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Achieving the SDGs with Biodiversity

The 2030 Agenda for Sustainable Development with its 17 Sustainable Development Goals (SDGs) charts a new path of balance for humanity and the planet. The highly interconnected SDGs will only be achieved in their entirety through transformative changes in our societies. Recent studies on the interactions between the SDGs identify the conservation of biodiversity as one of the most potent levers to achieve sustainability. The biodiversity-focused SDGs 14 (life below water) and 15 (life on land) emerge as multipliers of co-benefits across the goals. This factsheet aims to explain the importance of biodiversity for implementing all SDGs and to provide decision makers with options and entry points for transformative change.

The 2030 Agenda for Sustainable Development with its 17 Sustainable Development Goals (SDGs) aims to meet the needs of people and nature.[1] The functioning of the biosphere is vital for human resilience, livelihoods and well-being.[1, 2] Accordingly, SDGs with a focus on the biosphere play a foundational role for our societies, economies, and our quality of life (as shown in the 'wedding cake', Figure 1). In the face of ongoing demographic growth and behavioral changes leading to increased consumption, our societies depend on the supply of more natural resources than ever before, imposing high costs on the biosphere and causing an unprecedented global decline in biodiversity. Nearly one million species face extinction, ecosystems are being degraded, and ecosystem services are declining. This is particularly the case for many regulating and supporting services such as the provision of clean water, climate regulation, risk and disease protection, inspiration, or a sense of place.[3, 4]

