Mobilising Finance for Global Biodiversity Targets

The article provides a review of biodiversity trends, drivers of biodiversity loss and looks at how finance can be mobilised to help achieve the targets set by the Kunming-Montreal Global Biodiversity Framework (GBF). The GBF states that US$200 billion has to be raised by 2030 to finance the other biodiversity goals. So far, the amounts available are much smaller. On the private finance side, there are a number of new instruments, such as biodiversity credits. On the public finance side, a number of financial instruments aim to establish proof of concept or a commercial track record of new solutions, which can become either replicable or scalable. Also considered are options to reduce debt servicing in developing countries and allocate some of that to biodiversity.

El artículo proporciona una revisión de las tendencias de la biodiversidad, los factores que impulsan la pérdida de biodiversidad y analiza cómo se puede movilizar financiamiento para ayudar a alcanzar los objetivos establecidos por el Marco Global de Biodiversidad (GBF) de Kunming-Montreal. El GBF afirma que se deben recaudar 200 mil millones de dólares hasta 2030 para financiar los demás objetivos de biodiversidad. Hasta ahora, las cantidades disponibles son mucho menores. Por el lado de las finanzas privadas, hay una serie de instrumentos nuevos, como los créditos para la biodiversidad. Por el lado de las finanzas públicas, una serie de instrumentos financieros tienen como objetivo establecer una prueba de concepto o un historial comercial de nuevas soluciones, que pueden volverse replicables o escalables. También se consideran opciones para reducir el servicio de la deuda en los países en desarrollo y asignar parte de ello a la biodiversidad.

Artikuluak biodibertsitatearen joerak eta biodibertsitatearen galera bultzatzen duten faktoreak berrikusten ditu, eta Kunming-Montrealeko Biodibertsitatearen Esparru Globalak (GBF) ezarritako helburuak lortzen laguntzeko finantzaketa nola mobilizatu daitekeen aztertzen du. GBFk adierazi du 2030era arte 200 mila milioi dolar bildu behar direla biodibertsitatearen gainerako helburuak finantzatzeko. Orain arte, eskuragarri dauden kopuruak askoz txikiagoak dira. Finantza pribatuei dagokienez, zenbait tresna berri daude, hala nola biodibertsitaterako kredituak. Finantza publikoen aldetik, finantza-tresna batzuen helburua da soluzio berrien kontzeptu-proba bat edo merkataritza-ibilbide bat ezartzea, erreplikagarri edo eskalagarri bihur daitezkeenak. Era berean, garapen bidean dauden herrialdeetan zorraren zerbitzua murrizteko eta horren zati bat biodibertsitatera bideratzeko aukerak ere aztertzen dira.

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Table of contents

Keywords: Global Biodiversity Framework, Natural Capital Accounting, IPBES, externalities.

Palabras clave: Marco Mundial de Biodiversidad, Contabilidad del Capital Natural, IPBES, externalidades.

JEL Codes: Q56, Q57, H23, D62

DOI: https://doi.org/10.69810/ekz.1485

Entry data: 2024/09/06 Acceptance data: 2024/11/19

This review draws on a background paper I authored for the World Bank in 2024 titled: "Role of Natural Capital Data, Accounting and Evidence to Inform Biodiversity Policies in Developing Countries". I would like to thank Bekele Ambaye Shiferaw, Uju Dim, Tijen Arin, Sofia Elisabet Ahlroth and Matias Piaggio for comments and inputs to that paper.

1. INTRODUCTION

1.1. Biodiversity as a Key Part of Ecosystems

The Convention on Biological Diversity defines the term biodiversity "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». The same reference source defines an ecosystem as "a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit» [1] and ecosystem services as the benefits people obtain from ecosystems. The focus of much of the literature has been on the nature of these services and their value.

The link between biodiversity and ecosystem services is central to understanding both but is complex. The UN Guidance on Environmental-Economic Accounting—Ecosystem Accounting (UN *et al.*, 2021) notes that "biodiversity is integral to the maintenance of ecosystem integrity that is the reference from which the condition of

[1] www.cbd.int/convention/articles/default.shtml?a=cbd-02

ecosystem assets is assessed". The condition of ecosystems is key to the valuation of the services of such ecosystems. As the UN Report on Natural Capital Accounting for Integrated Biodiversity Policies notes, ecological and species diversity influence the condition and characteristics of ecosystems (United Nations, 2020). A large body of work involving field experiments, site studies, and aerial surveys complemented by mathematical modelling has found that a number of diversity indicators (e.g., covering soil and species diversity) are strongly related to ecosystem productivity (Dasgupta, 2021).

In defining the different components of an ecosystem, biodiversity indicators are mainly present in determining the biotic ecosystem characteristics. Variables that describe species composition, ecosystem structure and ecosystem processes are also used to characterize biodiversity and are therefore considered as essential biodiversity variables. Thus, measures of biodiversity play a critical role in determining ecosystem condition and consequently the value of the ecosystem to the economy[2].

This article reviews biodiversity trends, and drivers of biodiversity loss and addresses how finance can be mobilised to help achieve the targets set by the Kunming-Montreal Global Biodiversity Framework (GBF) with the support of the natural capital accounting established by the UNSEEA. The GBF is an outcome of the 2022 United Nations Biodiversity Conference and it aims to halt and reverse biodiversity loss by 2030. Trends in species and ecosystems are summarized in section 1.2. Section 1.3 lays out the drivers of biodiversity loss and the economic case for nature. Section 2 looks at the role of natural capital accounting in relation to the GBF targets. Section 3 focuses on the finance needed to achieve several of the targets and the roles of the public and private sectors in providing that finance.

1.2. Trends in Species and Ecosystems

According to the global assessment of biodiversity and ecosystem services undertaken by IPBES (IPBES, 2019) the overall picture for both biodiversity indicators and ecosystem services is one of deterioration. Global indicators of ecosystem extent and condition show an average decrease of 47 per cent from their estimated natural baselines, with many continuing to decline by at least 4 per cent per decade. Furthermore, the decline is higher in areas where the biodiversity is greater such as terrestrial "hotspots" of endemic species. Globally, while the net rate of forest loss has halved since the 1990s this has been largely because of net increases in temperate and high-latitude forests; high- biodiversity tropical forests continue to dwindle, and global forest area is now approximately 68 per cent of the estimated pre-industrial level. Inland waters and freshwater ecosystems show among the highest rates of decline. Only 13 per cent

[2] Although there is a strong overlap between measures of biodiversity and ecosystem condition, there are also differences. A s the Guidance Report observes, there are different spatial and temporal dynamics between individual species and ecosystems. Therefore, not all species or species-based biodiversity indicators are suitable to assess condition at all scales.

of the wetland present in 1700 remained by 2000; recent losses have been even more rapid (0.8 per cent per year from 1970 to 2008).

