perspective.

International wildlife trade is regulated by the Convention on Trade in Endangered Wild Species of Fauna and Flora (CITES), which entered into force in 1975. Despite its long history and considerable success in regulating some wildlife trade, implementation of the legal and administrative requirements of the convention has been weak in some countries, particularly in regions rich in high value wildlife (e.g. South East Asia) (OECD, 2019[209]). Illicit trade in wildlife products is clandestine and difficult to monitor, and, combined with weakness of CITES and shortfalls in data collection, mean much remains unknown about both legal and illegal trade in wildlife products (OECD, 2012[194]; OECD, 2019[209]).[57]

Effectively addressing illicit wildlife trade requires approaches that tackle not only the trade itself but also the demand for its services. The drivers of demand for wildlife products are highly varied and depend on the cultural, economic and cultural context of the consumers. Understanding how these variables drive demand for wildlife products is, therefore, fundamental to reducing the biodiversity impacts of illicit wildlife trade (Veríssimo, 't Sas-Rolfes and Glikman, 2020[214]). Effectively tackling the drivers of demand for wildlife products requires co-operation between relevant countries and expert organisations to develop the context specific interventions needed.

Generally, illicit wildlife trade is highly profitable and low risk for those directly involved. Legal loopholes and gaps in implementation of laws at a national level mean wildlife crime often goes unpunished. For international trade, corruption at maritime ports, airports and at land border crossings provides channels for the entry of a range of illicit products. The links between corruption, organised crime, money laundering and wildlife trade are recognised at the international level through the G20 High Level Principles on Combatting Corruption Related to Illegal Trade in Wildlife and Wildlife Products and the Financial Action Task Force (FATF) guidelines on Money Laundering and the Illegal Wildlife trade (FATF, 2020[215]). Addressing illicit wildlife trade, therefore, requires a broad focus on the governance environment that

enables actors in the value chain to profit. The OECD Task Force on Countering Illicit Trade and FATF have a number of recommendations for governments trying to address wildlife trade. These include:

- Prioritise combatting the financial flows associated with illicit wildlife trade by reinforcing engagement of financial intelligence units in follow-the-money investigations related to wildlife crime and strengthening beneficial owner transparency, both at national level and in co-operation with international partners.
- Strengthen co-operation between law enforcement and wildlife conservation authorities, through the drafting of strategic objectives and joint-investigations.
- Call for anti-corruption investigations by police and anti-corruption authorities on the back of arrests for wildlife crimes to identify and prosecute related criminal networks.
- Foster international co-ordination and operations with relevant counterparts.

Promoting responsible, transparent and sustainable supply chains and investment

Transparency of global supply chains is fundamental to promoting better biodiversity outcomes from trade. Sustainable and transparent global supply chains can facilitate the positive impacts of trade by informing production and consumption decisions that can lead to greater efficiency and reduced impacts. By promoting and implementing internationally recognised Responsible Business Conduct (RBC) standards in commodity supply chains, governments and businesses have an opportunity to support sustainable production and consumption patterns, promote transparency and address the root causes of biodiversity risks throughout global supply chains.

The OECD Guidelines for Multinational Enterprises (the Guidelines) and related due diligence guidance provide a framework to help enterprises manage a wide range of RBC risks throughout their supply chains. The Guidelines provide recommendations to businesses on how to manage environmental risks and improve environmental performance, including throughout their supply chains (OECD, 2011[158]) (see section 4 for further discussion). Additional recommendations on disclosure, human rights, consumer interests and science and technology are also relevant to biodiversity-related considerations by business. Guidance from the OECD on due diligence[58] also provides companies with clarity on ways in which they can address and report on biodiversity and other environmental impacts.[59] The Guidelines recommend that businesses disclose information on the potential environmental and social impacts of their activities. This information can help businesses in their implementation of RBC standards, and guide buyers and end consumers towards sustainable consumption patterns.