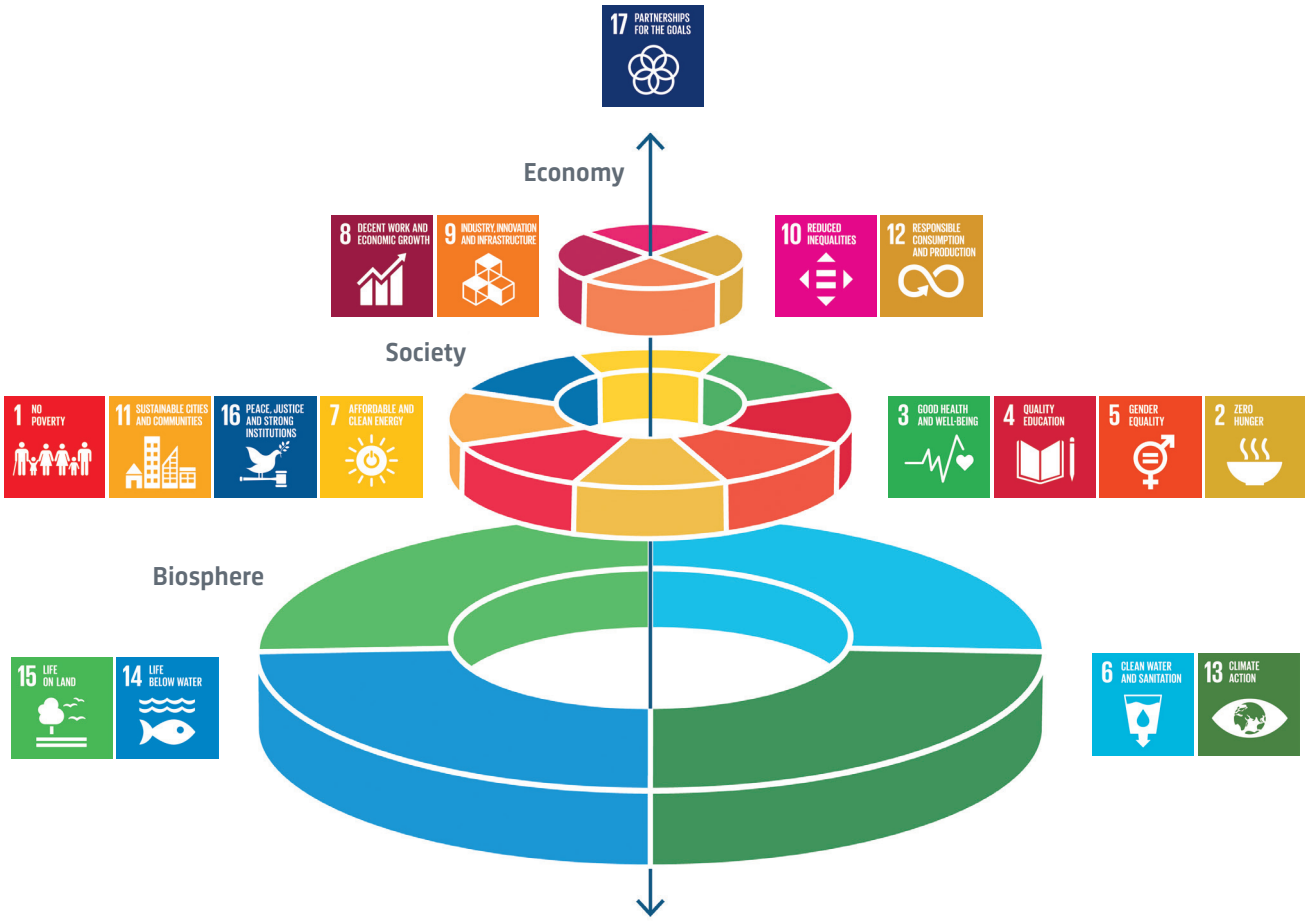

Figure 1: The SDG 'Wedding cake' shows the biosphere as the foundation of economies and societies and as the basis of all SDGs. Such a conceptualization adopts an integrated view of social, economic, and ecological development.[5] (Source: Azote Images for Stockholm Resilience Centre, Stockholm University)

The contribution of biodiversity to the SDGs

Substantial economic, social, and environmental benefits can be obtained from the well-coordinated implementation of the SDGs and intentional use of synergies among goals. Several studies on SDG interactions have demonstrated that actions or inactions toward specific goals positively or negatively affect progress towards other goals[6–12] (*co-benefits* and *trade-offs*, see Box: Key terms). These findings support a growing scientific consensus that coherent policies to achieve the SDGs require an understanding of the interactions between SDGs,[9–10, 13–19] even if they are, in certain cases, more direct than in others.[11]

Among the many interactions between the SDGs, the two biodiversity-focused SDGs 14 and 15, appear particularly important in achieving progress towards sustainability. As shown in a recent analysis,[9] progress on SDGs 14 and 15 contributes in most cases to the achievement of multiple other goals (Figures 2 and 3). That is, biodiversity-focused SDGs emerge as multipliers of co-benefits across all goals, and further serve to buffer negative interactions.[9] In this way, measures to implement SDGs 14 and 15 are most likely to foster multiple co-benefits across the 2030 Agenda, while entailing relatively small risks of trade-offs. Conversely, a siloed and short-sighted implementation concentrating only on the social or economic dimensions of sustainable development while neglecting the environmental dimension inevitably leads to 'human-driven decline of life on Earth'.[20] In addition, when measures to reach other SDGs are taken without accounting for potential negative impacts on natural resources (under SDGs 6, 12, 14, 15), the latter are likely to suffer collateral damage (Figure 3).[9] Based on existing data, negative interactions or trade-offs between biodiversity objectives and other SDGs are mainly related to the provision and extraction of material – Nature's Contributions to People (NCP), such as food, water and energy.[3, 4] The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) will specifically address these interactions in an upcoming 'Nexus Assessment' which aims to provide policy options for addressing such key interactions (ipbes.net/nexus).

Biodiversity is fundamental for achieving other SDGs

Building on the above evidence, the objective of this factsheet is to focus on the benefits that investments into biodiversity can elicit and illustrate how biodiversity conservation and the safeguard of the world's natural resources can contribute to each of 17 goals of the UN Agenda. This focus on the benefits does not imply that trade-offs are absent or irrelevant. Trade-offs require careful negotiation between societal actors and social groups, weighting them in a larger geographical contexts, and adopting a long-term perspective to ensure just and sustainable outcomes.[22]