In marine ecosystems, seagrass meadows have decreased in extent by over 10 per cent per decade from 1970 to 2000. Live coral cover on reefs has nearly halved in the past 150 years, the decline dramatically accelerating over the past two or three decades due to increased water temperature and ocean acidification interacting with and further exacerbating other drivers of loss. These coastal marine ecosystems are among the most productive systems globally. Their loss and deterioration reduce their ability to protect shorelines and the people and species that live there from storms, as well as their ability to provide sustainable livelihoods. Severe impacts on ocean ecosystems are illustrated by 33 per cent of fish stocks being classified as overexploited.

The global rate of species extinction is already at least tens to hundreds of times higher than the average rate over the past 10 million years and is accelerating. Human actions have already driven at least 680 vertebrate species to extinction since 1500. The threat of extinction is also accelerating: in the best-studied taxonomic groups, most of the total extinction risk to species is estimated to have arisen in the past 40 years.

Domestic varieties of plants and animals are the result of natural and human-managed selection, sometimes over centuries or millennia, and tend to show a high degree of adaptation (genotypic and phenotypic) to local conditions. As a result, the pool of genetic variation which underpins food security has declined. Many hotspots of agrobiodiversity and crop wild relatives are under threat or not formally protected. The conservation status of wild relatives of domesticated livestock has also deteriorated. These wild relatives represent critical reservoirs of genes and traits that may provide resilience against future climate change, pests and pathogens and may improve current heavily depleted gene pools of many crops and domestic animals. Available data suggest that genetic diversity within wild species globally has been declining by about 1 per cent per decade since the mid-19th century; and genetic diversity within wild mammals and amphibians tends to be lower in areas where human influence is greater. Figure 1 provides an overview of the global indicators of natural ecosystem structure. It shows decadal declines in most indicators as well as an overall fall relative to pristine conditions for many of them.

1.3. Drivers of Biodiversity Loss and Economic Case for Biodiversity

The drivers of biodiversity loss are separated into direct and indirect (IPBES, 2019). The direct drivers listed are: (a) industrial fishing, which has a footprint four times larger than agriculture, (b) agriculture, including grazing, which has immense impacts upon terrestrial ecosystems, with important differences depending upon enterprise's intensity and size, (c) reductions in forest cover which totalled 290mn has during 1990 to 2015, (d) harvesting of wild plants and animals from land and seascapes, (e) mining, which has risen dramatically, with big impacts on terrestrial biodiversity hotspots and global oceans, mostly in developing areas with weaker regulation and (f) construction of dams, roads and cities, which have strong negative impacts on nature, (g) airborne and seaborne transportation of goods and people has risen dramatically, causing both increased pollution and a significant rise in invasive alien species, (h) illegal extraction – including fishing, forestry and poaching – adds to unsustainability, yet is fostered by markets (local, global) and poor governance.

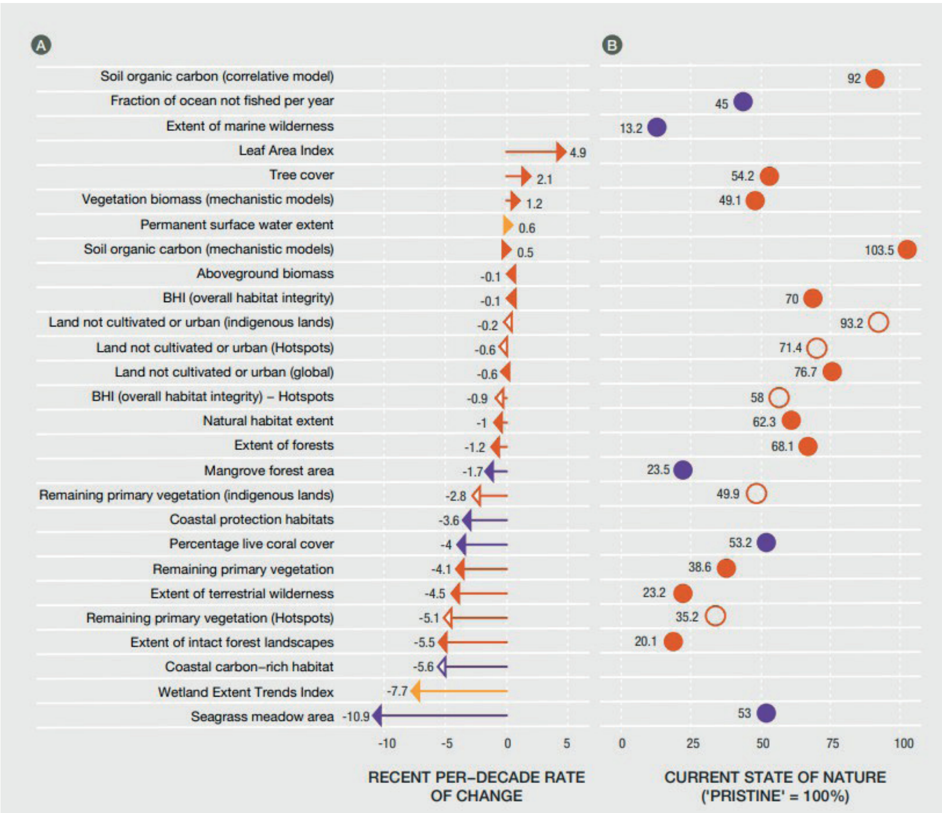
The indirect drivers of loss identified by IPBES are: (a) values (the way nature is conceived and valued), (b) demography (increase in population is a big factor in scales of degradation), (c) loss of indigenous knowledge for managing nature, (d) migration and urbanisation and (e) expanding trade resulting in greater impacts on nature in low-income countries.

While these drivers are pertinent to any analysis of the causes of and solutions to biodiversity loss, once can go further and ask what are the underlying economic and institutional factors behind these drivers. Here a number of market failures stand out. As has been noted by Dasgupta (2021; 2022) and others, subsidies to exploit nature play a major part. Governments have been spending around $700 billion a year on agricultural subsidies, $35 billion on fishery subsidies and $4-6 trillion on energy subsidies. These cause more damage to ecosystems than the benefits they provide to the recipients of the subsidies. The second underlying factor is that much of the biodiversity is part of the global commons, such as oceans and tropical rainforests, that provide benefits to everyone on the planet but are de facto open-access resources and not managed for sustainable global benefits. Some are not managed at all, while others are under national jurisdiction where national rather than global objectives determine the way they are exploited.