More specifically, the OECD-FAO Guidance for Responsible Agricultural Supply Chains (2016[216]) (here after OECD-FAO Guidance) provides a practical tool for public and private investors in the sector, that encompasses environmental sustainability. The guidance refers to a number of critical environmental matters, spanning environmental protection and the sustainable use of natural resources, climate change and biodiversity, and encourages companies to contribute to the development and diffusion of environmentally-friendly technologies.

The OECD-FAO Guidance also recommends enhanced due diligence in 'red flag' contexts, including, for example, when operating in areas affected by environmental degradation or protected areas (red flag locations); producing or sourcing commodities with adverse environmental outcomes (red flag products); and business partners linked to such locations or products (red flag business partners). Further, it encourages companies to use existing impact and risk assessments to identify and assess environment related risks such as Environmental Impact Assessments (EIAs), Environmental, Social, and Human Rights Impact Assessments (ESHRIAs) and tools developed by environment groups such as Supply Risk developed by the World Wildlife Fund (WWF).

The fraudulent misrepresentation of the origin of goods, such as the products of IUU fishing, illegal logging and mineral extraction can have significant impacts on biodiversity. The complex nature of global commodity supply chains mean fraudulent goods are difficult to identify. Developing data and implementing technological solutions, such as blockchain, can help track and manage the flow of goods through the entire supply chain more accurately (Box 5.1). This in turn can help the identification of fraud and anomalies through increased transparency on who is handling the goods at each point in the supply chain. Further, improved supply chain transparency can help target outreach, law enforcement efforts, capacity building, development support and other efforts (e.g. investments in logistics, security and infrastructure) to the most vulnerable segments of the supply chain (OECD, 2019[217]).

Smooth co-operation between the government agencies responsible for managing trade-related processes in supply chains (e.g. customs, environmental protection agencies, sanitary agencies etc.) and appropriate legal and technological frameworks are essential for the implementation of new technologies to ensure supply chain transparency. When adopting an advanced technological solution it is important to avoid creating a 'digital divide', by working closely with any informal and less sophisticated supply chain actors, who may be prevented from participating in legitimate markets due to a reliance on paper based systems or other low-tech solutions.

Quantifying and mapping biodiversity impacts and dependencies are crucial to inform decisions of businesses, consumers and policy makers. Governments can have a role in supporting connectivity and the development of a data collection infrastructure (sensors network, remote sensing, etc.) for sectors important to biodiversity, such as agriculture, including by directly investing in data collection technologies where there is a public good or public interest rationale to do so (OECD, 2019[218]).

Box 5.1. Digital technologies to enhance transparency of pesticide supply chains

The growth of trade in illegal pesticides is a major concern. A large volume of counterfeit, fake and unauthorised pesticides are reaching farmers, with detrimental consequences for biodiversity. Blockchain is a potentially valuable technology for ensuring full traceability along complex global supply chains, reducing opportunities for fraud. In addition to the quick and accurate detection of illegal products, blockchain enables secure data exchange between multiple stakeholders and automatic processing, such as through smart contracts. Wider adoption of these tools by Customs and other control agencies would significantly reduce the risk of entry and sale of illegal pesticides and their associated biodiversity impacts. Yet, blockchain is not a panacea for trade in illegal pesticides. The high investment costs of information technology development and infrastructure can hinder adoption of digital solutions, especially in developing countries. An effective strategy would require a combination of policy actions based on using digital technologies (e.g. blockchain, AI, big data analytics, the Internet of things, geospatial data) and existing best practices, such as the OECD guidance to identify illegal trade of pesticides. Other policy interventions, including raising public awareness of the risks associated with illegal pesticides, as well as legislative solutions, such as strengthening sanctions and closing legal loopholes, will also be required.

Source: Frezal and Garsous (2020[219]), New Digital Technologies to Tackle Trade in Illegal Pesticides, OECD publishing, Paris and OECD OECD, Best Practice Guidance to Identify Illegal Trade of Pesticides, OECD publishing, Paris.