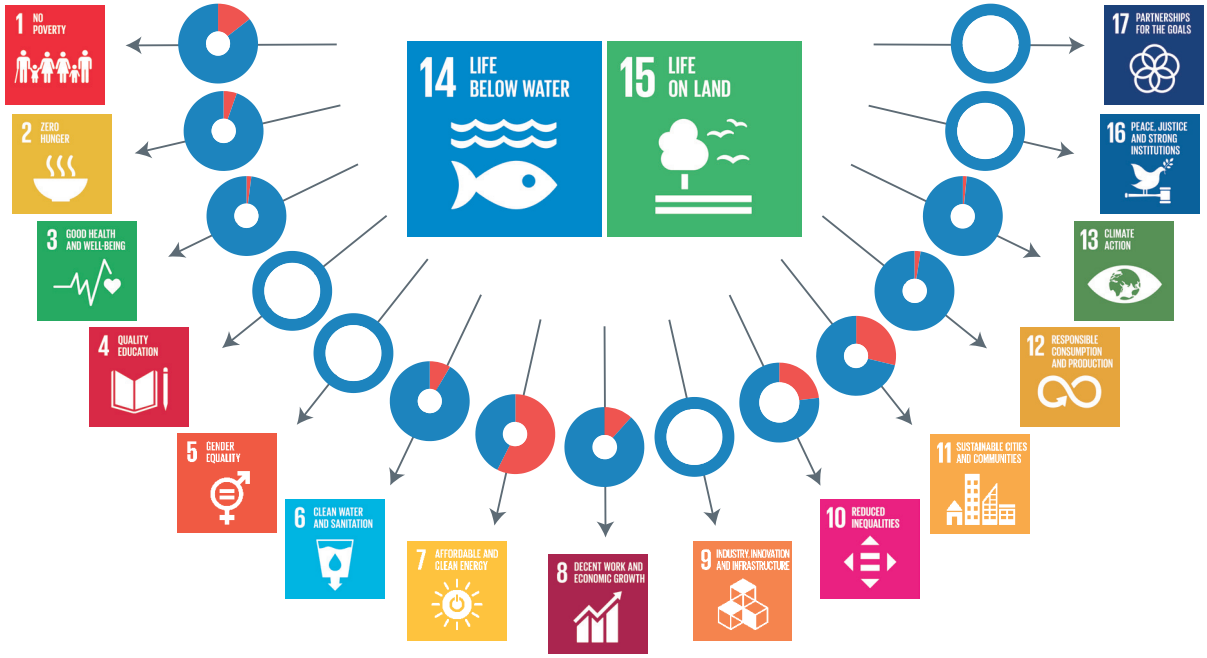

Figure 2: Contribution of Life below Water and of Life on Land (SDGs 14 and 15) to other SDGs. The data is the result of a systematic compilation of the current state of knowledge about interactions among the SDGs, in terms of co-benefits (blue) and trade-offs (red). The compilation is based on a total of 65 global assessments (UN reports and international scientific assessments), as well as 112 scientific articles published since 2015 with explicit reference to the SDGs. The slim donuts show either gaps in knowledge or weaker interactions.[21, 23]

SDG 1: Conserving biodiversity contributes to maintaining the long-term social, economic and environmental resilience of local livelihoods,[24] and is therefore critically important to **end poverty in all its forms everywhere**. Biodiversity and healthy ecosystems are 'the wealth of the poor', accounting for an estimated 50 to 90 percent of the livelihoods of poor rural and forest-dwelling populations.[25] In addition to these direct contributions to poverty alleviation, biodiversity also supports human societies in many other indirect ways: providing services, such as water supply, medicinal plants or firewood that further reduce multidimensional aspects of poverty, such as those related to health and living standards.[26] Sustainable livelihood and farming practices that conserve biodiversity and promote sustainable use of natural resources can help lift people out of poverty by increasing people's income[26] and by reducing vulnerability to external economic shocks or environmental disasters. For example, ecotourism and organic farming can represent important income opportunities, assuming local willingness to pay for organic products or opportunities for fair trade and biotrade[27] schemes. Furthermore, the use of local seeds and crop varieties potentially offer increased resilience to external shocks, such as brought about by market dynamics.[28] Financial aids dedicated to environmental conservation and sustainable use of biodiversity can contribute to improving the livelihoods of those disadvantaged population groups in remote areas. Examples include the FONAG fund in Ecuador, which pays mountain communities around Quito for watershed conservation.[29]