Third, is the nature of international trade, which includes a lot of exports of nature-based products from developing countries to developed ones. These exports cause losses of biodiversity in the countries of origin that are not accounted for in the prices paid for the exports. Thus, the exporting countries suffer a loss (along with the global community to some extent) but the importing-rich countries gain more than they would if the costs in terms of losses were accounted for Dasgupta (2022). Because of these market and institutional failures, biodiversity and essential ecosystem services (e.g., regulating services) are not adequately priced and integrated into mainstream economic decisions. Loss of nature and biodiversity often remains unaccounted and not reflected in the countries' national system of accounts or in the firms' balance sheets. As a result, existing metrics for measuring growth and economic performance such as GDP do not capture the social costs associated with the depletion of renewable natural capital including loss of biodiversity and ecosystem services. These underlying factors are at the root of the direct drivers identified in the IPBES report.

The losses of biodiversity and degradation of ecosystems matter because they impact the ecosystem services that provide benefits to people. The IPBES refers to these as Nature's Contributions to People and its review of trends indicates that in 14 of 18 categories under which biodiversity and ecosystems make such contributions, there has been a decline from 1970 to the present (IPBES, 2019)[3]. Only three categories – Energy, Food and Feed and Materials and Assistance have had an increase over this period and one – regulation of ocean acidification – has remained stable.

Figure 1. **GLOBAL INDICATORS OF NATURAL ECOSYSTEM STRUCTURE**



Note: Marine indicators are in purple, terrestrial in orange and freshwater in yellow. Solid symbols are used for overall indicator values, whereas hollow symbols show the indicator is a subset of another indicator.

Source: IPBES (2019)

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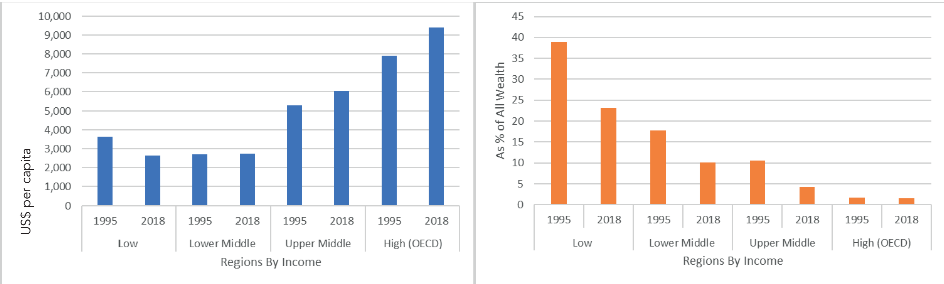
[3] The categories are: Habitat creation and maintenance, Pollination, Regulation of air quality, Regulation of climate, Regulation of ocean acidification, Regulation of freshwater quantity and Freshwater and coastal water quality, Protection and decontamination of soils, Regulation of extreme events, Regulation of detrimental organisms and biological processes, Supply of energy, Supply of food, Supply of materials, Supply of medicinal, biochemical and genetic resources, Learning and inspiration, Physical and psychological experiences, Supporting identities and Maintenance of options (IPBES, 2019 Figure SPM 1).

The contributions of nature are quantified in monetary terms where possible through the concept of natural capital, which is defined as: "that part of nature which directly or indirectly underpins value to people, including ecosystems, species, freshwater, soils, minerals, the air and oceans, as well as natural processes and functions"[4]. As with all forms of capital assets, the value is given as the present value of the flow of services that the asset provides over its lifetime, which may be infinite for an ecosystem that is maintained in a sustainable condition. It is divided between renewable natural capital (in the form of services from forests, fisheries, mangroves, and agriculture) and along non-renewable natural capital (i.e., sub-soil assets based on fossil fuels, minerals etc.).

Using this approach estimates have been made of the value of renewable natural capital, which is the form closely related to biodiversity. The World Bank Comprehensive Wealth Accounting (World Bank, 2021) estimated for all countries the values of renewable and non-renewable natural capital, produced and human capital over the period 1995 to 2018. Renewable natural capital made up 4.3% of all capital in 1995 but this declined to 3.1% by 2018. Figure 2 gives the amounts of per capita renewable natural capital for different income regions over this period as well as the share it makes up of all forms of capital.

Figure 2. **RENEWABLE NATURAL CAPITAL BY REGION**



Source: World Bank (2021)

While the total value of renewable natural capital increased in all regions, in *per capita* terms it declined significantly in the low-income region. The decline was particularly sharp in sub-Saharan Africa (by 42%). This will likely impact most of low-income and vulnerable rural households in that region. Furthermore, "blue natural capital" (fishery and mangroves) declined globally by half over the same period, mainly because of a collapse in the value of fishery of 83%. Despite the fall in *per capita* terms, natural capital remains a large part of all wealth in low-income countries. These estimates of natural capital are not complete (several marine ecosystems

4 Natural Capital Terminology (publishing.service.gov.uk)

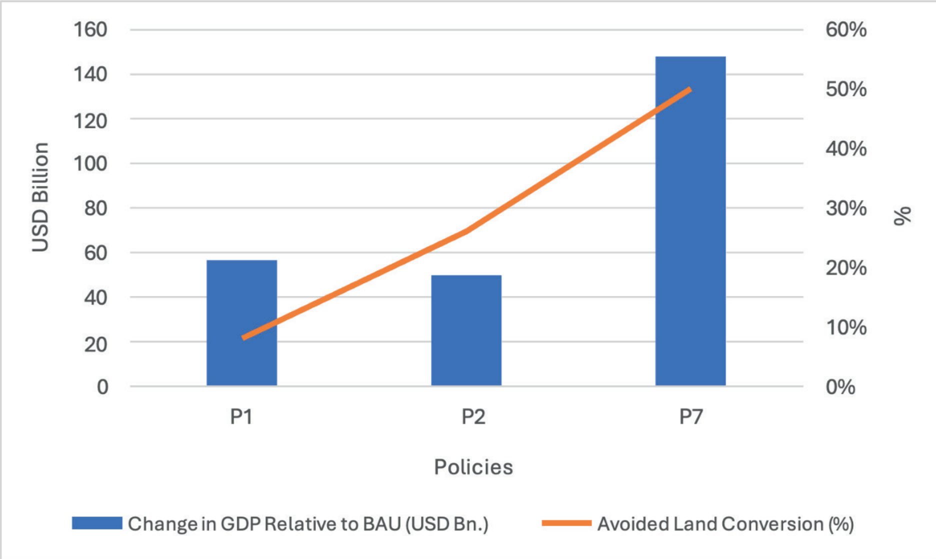
are not covered, for example), but the figures show the importance of natural capital and places where its loss is a matter of concern.