Aligning biodiversity and trade objectives in trade agreements

Free trade agreements (FTAs) are increasingly supporting sustainable development and can play an important role in promoting positive biodiversity outcomes from trade. Almost all FTAs signed in the last 30 years contain at least one environmental provision (WTO/UNEP, 2018[219]), with the number of

environmental provisions and their level of detail increasing significantly in recent years (WTO/UNEP, 2018[219]).[60] However, the lack of a counterfactual (i.e. what would have happened in the absence of the FTA) and the complex nature of biodiversity-trade linkages mean the impacts of environmental provisions in trade agreements are difficult to measure.

Ex ante impact assessments of trade agreements on biodiversity can help promote understanding and transparency of the potential impacts, inform the design of FTAs and promote the positive impacts of trade on biodiversity. Currently only a small number of economies – including the European Union, Switzerland and Canada – conduct broad sustainability assessments of trade agreements that include the impacts on biodiversity.[61] *Ex ante* assessments of biodiversity impacts can help countries identify where domestic consumption of traded goods may have negative biodiversity impacts in other regions (e.g. leading to deforestation and habitat loss). Consequently further consideration and policy intervention, such as reforming harmful support or increasing international assistance, to promote positive biodiversity outcomes may be required to address these biodiversity 'pressure points'.

In some cases, the quantitative measurement of biodiversity impacts, such as habitat degradation and changes in species composition and abundance, and changes in ecosystem functioning is challenging, meaning that quantitative *ex ante* assessments are not possible for some biodiversity impacts. Even where data are available, it can be difficult to translate this into a comparable metric, such as monetary values (see section 2), further complicating analysis of the biodiversity impacts of trade agreements. Development of methodologies for integrating biodiversity impacts into the assessment of FTAs via economic models and life cycle analysis can help overcome these issues (OECD, 2020[65]). Where quantitative analyses of biodiversity impacts are not possible, governments can also consider qualitative analysis of impacts. Techniques such as stakeholder consultation can foster peer learning between different policy communities and help to build legitimacy for FTAs (e.g. labour standards (Postnikov and Bastiaens, 2014[220])). The process of measuring biodiversity impacts of FTAs *ex ante* can also result in improved institutional understanding of issues and help identify opportunities both to address biodiversity impacts embedded in trade and to use trade to promote biodiversity outcomes.

Finally, trade agreements can directly address issues relating to the biodiversity impacts of trade, such as harmful support. Currently, members of the WTO are negotiating binding disciplines on fisheries subsidies, which could have considerable positive impacts on biodiversity. However, further development of data sources, such as the OECD Fisheries Support Estimate database, would be needed to support any eventual agreement.

Glossary

Abiotic flows: contributions to benefits from the environment that are not underpinned by or reliant on ecological characteristics and processes.

Biodiversity: biological diversity (biodiversity) means 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.

Ecosystem services: The benefits ecosystems provide to humans. The Millennium Ecosystem Assessment categorised these as provisioning, regulatory, supporting and cultural services.

Financial materiality: refers to the material risks likely to influence enterprise value, including financial performance of individual companies at the micro-level, and broader financial stability at the macro-level, resulting from the loss of biodiversity and ecosystem services (and other environmental challenges).

Double materiality: refers to the fact that biodiversity and broader sustainability matters can move between environmental materiality lens and financial materiality lens. The size of these lenses is not static.

Inclusive wealth: The social value (based on accounting prices) of an economy's total stock of natural, produced and human capital assets.

Natural capital: The stock of renewable and non-renewable natural assets (e.g. ecosystems) that yield a flow of benefits to people (ecosystem services). The term 'natural capital' is used to emphasise it is a capital asset, like produced capital.

Tipping point: A set of conditions of an ecological system where further perturbation will cause change to a new state and prevent the system from returning to its former state.

Zoonosis: An infectious disease that has jumped from a non-human animal to humans. Zoonotic pathogens may be bacterial, viral or parasitic, or may involve unconventional agents and can spread to humans through direct contact or through food, water or the environment.