SDG 2: Investing efforts in biodiversity restoration and conservation contributes significantly to SDG 2, which aims to **end hunger, achieve food security and improved nutrition, and promote sustainable agriculture**. Biodiversity contributes to food security in different ways, by buffering overall agricultural production against threats like weather extremes, pest outbreaks, plant diseases, market fluctuations or failures, among others.[30] Seeking synergies between these two major challenges of our time have the potential to generate multiple benefits for sustainable development.[31] One way biodiversity contributes to food security is through crop pollination, as pollinator-dependent crops contribute to 35 percent of global crop production volume.[32] Another benefit is the regulation of the ecosystem functions of soils by native earthworms and diverse microbiota, which render soils fertile over the long-term.[33] Biodiversity is at the core of ecological intensification, which aims at maximizing resource efficiency and decrease inputs over time.[34, 35] Biodiversity is central to agroecology, which prioritizes biodiversity conservation in agricultural areas as the basis for healthy agroecosystems.[36] Agroecology addresses the trade-off between intensification, where outputs per unit of land are substantially increased with use of better seed, technologies and management practices, and extensification, such as maintaining low-input agriculture to preserve existing agro-ecosystems.[37] This is possible either with ecological intensification, through increased production using biodiversity-friendly, sustainable management practices, and/or through a transformation of the food system towards more plant-based diets and decreased food waste.[38]

SDG 3: Biodiversity and conservation are crucial to **ensure healthy lives and promote well-being for people of all ages**. The benefits of biodiversity and healthy ecosystems on health are numerous. For example, ecosystems mitigate noise, air pollution, as well as heat, and biodiversity is the primary source of medical drugs for most people.[39, 40] Green spaces in cities are important for the health and safety of city dwellers, by improving air quality and supporting the production and supply of clean water.[41] Existing evidence also attributes an important role to biodiversity in contributing to mental health and well-being,[42] which has been made clearer by the COVID-19 pandemic.[43] In rural contexts, the more diverse landscapes achieved and maintained through agroecological approaches serve as refuges for birds and pollinators,[44] which at the same time contribute to the health of farmers and communities by providing alternatives to pesticide-intensive agriculture.[45] The COVID-19 pandemic showcases how the depletion of ecosystems has devastating impacts on society.[46, 47] In that respect, minimizing the disturbance of natural systems would greatly help preventing the emergence and spread of new pathogens causing such zoonotic diseases.[48, 49, 121, 122]

SDG 4: Biodiversity is an inspiration for art, literature, as well as science and triggers curiosity. Maintaining a natural environment and learning about biodiversity can therefore substantially contribute towards **ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all**. Children playing freely in natural environments develop awareness, reasoning, as well as observational skills and show improved mental and physical health.[50] Nature buffers pressures from society on both children and adults.[51, 42] Further, children who learn about biodiversity or experience it in field trips or outside classrooms have improved science literacy, language and arts skills.[52, 53] It is not only learning about nature but learning from nature that helps increase understanding of how our economy and society at large, as well as processes and systems, should or could function in a sustainable way.[54]

SDG 5: Conserving biodiversity and ensuring the functioning of ecosystems is in many ways fundamental to **achieve gender equality and empower all women and girls**. In certain cases, inequalities between women and men in access, control, and ownership of land and natural resources, as well as socio-cultural barriers to economic opportunities for women, can mean that women are more dependent on local access to nature and are more vulnerable to the effects of environmental degradation.[55, 56] In the many cases, such as in most of the Himalaya region,[57] where women and girls are in charge of collecting natural resources for the family's well-being – either because of the social structure in place or because of their knowledge,[58, 59] healthy and biodiverse ecosystems means less time spent collecting goods and more time available for income generating activities, involvement in the management and conservation of nature, and education.

SDG 6: Investing in biodiversity conservation along river catchments is a cost-effective nature-based solution to **ensure availability and sustainable management of water and sanitation for all**, with many co-benefits for the other SDGs. Natural riparian ecosystems in particular contribute to clean and reliable water supply.[60] They regenerate drinking water, replenish groundwater reservoirs and buffer against negative impacts to groundwater.[61] Their maintenance is necessary to ensure the continuous provision of ecosystem services. In urban areas, intact green spaces also serve to retain water and dilute wastes and other pollutants, help maintain good water quality and provide protection against floods.