A study that focused on biodiversity loss specifically used an index referred to as mean species abundance (MSA), which reflects the impact of loss of species relative to pristine conditions on the services that ecosystems can provide within different biomes. It is a metric of ecosystem condition in the SEEA EA accounts, in particular of ecosystem compositional characteristics. Such "MSA adjusted areas" have been estimated for different biomes across the world and over time, going back to 1900 and even earlier in the biodiversity modelling work undertaken by the GLOBIO3 team in the Netherlands (Alkemade *et al.*, 2009). Estimates have also been made of the likely loss of ecosystem services by 2050 if no action is taken. In a Costs of Policy Inaction study, Braat and ten Brink (2008) calculate those monetary losses will run at around one per cent of GDP in 2050 and cumulative losses from 2000 to 2050 will be around 7% of 2050 consumption.

While inaction to biodiversity loss will result in significant economic costs, an ambitious program, with the right policies, can avoid such losses. Leclère *et al.* (2020) use an ensemble of land-use and biodiversity models to assess whether —and how— the declines in biodiversity through habitat conversion can be reversed. They show that a program to increase the extent of land under conservation management, restore degraded land and generalise landscape-level conservation planning, biodiversity trends from habitat conversion could become positive by the mid-twenty-first century on average across models (confidence interval, 2042–2061), but not for all models. Food prices could increase and, on average, across models and almost half (confidence interval, 34–50%) of the future biodiversity losses could not be avoided. However, additionally tackling the drivers of land-use change could avoid conflict with affordable food provision and reduce the environmental effects of the food-provision system. Through further sustainable intensification and trade, reduced food waste and more plant-based human diets, more than two-thirds of future biodiversity losses could be avoided and the biodiversity trends from habitat conversion are reversed by 2050 for almost all of the models.

From a more economic perspective, a World Bank study on the Economic Case for Nature (World Bank, 2021a) has looked at the impact of the loss of ecosystem services under business as usual from pollination, provision of timber, food from marine fisheries, and carbon sequestration by forests (thus covering more than just biodiversity loss). They estimate these losses to result in a fall in global GDP growth of 2.3% or US$2.7 trillion between 2021 and 2030, with the loss in low-income countries' growth being as much as 10%. On the other hand, if a set of policies are put in place, up to half of these losses can be prevented. The policies consist of (a) repurposing public sector support to economic activities such as agriculture so that such support is not linked to current or future production volume or value, thus removing incentives to maintain marginal land in production; (b) creating incentives for conservation, for example by paying landowners in exchange for the protection of forest carbon sinks and (c) increase public investment in agricultural research and development (R&D) as an incentive to increase output on existing agricultural areas, rather than expanding cultivated areas (Figure 3).

Figure 3. **CHANGE IN GLOBAL GDP AND AVOIDED CONVERSION OF NATURAL LAND COMPARED WITH BUSINESS-AS-USUAL, BY POLICY**



P1: Repurpose public sector support to economic activities such as agriculture, so that such support is not linked to current or future production volume or value, thus removing incentives to maintain marginal land in production

P2: Create incentives for conservation, for example by paying landowners in exchange for the protection of forest carbon sinks. This can be done through domestic carbon payment schemes or a global scheme. Here a domestic scheme is assumed.

P7: This is P1 plus P2 but with a global carbon payment scheme and an increase public investment in agricultural research and development (R&D) as an incentive to increase output on existing agricultural areas, rather than expanding cultivated areas.

Source: World Bank (2021)

The modelling shows that even ambitious targets, such as protecting 30 percent of the planet by 2030 (the "30x30" goal, which is relevant to GBF target 3) have economic benefits. When combined with the most conservation-effective of the policy scenarios, achievement of the 30x30 goal results in a 0.1 percent decline of global GDP in 2030, compared with business-as-usual.

Central to these analyses is data on the value of ecosystem services at a highly spatially disaggregated level. The collection and consistent reporting of such information, which is also key to Goal B of GBF, has to be made for all countries and Natural Capital Accounting in accordance with the UN guidelines provides the framework for that. The next section lays down what the SEEA consists of and the way in which it can be used to evaluate biodiversity policies and target linked to the Global Diversity Framework.

2. NATURAL CAPITAL ACCOUNTING (NCA) AND BIODIVERSITY POLICIES AND TARGETS

2.1. NCA and the SEEA Accounting Systems

The information requirements surrounding biodiversity policy questions require a large amount of data. Data on ecosystems, and the services that they provide is of vital importance, as is data on species occurrence. This information is delivered in a coherent and comparable form by the UN SEEA. As UN statistics division notes:

"The System of Environmental-Economic Accounting (SEEA) is the accepted international statistical standard for NCA and provides a framework for organizing and presenting statistics on the environment and its relationship with the economy.

Placing environmental statistics into an accounting framework dramatically increases their usefulness for policy, enabling international comparability, replication over time, and straightforward integration with existing national accounts. Importantly, the SEEA is well aligned with national accounting principles, namely those used in the System of National Accounts (SNA), from which GDP and other mainstream macroeconomic indicators are derived. This relationship between the SEEA and the SNA allows the SEEA to provide a coherent set of statistics on the environment-economy nexus that can easily be integrated into policy analysis." (United Nations, 2020, Page 26).

The SEEA consists of two parts: the SEEA Central Framework (SEEA-CF) and the SEEA Ecosystem Accounting Framework (SEEA-EA).

The SEEA-CF registers information on individual environmental assets such as energy, water, fish and timber, providing information on how they are extracted from the environment, used in the economy, and returned to the environment in the form of waste, water and air emissions. It allows for the integration of environmental information (often measured in physical terms) with economic information (often measured in monetary terms). The power of the SEEA Central Framework comes from its capacity to present information in both physical and monetary terms coherently. Data relevant to biodiversity policies in this framework include supply and use tables which record the flows of natural inputs (e.g., minerals, timber, fish and water), products and residuals (e.g., solid waste, air emissions and return flows of water) in both physical and monetary terms across different sectors in the economy as well as those entering and leaving the economy. The framework also records stocks and changes in stocks of environmental assets (e.g., water, timber, fish, minerals and energy resources etc.) in physical and monetary terms. Finally, the framework also records transactions taken to preserve and protect the environment.

The second part, SEEA-EA, complements the SEEA-CF by taking the perspective of ecosystems. The SEEA-EA constitutes an integrated and comprehensive statistical framework for organizing data about habitats and landscapes, measuring ecosystem services, tracking changes in ecosystem assets, and linking this information to economic and other human activity. It enables the presentation of indicators of the level and value of ecosystem services in a given spatial area. The SEEA-EA is built on five core accounts, i.e., ecosystem extent, ecosystem condition, physical and monetary ecosystem services flow, and monetary ecosystem asset accounts. These accounts are compiled using spatially explicit data and information about the functions of ecosystem assets and the ecosystem services they produce.