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Notes

[1] Metz Charter is available here: www.elysee.fr/admin/upload/default/0001/04/e69a15d02877b265898bd98391adf06fa0bff386.pdf

[2] Primary forests are defined by FAO as naturally regenerated forests of native tree species where there are no clearly visible indications of human activity and the ecological processes are not significantly disturbed.

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

[4] For an overview of the other limitations of GDP see Bergh (2009[251]), The GDP paradox.

[5] Social capital is treated as an enabling capital in the Dasgupta Review.

[6] Conventional measures of multifactor productivity tend to overestimate productivity growth in countries where output growth relies on depletion of natural capital or on heavily polluting technologies, and to underestimate productivity growth in countries that invest in more efficient use of natural resources or in pollution abatement. OECD's environmentally-adjusted multi-factor productivity (EAMFP) indicator is work-in-progress, with the coverage of environmental services currently limited to air emissions and subsoil assets due to data limitations. It is important to note that the EAMFP is based on market prices. It does not account for non-market environmental damages and other social costs of pollution, and is therefore not a measure of social welfare.

[7] Thematic accounts are standalone accounts on topics of interest in their own right and also of direct relevance in the measurement of ecosystems and in assessing policy responses. Accounting for biodiversity considers both ecosystem and species-level biodiversity. Biodiversity is considered primarily a characteristic of ecosystem assets rather than an ecosystem service. In accounting terms, this permits recognition of declines or improvements in biodiversity over time and links to the capacity of ecosystems to supply ecosystem services.
[8] Australia, Liberia, Mauritius, Mexico, Netherlands, Norway, Peru, South Africa, Uganda.
[9] https://seea.un.org/news/aries-seea-rapid-generation-natural-capital-accounts
[10] https://www.eo4ea.org/
[11] https://www.wavespartnership.org/
[12] https://seea.un.org/home/Natural-Capital-Accounting-Project
[13] https://seea.un.org/content/enhanca-enhance-natural-capital-accounting-policy-uptake-and-relevance
[14] "Living in harmony with nature" where "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people"
[15] Complementary guidance on "Enabling a Natural Capital Approach" has also been developed (Defra, 2020[254]).
[16] The estimate of biodiversity-harmful support includes expenditure (budgetary transfers) but also market price support. It is therefore not directly comparable with positive biodiversity expenditure.
[17] In document CBD/SBI/3/5 on Resource Mobilisation, proposed elements for the post-2020 Global Biodiversity Framework include (Annex 1, para 3): "(a) By 2030, all countries have achieved significant progress in fiscal, budgetary, and financial mainstreaming, including by reviewing all relevant government budgets to result in at least no net harm to biodiversity…"
[18] By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.
[19] Draft Target 17 CBD/SBSTTA/24/3Add.1
[20] OECD is currently collecting updated country-level data on biodiversity-offset programmes and the finance they mobilise.
[21] The total number of PES schemes globally is estimated to be over 300.
[22] The eight countries are China, Costa Rica, Japan, Norway, Peru, Switzerland, the United Kingdom, and the United States.
[23] For a discussion of key design features for biodiversity offsets see (OECD, 2016[98])
[24] At the international level, the need to reform harmful support is recognised at the G7 level where Leaders committed to the "elimination of inefficient fossil fuel subsidies" at the Summit in Ise-Shima in May 2016. More broadly, Aichi target 3 calls for "incentives, including subsidies, harmful to biodiversity" to be "eliminated phased out or reformed" and SDG target 14.6 calls for the prohibition of certain fisheries subsidies.
[25] The Green Recovery Database currently contains around 760 measures spread over 43 countries and the EU. While some sub-national measures are included, coverage focuses on national-level measures, which may skew results for some countries. Measures include tax reduction or other subsidies (not R&D); grant or loan (including interest-free loans and guarantees); regulatory change; skills and training; R&D specific subsidies. The database is currently being updated and it will be made publicly available in April 2021.
[26] NextGenerationEU is a EUR 750 billion temporary recovery instrument to help repair the immediate economic and social damage brought about by the coronavirus pandemic. The political agreement of the Special European Council of 17-21 July 2020 sets an overall climate target of 30% applicable to the total amount of expenditure from the EU budget 2021-27 and Next Generation EU.
[27] For a focussed discussion on development finance and COVID-19 see OECD's brief on The Impact of the Coronavirus (COVID-19) Crisis on Development Finance, https://www.oecd.org/coronavirus/en/policy-responses
[28] According to an S&P Global Trucost analysis of 3,500 companies representing 85% of global market cap, 65% of companies business models align with the SDGs), yet less than 1% of business models align with SDGs 14 and 15, "Life below Water," and "Life on Land".
[29] Only 36% of respondents to the World Economic Forum (WEF)'s *Global Risk Report 2021* forecast that human environmental damage will present clear and present dangers in the short term (0-2 years) (WEF, 2021[222]). According to a recent survey of asset managers and asset owners, .fewer than one in ten respondents identified the financial sector as a top three sector at risk from biodiversity loss. Only a minority of investors and other financial actors have started to assess, manage or report on biodiversity: 72% of respondents have not assessed the impact of their investments on biodiversity; 27% are not currently addressing biodiversity; and less than 10% have measurable biodiversity targets (Responsible Investor & Credit Suisse |, 2021[148]).
[30] Examples of initiatives include: the future Task Force on Nature-related Financial Disclosures (TNFD); the Business for Nature coalition (Business for Nature, 2021[244]); the Finance for Biodiversity Pledge (Finance for Biodiversity Pledge, 2021[238]); the Natural Capital Finance Alliance (NCFA, 2021[229]); EU Business@Biodiversity Platform (European Commission, 2021[239]); CBD's new Finance Engagement Programme; the Capitals Coalition and its