In the SEEA-EA, ecosystem assets are areas covered by specific ecosystem types such as forests, wetlands, agricultural areas, rivers, coral reefs, etc. The physical accounts have been adopted by the UN Statistical Commission as an international statistical standard in 2021, while the monetary accounts represent internationally recognised statistical principles and recommendations for the valuation of ecosystem services and assets. A defining characteristic of ecosystem accounting is that it is spatially explicit, i.e., it builds accounts based on underlying maps with information. As such, ecosystem accounting produces an integrated spatial information system.

Ecosystem extent accounts provide information on the extent of different ecosystem types within a country in terms of area. In particular, they describe the environment in terms of sets of mutually exclusive (i.e., nonoverlapping) ecosystem assets. All assets together populate an ecosystem accounting area, which could range from a watershed in a municipality, a country etc. The extent account describes the various types of ecosystems that are distinguished within an area and how they change over time.

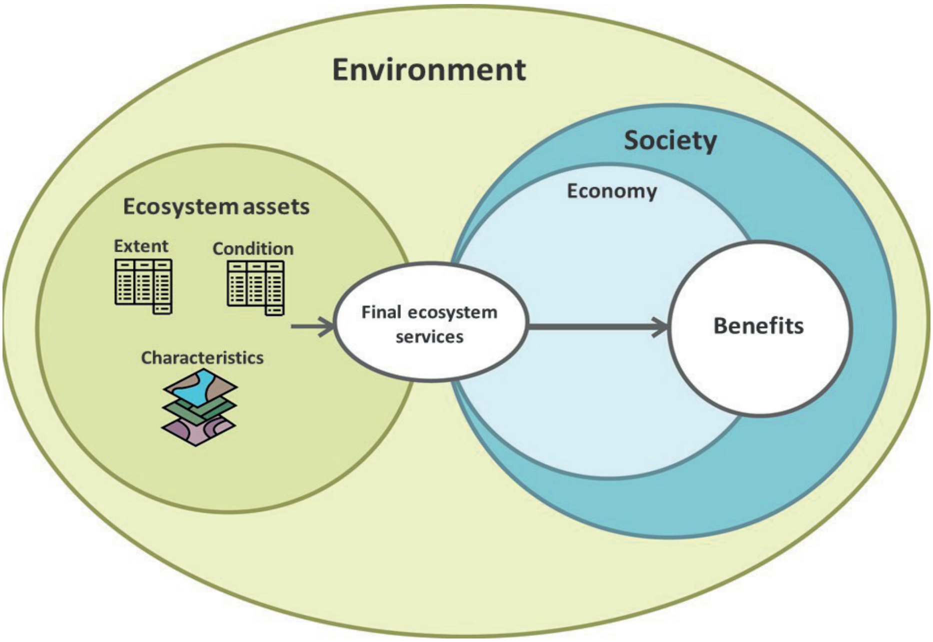
Ecosystem condition accounts measure the overall quality of an ecosystem asset and capture, in a set of key indicators, the state of the ecosystem in relation to both its naturalness and its potential to supply ecosystem services. The condition account compares different years to track changes over time. Condition accounts provide valuable information on the health and state of ecosystems and their capacity to deliver critical ecosystem services in the future.

The conceptual model underlying ecosystem accounts is shown in Figure 4. The model starts with identifying ecosystem assets, an ecosystem that is mapped by mutually exclusive spatial boundaries such that each asset is classified into a single ecosystem type. Assets are described through their extent and condition. The information on the ecosystem assets is used to estimate the final ecosystem services, which are the contributions of ecosystems to the benefits. Some ecosystem services are reflected in the economic accounts (e.g., crop provisioning), whereas others are not (e.g., water purification). Finally, the benefits from the ecosystem services form part of the measured individual and social well-being.

The link between the environment and society sides of the concept is presented in the ecosystem services flow accounts. These measure the supply of ecosystem services as well as their corresponding use and beneficiaries, classified by economic sectors used in the national accounts, in both physical and monetary terms. SEEA-EA uses the following three broadly agreed categories of ecosystem services:

- Provisioning services (e.g., supply of food, fibre, fuel and water);
- Regulation and maintenance services (related to activities of filtration, purification, regulation and maintenance of air, water, soil, habitat and climate); and
- Cultural services (related to activities of individuals in, or associated with, nature, such as recreation).

Figure 4. **SEEA-EA. CONCEPTUAL MODEL**



Source: United Nations *et al.*, 2021 Figure 2.1)

Ecosystem services are defined in SEEA-EA as the contribution to benefits, rather than as the benefits themselves, in order to avoid double counting. For example, an agricultural crop such as corn or maize is already recorded in the national accounts. Moreover, corn is the result of combining human capital (in the form of labour), produced capital (machinery) and natural capital (the cropland). The objective of the ecosystem services accounts is to isolate the contributions of nature to the production of the crop. By expanding the national accounts production boundary, the accounts also recognize a range of ecosystem services that lead to benefits that are not currently recognized in the SNA such as carbon sequestration or air filtration. It is also worth noting that the SEEA-EA follows the valuation concept of exchange values, same as is applied in the SNA to allow for comparability and integration with national accounts.

Finally, the monetary side of the ecosystem services flow accounts feeds into the asset account, which records the monetary value of opening and closing stocks of all ecosystem assets within a given ecosystem accounting area, as well as additions and reductions to those stocks. The value of the ecosystem assets is estimated by discounting annual flows of services over the projected period i.e., the expected lifetime of the ecosystem, using a so-called net present value method. In order to estimate these projected service flows, it is important to take into account the capacity of the ecosystems to sustain these service flows which will depend on their condition and the extent to which these ecosystems are sustainably managed, and if not, make corrections to future service flows. Thus, the valuation of ecosystem assets allows an assessment of a more comprehensive measure of the wealth of a country (in addition to produced capital, financial capital etc.).

2.2. Use of NCA in Relation to Global Biodiversity Framework (GBF) Targets

There are two headline indicators in the GBF where UNSD has a lead role. These are (a) Goal A A.2 Extent of Natural Ecosystems by Type; (b) Goal B B.1 Functions and Services Provided by Service Type. In addition, NCA plays an important part in guiding policies and resources to the achievement of several targets[5]. These are detailed in Annex 1. The key role of NCA is to provide information to undertake an evaluation of policies and investments related to the different targets. The benefits of meeting the targets result in an increase in ecosystem services that can only be measured if data on the baseline services and their dependence on condition are available. These benefits determine priorities of where action should take place to meet the targets and in designing measures that yield the greatest net benefits. Data on ecosystem condition are also important in determining sustainable exploitation rates for renewable resources and in setting regulations on harvesting and trade. In addition, data on biodiversity indicators is the basis for biodiversity credits and other markets,

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[5] Only 15 of the 23 targets are listed in the table. T h e 8 where the links to NCA are indirect or incidental have been left out.

which derive biodiversity ‘units’ based on these indicators. The ecosystem condition accounts provide important information for this purpose.

3. MOBILIZING FINANCE AND SELECTING POLICIES FOR REALIZING THE GBF TARGETS: ROLES OF THE PRIVATE AND PUBLIC SECTORS AND INTERNATIONAL FINANCE INSTITUTIONS

Target 19 of the GBF states that US$200 billion has to be raised by 2030 to finance the other biodiversity goals. So far, the amounts available are much smaller: a recent UNEP report on the State of Finance for Nature assessed total financial flows to Nature-based Solutions (NbS) were about US$154 billion annually, of which US$26 billion or 17% was from private finance (UNEP, 2022). However, not all this is for programs linked to biodiversity. An OECD report estimated finance for biodiversity from all sources (private and public) currently at US$77-87 billion a year (OECD, 2020). Official finance from donor sources is given from the DAC database in the OECD at US$17.1 billion in 2020 (an increase of 119% since 2011[6]).

Overall, therefore, an increase is needed from both public and private sources to achieve this target. The Target goes further in asking for a larger role for private sector finance: Target 19c of the GBF specifically relates to increased private sector finance to support biodiversity, and target 19d calls for schemes such as payment for ecosystem services, green bonds, biodiversity offsets and credits, and benefit-sharing mechanisms, with environmental and social safeguards. Thus, there is a role of both public and private sources of finance. Both have links to natural capital.

3.1. Biodiversity Credits

Biodiversity offsets and habitat banks were discussed earlier: their use so far has been mainly in OECD countries, where a developer who causes a loss of biodiversity in one place can acquire an equivalent amount elsewhere to ensure that there is no net loss as a result of the development. The only example outside the OECD is Colombia. Some work to develop these further is ongoing and is linked to the creation of biodiversity credits more widely.

Biodiversity credits offer an opportunity for a voluntary purchase of a credit that ensure the protection of a parcel of land with a certain level of biodiversity, or that guarantees an increase in its biodiversity level over time through restoration. The demand for such credits comes from companies with commitments on corporate responsibility (CSR) and those committing to nature-related disclosures (such as under the emerging Taskforce on Nature-related Financial Disclosures (TNFD) Framework1), philanthropists and impact investors, and individuals interested in conservation. As with voluntary carbon markets, buyers will often be driven by cor-

[6] A Decade of Development Finance for Biodiversity | OECD iLibrary (oecd-ilibrary.org)

porate commitments to nature-positive targets (Ducros and Steele, 2022). The supply of credits can be from local communities, NGOs or private companies undertaking to conserve or restore particular areas.

A key factor in getting a market for such credits to work is to have a workable biodiversity metric so that it can be traded. Once the units for transaction are defined, accounting systems can be set up to establish an inventory, a register and a data management system that supports transparency. The schemes also have to ensure that they genuinely provide additionality (i.e., there is an increase in biodiversity relative to a baseline) and that there is no leakage (conservation at the site does not directly cause an increase in loss elsewhere). Both these depend on being able to establish and monitor a baseline for the sites considered.

The three schemes currently in operation use different metrics so trading across them is not possible. The metrics combine different indicators of biodiversity (ones used include: species richness, importance of species, fauna and flora intactness, IUCN risk category of the ecosystem and ecological connectivity). Account is also taken to how long the preservation is for (permanence) and other factors. All schemes require data on the ecosystem extent and condition so draw on SEEA EA account information where available (but need to go further in some cases). The programs have some promise, they are still in their infancy. As the report from Nature Finance notes, while biodiversity offset schemes are currently mobilising jointly about US$ 6-9 billion annually, the voluntary side (credits aimed at achieving impacts beyond value chain and targeting higher-order contributions) currently has very little trading and associated investment in biodiversity outcomes. One estimate suggests as little as US$8 million in funding pledged although broader assessment suggest somewhat larger numbers. There is also some debate on the suitability of these credits as effective means of biodiversity conservation.

For the credits to become increase in scale, the metrics have to applicable at scale so more suppliers can participate. One scheme likely to offer that is the Wallacea Trust methodology, which bases its biocredit on a basket of a minimum of five biodiversity metrics that reflect conservation objectives for the region of the submitted site. Complete taxa (normally functional taxa such as breeding birds or soil invertebrates) are used for each of the metrics and these combine both species richness weighted by the importance value of each species on a five-point scale (e.g., IUCN-listed critically endangered species score a five, IUCN least concern species score one, etc) and abundance on a five- point logarithmic scale. The biocredit is defined as a 1% restoration or avoided loss per hectare in the median value of the basket of metrics. This approach allows biodiversity improvements or avoided loss to be quantified and compared across different ecoregions. Such comparison creates the benefit of collective aggregation of biodiversity stocks in a variety of ecosystems and allows buyers to quantify the impact of their investment in biodiversity improvements and/or avoided loss (Ducross and Steele, 2022).

3.2. Linking Biodiversity to Carbon Credits

Biodiversity-positive carbon credits are carbon credits that include additional and specific management actions linked to the enhancement, conservation, and or restoration of biodiversity.

These credit types combine, "link", or "bundle" verified biodiversity benefits typically in conjunction with a one-to-one carbon credit. In the voluntary carbon market (VCM), biodiversity is often referred to as one in a series of co-benefits that can be bundled or labelled alongside carbon credits - another co-benefit that is often seen as critical for the integrity of such bundled credits is community benefits, meaning the amount of money or material impact that the implementing community receives due to the project. As a result of these additional nature benefits, the credits can be sold at a premium thus providing some finance for biodiversity protection. Not all carbon credits have biodiversity benefits and some (e.g., fast-growing monoculture plantations may be good for carbon sequestration but are typically bad for biodiversity), so only a part of the VCM (currently with a market valuation approaching US$2 billion) is relevant (GEF, 2023).

The primary overlap between carbon offset markets and natural forest conservation is at the frontier between an expanding agricultural frontier where forests are "next in line" to be felled for that expansion. Typically, carbon credits that are bundled with biodiversity can be traded at a premium relative to stand-alone carbon credits. According to Ecosystem Marketplace's market insights report, credits combined with additional benefits beyond carbon saw a clear price premium over the global 2021 Ecosystem Marketplace's Global Carbon Price benchmark of $4.00/tCO2e; similarly, over the past year the Climate, Community, & Biodiversity (CCB) standard credits added on average about $2.55 (max $5.34 / min $0.54) to the REDD+ and Nature Restoration credit types[7]. In 2020, Verra's CCB standard credits demonstrated a 277% increase in volume sold between 2020 and 2021 representing 17.4 MtCO2e to 65.9 MtCO2e in credits (GEF, 2023).

Despite the growth in biodiversity-linked carbon credits, the supply of such credits remains small. Increasing the market for such credits will require further use of NCA to standardize biodiversity measures and adopt a common methodology for measuring biodiversity outcomes. This will help reduce the additional costs and resources necessary to pursue additional certification for carbon project developers seeking biodiversity-positive carbon credit labels.