Natural Capital Protocol (Capitals Coalition, 2021[252]) (Capitals Coalition, 2021[253]); along with domestic and sectoral initiatives.

[31] Operational risks can be associated with market (e.g. credit rating downgrades and share price losses from ecosystem disruption or tipping points) and credit risks (e.g. increased insurance claims, or risks to real estate) (Dasgupta, 2021[1]). Globally, the loss of mangroves could increase annual damages to property by 16% (USD 82 billion) (Beck et al., 2018[248]) (WEF, 2020[4]). Conversely, protecting coastal wetlands could save the insurance industry USD 52 billion per year through reduced losses from storm and flood damage (Barbier et al., 2018[249]).

[32] Examples of market transition risks include long-term profitability changes due to market shifts as a result of actions to address biodiversity loss, or repricing of assets as a result of natural capital regulatory; Credit-related transition risks include: increased cost of capital or lending requirements linked to increased environmental standards; and stranding assets, through write-downs or write-offs (Dasgupta, 2021[1]). Also see (PwC and WWF, 2020[135]); (AXA and WWF, 2019[132]).

[33] The firm Bayer for instance lost almost 40% of its market capitalisation after acquiring the company Monsanto, which was accused of producing a pesticide harming honeybees (Bender, 2019[247]). And Indonesia's 2019 permanent moratorium on clearing primary forests and peatlands is expected to reduce business activities like palm oil plants and logging, with implications for financial firms exposed to those assets (McCraine et al., 2019[232]) (Dasgupta, 2021[1]). Similarly, the transition to business models that are less nitrogen-intensive could expose the three largest Dutch banks to transition risks for the EUR 81 billion in loans to Dutch sectors with nitrogen-emitting activities (DNB and PBL, 2020[131]).

[34] They include liability risks arising from physical or biological impacts (e.g. from disclosing local biodiversity impacts), transition to a sustainable or regenerative economy, or misrepresentations of biodiversity risks or impacts (Commonwealth Climate and Law Initiative, 2020[242]). In 2019, bond investors filed securities action against the Pacific Gas and Electric Company for misrepresenting efforts to address California's wildfire risks in their bond issuance (Dasgupta, 2021[1]) (PwC and WWF, 2020[135]).