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[7] The Climate, Community and & Biodiversity (CCB) Standards are an additional certification created by the CCB Alliance that can be linked to carbon credits. To receive the CCB label, projects must meet seventeen required criteria. The standards require net positive biodiversity outcomes measured against an established baseline within the project boundaries and project lifetime. The standards require the use of appropriate methodologies for measuring and monitoring but do not prescribe specific methodologies.

3.3. REDD+

In addition to this form of credit, there is also the REDD+ framework to bundle carbon reductions, human well-being and nature enhancement. Around 50 countries have REDD+ programs at various development phases, and over 350 REDD+ projects have been initiated to Date. Project-based REDD+ credits are supplied both to the voluntary carbon market (VCM) and to compliance markets. They have mainly been linked to the VCM and represent the largest volume of nature-based credits, making up 24.5% of credits issued[8]. While REDD+ has been active for more than a decade and has played a notable part in preventing deforestation, it has had several problems. These include: "lack of initial financial resources for supplier countries, capacity building for implementation, issues around additionality, leakage and permanence, inappropriate outreach strategies and engagement of IPLCs, climate credibility, governance, lack of cross-sectoral planning and implementation, unclear or missing benefit sharing mechanisms, weak safeguards around information systems. One of the more persistent issues is around the actual and perceived integrity of the credits". (GEF, 2023, P. 32). To address these, new approaches for the implementation of REDD+ have emerged, referred to as jurisdictional and nested approaches. Jurisdictional REDD+ approaches are a departure from project-based REDD+ initiatives in that they operate at the national or subnational levels and are rooted in more expansive and inclusive governance systems than what can be achieved through the scope of an individual project. Similarly, nested approaches seek to integrate standalone projects at multiple scales into a single accounting framework that uses data from the SEEA EEA. On the use of such data for REDD+ in a nested approach see World Bank (2021c).

3.4. Public Sources of Finance

Along with market-based sources of finance, there are a number of financial instruments that involve direct public sector investment in specific instruments. They aim to establish proof of concept or a commercial track record of new solutions, which can become either replicable or scalable. Grants remain the most frequent financial instrument for biodiversity to date, but their concessional nature and limited long-term sustainability come at a high cost for public institutions. This has led to a search for more innovative instruments that blend public and private finance ("blended finance"), helping leverage private financial flows at scale and increase the efficiency of scarce public resources.

Sovereign debt is one such instrument. Debt conversions, often known as "debt for-climate" and "debt-for-nature swaps" are transactions where countries restructure, reprofile, and reduce their debt obligations in exchange for committing some portion of the freed-up financing toward domestic climate and nature projects (IMF,

8 Voluntary Registry Offsets Database, Berkeley Carbon Trading Project.

2022). Debt for climate and nature swaps rely on blended finance, in the form of insurance policies or guarantees to provide below-market borrowing rates for the borrower country. Examples include the GEF-supported Seychelles' 2016 debt conversion, which resulted in $22 million of investment in marine conservation (Convergence, 2017). Belize's 2021 debt conversion enabled the issuance of $364 million worth of blue bonds linked to national marine conservation activities (TNC, 2022). A modified financial structure using partial guarantees provided by IDB and TNC was used to refinance $150M in Barbados' debt to support implementation of their marine conservation 30x30 commitments in 2022 (GEF, 2023). Recently, Portugal agreed to provide debt relief to Cabo Verde on condition the funds are used for climate and nature (Expresso Das Ilhas, 2023).

3.5. Public-Private Blended Sources of Finance

Instruments involving public and some private sources can also support nature and climate objectives. One of these is Green, Social, Sustainability and Sustainability-linked (GSSS) bonds, which represent a new asset class across developed markets. GSSS bonds, which grew by $600 billion in 2021 alone, are borrowing instruments where the financial and structured characteristics are based on meeting pre-agreed sustainability criteria measured through key performance indicators (KPIs) (GEF, 2023). For example, nature performance bonds are tied to measurable targets for restoring wetlands, protecting forests, and reducing threats to wildlife and plant species, while still allowing for general use of proceeds (Nature Finance, 2021).

Countries can issue these bonds when seeking to raise cheaper financing for any purpose, while simultaneously pursuing their own national sustainability goals. While this type of bond is nascent and limited to countries with economies strong enough to raise funds in capital markets, there are increasing examples of such issuances. Chile issued a $2 billion sustainability-linked bond in March 2022, with two KPIs geared towards reducing emissions and increasing Chile's use of renewable energy (BNP Paribas, 2022). Benin issued a EUR 500 million sustainable development goal (SDG) bond in July 2021. The bond is linked to Benin's framework and based on the prioritization of the most pressing targets and on the total cost to achieve them (Natixis, 2021a). Mexico issued a EUR 750 million SDG bond in September 2020, and a second EUR 1,250 million SDG bond in July 2021, linked to Mexico's commitments under the 2030 Agenda and SDG commitments (Natixis, 2020; Natixis, 2021b).

On biodiversity specifically, one landmark example is the Wildlife Conservation Bond or "rhino bond", issued in March 2022 by the World Bank with GEF support. This five-year $150 million Sustainable Development Bond is a combination of existing financial products – a bond with an excellent credit rating paired with a performance-based grant funded by the GEF, which results in a ground-breaking financial structure that enables private sector investment in global public goods. At the end of the life of the bond, investors will receive back the principal along with a variable payout depending on the population growth rate of black rhino, a critically endangered species, in two target areas in South Africa. The coupon payments from the bond, instead of going to investors as for typical bonds, are instead used to fund the conservation activities on the ground. (GEF, 2023)

While having considerable potential, GSSS bonds still make up just a fraction of the bond market. The size of this market remains particularly limited in developing countries: Africa, for instance, accounted for only 0.077% of the global green bond market in 2021. (GEF, 2023). The market for GSSS bonds is hampered by several barriers in developing countries, especially least-developed countries and small island developing States. Adequate market infrastructure is needed to provide the foundation for capital market depth and liquidity. This includes exchanges and trading platforms, clearing houses, credit risk assessment, custodians, and fiduciaries, without which bond markets will be difficult to scale. To address these barriers, the Global Climate Fund (GCF) has invested in multiple solutions, including the above-mentioned Green Guarantee Company and support to Jamaica in setting up a Caribbean green bond listing on the Jamaica Stock Exchange, enabling it to list green bonds through a dedicated facility.

Equity is another instrument that can be found under the "blended finance" label. The above- mentioned Global Fund for Coral Reefs, for instance, uses GCF's $125 million in public first-loss equity to crowd in private equity, with the potential to create a new asset class to mobilize institutional and citizen savings for coral reef protection.

4. CONCLUSIONS

Biodiversity is a key component for the integrity and functioning of terrestrial and marine ecosystems, which in turn provide critical services to the economy and society that are embedded in nature. Both biodiversity and ecosystem services have been declining in many countries and within global commons, resulting in losses that affect the well-being of many, especially those most dependent on these assets. The resource-dependent communities, including women and poor people in low-income countries, are particularly vulnerable and disproportionately affected by the loss of biodiversity and ecosystem services.

The major direct drivers of the losses are industrial fishing, intensive agriculture, especially overgrazing, loss of forest cover, over-harvesting of wild plants and animals and extractive industries. The indirect factors behind these are the increase in population, loss of indigenous knowledge for managing nature, migration and urbanisation and expanding trade, which does not account for the externalities from the export of land- and marine-intensive products. Underlying these drivers is the way economic activities are organised and supported by governments and private decision-makers, which leads to under-pricing of natural capital or negative impacts that impose high social costs that are not captured in the national system of accounts or firms' balance sheets. For example, agricultural, fishery and energy subsidies exert increased pressure on ecosystems. The fact that many of these systems are part of global commons but are controlled by national jurisdictions or not controlled at all means they tend to be over-exploited. The failure to reflect externalities associated with many nature-based activities in the prices paid for the final products accelerates the over-exploitation of nature.

The losses of biodiversity and degradation of ecosystems matter because they impact on the ecosystem services that provide benefits to people in the short term and diminish opportunities for long-term growth and sustainable development in affected countries. Declines in services include pollination, soil quality, flood and erosion control, disease control, regulation of freshwater flow and quality in watersheds and wetlands, regulation of air quality, climate and ocean acidification, and regulation of extreme events, among others. When certain thresholds are exceeded, loss of biodiversity and ecosystem services could drive large responses and feedbacks that severely disrupt the provision of benefits to people and economies.

To facilitate the mainstreaming of nature and biodiversity into economic systems, these contributions of nature can be quantified in monetary terms through the concept of renewable natural capital.

Natural capital accounting is often used to measure in monetary terms the goods and services that nature provides to economies (e.g., the changing wealth of nations report produced by the World Bank)**.** Estimates of such capital indicate that in *per capita* terms, it has declined in low-income countries during the past quarter century. Furthermore, “blue natural capital” (fishery and mangroves) has declined globally by half over the same period, mainly because of a collapse in the value of fishery.

While past and present policies have resulted in significant losses of natural capital, recent studies have shown that an ambitious program, with the right policies, can avoid further losses and recover some of the past losses. The targets for such a program are set out by the Kunming-Montreal Global Biodiversity Framework (GBF), an outcome of the 2022 United Nations Biodiversity Conference.

Furthermore, a major role in selecting the right policies and implementing them effectively in the right places to meet the targets of the GBF often depends on the availability of data using the UN System of Environmental Economic Accounts – Ecosystem Accounting (SEEA EA) framework. This Natural Capital Accounting System links the information on the extent and condition of different ecosystems to the services they provide and to the values of those services.

The role of NCA is to provide information to undertake an evaluation of policies and investments related to the different targets. The benefits of meeting the GBF targets result in an increase in ecosystem services that can only be measured if data on the baseline services and their dependence on condition are available. These benefits determine priorities of where action should take place to meet the targets and in designing measures that yield the greatest net benefits. Data on ecosystem condition are also important in determining sustainable exploitation rates for renewable resources and in setting regulations on harvesting and trade. In addition, data on biodiversity indicators is the basis for biodiversity credits and other markets, which derive tradable biodiversity 'units' based on these indicators. The ecosystem condition accounts provide important information for this purpose.

Finally, there is the need to mobilize finance to implement many components of the programs. The GBF states that US$200 billion has to be raised by 2030 to finance the other biodiversity goals. So far, the amounts available are much smaller; an OECD report estimated finance for biodiversity from all sources (private and public) currently at US$77-87 billion a year. Thus, an increase is needed from both public and private sources to achieve this target.

On the private finance side, there are a number of new instruments, such as biodiversity credits, which offer an opportunity for a voluntary purchase of biodiversity protection to companies with commitments on corporate social responsibility (CSR) and/or explicitly considering nature and climate risks into their core investment and business strategies. There are issues relating to the metrics used and potential for scaling up the existing schemes but some advances are being made (e.g. ESG data supported by the World Bank's Global Program on Sustainability to inform financial market decisions). Some involve linking biodiversity credits to carbon credits. There are also some developments in the REDD+ market that hold promise for expansion using data from the SEEA EA.

Notwithstanding these developments, the current level of the market for biodiversity credits and REDD+ is small. Efforts for developing high-integrity biodiversity credits, including measurement, reporting and verification systems will be key to developing such markets. Increased interest among major financial institutions and businesses towards managing and disclosing nature and climate-related financial risks, dependencies and impacts (e.g., TNFD and TCFD) offers promise for attracting private sector finance for nature and biodiversity.

On the public finance side, a number of financial instruments aim to establish proof of concept or a commercial track record of new solutions, which can become either replicable or scalable. Grants remain the most frequent financial instrument for biodiversity to date but pressure on such sources is high. Others that blend public and private finance ("blended finance"), help leverage private financial flows at scale and increase the efficiency of scarce public resources. These include debt conversions or "debt for-climate" and "debt-for-nature swaps" in which there is renewed interest[9]. Such instruments have been tried for some decades with a number of benefits, but also

[9] https://www.imf.org/en/Blogs/Articles/2022/12/14/swapping-debt-for-climate-or-nature-pledges-can-help-fund-resilience#:~:text=Such%20countries%20face%20a%20high,spending%20on%20other%20development%20priorities

downsides. It has been noted that a debt swap can downgrade a country's debt rating. Furthermore, any deterioration of the fiscal situation in a debt swap country can undermine the capacity of the debtor country to meet its obligations under the DNS (OECD, 2007). Again, the amounts raised so far are small.

Instruments involving public and some private sources, such as Green, Social, Sustainability and Sustainability-linked (GSSS) bonds are based on meeting pre-agreed sustainability criteria measured through key performance indicators (KPIs). Examples of issuance of such bonds include Benin, Chile and Mexico. On biodiversity specifically, a landmark example is the Wildlife Conservation Bond or "rhino bond", issued in March 2022 by the World Bank with GEF support. Data and evidence from programs supported by such bonds will help make the case for them and expand their use. So far, while having considerable potential, GSSS bonds make up just a fraction of the bond market and are extremely small in developing countries. Equity is another instrument that can be found under the "blended finance" label.

In conclusion, meeting the biodiversity targets remains a challenge but one for which there is hope if the right policies and programs are implemented. To do this, data and evidence on the impacts of any measures is critical and natural capital accounting has a central part to play in providing it.

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