[35] A dozen accounting approaches exist that are in line with the Natural Capital Protocol principles, i.e. relevance, rigor, replicability and consistency (Natural Capital Coalition, 2016[230]); (Lammerant et al., 2019[141]).

[36] Metrics and measurement approaches include: MSA (Mean Species abundance); PDF (Potentially Disappeared Fraction); STAR (Risk of extinction); aggregate index such as the biodiversity impact index (used by LIFE Key); and monetary value (e.g. euros, e.g. used by Kering's Environment Profit & Loss (EP&L)) (Lammerant et al., 2019[141]) (OECD, 2019[140]) (Finance for Biodiversity, 2021[146]).

[37] Examples include: CBF – Corporate Biodiversity Footprint (Iceberg Datalab and I Care Consult as scientific partner); BFFI – Biodiversity Footprint Financial Institutions (CREM and PRé Sustainability, together with ASN Bank); STAR – Species Threat Abatement and Restoration (IUCN); GBSFI – Global Biodiversity Score for Financial Institutions (CDC Biodiversité); BIA – Biodiversity Impact Analytics (Carbon 4 Finance, CDC Biodiversité); and ENCORE – Exploring Natural Capital Opportunities, Risks and Exposure (UNEP-WCMC, UNEP FI & NCFA); (Finance for Biodiversity, 2021[146]).

[38] i.e. assessment of current or future performance; tracking progress to targets; comparing options; assessment or rating by third parties; screening and assessment of opportunities; biodiversity accounting; and ESG screening and engagement (Finance for Biodiversity, 2021[146]).

[39] The type of data commonly used as input data to measurement tools include: state data; data related to emissions, resources and pressures; and economic quantification of activities (Finance for Biodiversity, 2021[146]).

[40] For instance, developers of the Biodiversity Footprint Financial Institutions (BFFI) tools (ASN Bank, PRé Sustainability and CREM) are assessing companies MSCI index to develop scores that will be made available for all financial institutions with a Refinitiv license (Finance for Biodiversity, 2021[146]).

[41] An increasing number of central banks, supervisors financial institutions are trying to better assess the economic and financial impact of climate-related financial risks (e.g. physical and transition risks) (Carney, 2015[243]). This is partly due to a transition in thinking amongst investors based on implementation of the recommendations of the FSB's industry-led Task Force on Climate-related Financial Disclosures (TCFD), as well as momentum amongst financial regulators generated by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) (TCFD, 2017[225]).

[42] Institutional investors can invest 11.4 trillion in infrastructure, yet they hold only USD 314 billion in green infrastructure (OECD, 2020[167]).

[43] Strong growth in ESG investing has encouraged a proliferation of disclosure frameworks, metrics, rating methodologies and investment approaches, which creates further challenges to ensure that sustainable finance delivers on biodiversity impacts (Boffo and Patalano, 2020[246]). ESG practices vary so widely that they lack clear alignment with both financial materiality and environmental goals (Boffo et al., 2020[245]).

[44] Using a *dynamic materiality* approach. They include CDP, the Climate Disclosure Standards Board (CDSB), the Global Reporting Initiative (GRI), the International Integrated Reporting Council (IIRC) and the Sustainability Accounting Standards Board (SASB). (IMP, 2020[234]).

[45] Along with the need for greater coordination to standardise sustainability disclosure practices (OECD, 2020[228]). The IFRS Foundation Consultation suggests that a new Sustainability Standards Board (SSB) could consider how to extend its scope beyond financial materiality, in light of evolving stakeholder views (IFRS Foundation, 2020[235]).

[46] Land Degradation Neutrality (LDN) is defined by the Parties to the UN Convention to Combat Desertification as "a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems." (UNCCD, 2021[223]).
[47] Although not all 64 trillion are investable in nature-positive activities due to constraints in investment mandates (OECD, 2020[167]).
[48] Including biodiversity offsets, sustainable commodities, forest carbon finance, payments for ecosystem services, water quality trading and offsets, philanthropic spending, private contributions to conservation non-governmental organisations (NGOs), and private finance leveraged by bilateral and multilateral public development finance (OECD, 2020[81]).
[49] See (OECD, 2018[226]) (OECD, 2019[140]) (OECD, 2021[227]) (OECD, 2015[178]) for more information.
[50] The OECD *Policy Framework for Investment* (PFI) is the most comprehensive and systematic approach for improving investment conditions ever developed. The PFI looks at 12 different policy areas affecting investment: investment policy, investment promotion and facilitation, competition, trade, taxation, corporate governance, finance, infrastructure, developing human resources, policies to promote responsible business conduct and investment in support of green growth, and lastly broader issues of public governance (OECD, 2015[178]).
[51] Examples include: the Coalition for Private Investment in Conservation (CPIC, 2021[241]); the Nature+ Accelerator Fund set up by IUCN, Mirova and the CPIC with GEF funding (IUCN, 2021[233]); EIB's Natural Capital Financing Facility (EIB, 2021[240]) (EIB, 2019[255]); or the Natural Capital Investment Alliance founded by HSBC Pollination Climate Asset Management, Lombard Odier and Mirova (Mirova, 2021[231]) (Global Canopy, 2021[236]).
[52] See (OECD, 2018[226]) (Global Canopy, 2021[236]) (Green Digital Finance Alliance, 2020[188]).
[53] Following the publication of the EU Taxonomy Regulation framework on June 18 2020, the EC appointed a Platform on Sustainable Finance to which the OECD is an observer. The mandate of the Platform is among other things to advise the European Commission on addressing other sustainability objectives, including activities that significantly harm environmental sustainability, based on an assessment of relevant impacts.
[54] Recent analysis by MSCI found for instance that the majority of soy exports of the world's largest soy processors, traders and purchasers remains uncertified to third-party sustainability standards.
[55] For example, it is estimated that more than 50% of the biodiversity loss associated with consumption in developed economies occurs outside their territorial boundaries (Wilting et al., 2017[221]). There are, however, complex debates over the respective roles and responsibilities of developed and developing countries in this debate. For example, some argue that developed countries, which deforested over the course of their development, should contribute to the cost of conservation of the world's remaining forests in developing countries (see for example the REDD+ initiative). Equally, while much of the world's biodiversity is found in tropical and subtropical areas dominated by developing countries, there are also debates about how to combine development and conservation, and concerns about sovereignty, global public goods and world heritage.
[56] The total net transfers for agriculture support amount to USD 708 billion (EUR 620 billion) per year, offset by an implicit taxation of farmers in some countries worth more than USD 89 billion (EUR 78 billion) per year. Of this USD 708 billion, only around USD 136 billion is devoted to research, innovation and support services to farmers.
[57] There is a need for greater transparency across global supply chains to tackle wildlife trade, promote responsible business conduct and to facilitate public-private cooperation to ensure resilience is addressed in OECD (2021, forthcoming) Fostering Economic Resilience in a World of Open and Integrated Markets: Risks, Vulnerabilities and Areas for Policy Action, report prepared for the UK G7 presidency.
[58] For the most recent non-sector specific guidance, see the OECD Due Diligence Guidance for Responsible Business Conduct; http://mneguidelines.oecd.org/duediligence/.
[59] See *forthcoming* OECD (2021) Responsible Business Conduct tools and instruments to address environmental challenges
[60] For example, more than half of all FTAs notified to the World Trade Organization (WTO) between 2010 and 2012 included environmental provisions that go beyond just environment-related language in the preamble and reinstating environmental exceptions provisions of the General Agreement on Tariffs and Trade; this is an increase from 29% for FTAs signed before 2010 (George and Yamaguchi, 2018[237])
[61] EU Sustainability Impact Assessments (SIA) cover a range of environmental issues including greenhouse gas emissions, air quality, use of energy, water quality and resources, land use, soil quality, waste and waste management, biodiversity, ecosystem services and protected areas (EC, 2016[250])