SDG 7 aims to **ensure access to affordable, reliable, sustainable, and modern energy for all**. Investing in biodiversity and ecosystem conservation means investing for the three billion people or more who rely on natural resources for their cooking and heating.[62] Contributions from intact and biodiverse ecosystems, including water supply, erosion control, soil and slope stabilization through vegetation, and protection against natural disasters, are essential for the renewable energy sector, producing solar, wind and hydropower. Nature's contributions, such as pollination, disease control, and water supply, in turn, are key to the production of biofuels and are entirely dependent on well-conserved and biodiversity-rich ecosystems.[63, 64] This means that an eventual spatial expansion of renewable energy production must be appropriately managed to avoid harm to biodiversity.[63, 65–67] Recognizing that renewable energy production can result in adverse outcomes for biodiversity, additional biodiversity mitigation measures and adaptation schemes are needed to minimize such trade-offs.[68] Additionally, adequate biodiversity conservation, for example of soils and water, can help to increase the longevity of energy supply (i.e. hydropower[69]).

SDG 8: Healthy ecosystems, whether marine or terrestrial, support the provision of ecosystem services that are central to economic activities in many sectors. Examples include pollination and irrigation for agriculture, raw materials for construction, freshwater supply for the pharmaceutical and manufacturing sectors, cultural services for ecotourism, and the wild species on which global fisheries rely that provide income to 60 million people.[70–72] Trade of goods and services derived from biodiversity under environmental, social and economic sustainability criteria (BioTrade) can incentivize sustainable use and mitigate risks to supply chains.[73] The contribution of ecosystem services to the global economy is estimated to be 1.5 times the size of global annual GDP.[74, 27] Placing biodiversity at the center of all economic initiatives and policies- for instance, through valuing and assessing biodiversity impacts and improving due diligence[74] – is therefore not only a precondition but also the most effective way to ensure achievement of SDG 8 – the **promotion of sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all**.

SDG 9: Accounting for medium to long-term effects on the surrounding natural environment improves outcomes for **building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation**. Possible additional short-term costs of respecting or even building 'with' the natural environment produce greater long-term savings and returns due to higher

durability and resilience against natural hazards.[75] Examples of such accounting are investments in green infrastructure which can absorb run-offs,[76] protect against extreme weather events like floods or droughts, and provide safe passages for animals (wildlife crossing), or reinforcement of existing infrastructure in combination with natural development (e.g. Prince Hendrik Dike, Netherlands[77])

SDG 10: Investing in the conservation of biodiversity, ecosystems and sustainable practices can- if inclusive, participatory, and respecting rights and needs of indigenous peoples and local communities[55] – help to **reduce inequality within and among countries**. Sustainable practices increase long-term reliability of agricultural output, and support high-skill jobs outside of urban centers. If co-designed with local stakeholders and communities, and implemented carefully, protected areas and other area-based conservation measures can provide employment opportunities in rural areas, and thereby support rural poverty reduction and increase equality within a country.[78] Ensuring accessibility to nature across social groups can support better mental and physical health within society. Well designed payment for ecosystem schemes can contribute to poverty alleviation and other equality objectives.[79]

SDG 11: Investments into biodiverse and green areas within and around urban areas **make cities and human settlements inclusive, safe, resilient and sustainable.**[80] Biodiversity supports the functioning of cities[81] and specifically contributes to improved air quality, urban cooling, noise reduction, reduction of water runoff and flooding, and provision of green areas for recreation.[11] Accordingly, it is essential to ensure that biodiversity is fully integrated into and engages with urban planning and development, architecture, commercial horticulture, entrepreneurship and the public.[82]

SDG 12: A precondition to **ensure sustainable consumption and production patterns** is making them biodiversity-friendly. Maintaining rich biodiversity and healthy ecosystems is essential for the much needed transformational shift to sustainable harvesting, hunting, forestry, fishing, agriculture, mining, processing, production, and trading.[83, 4] Most activities of productive sectors in human societies depend on healthy ecosystems[84] and ecosystem services further mitigate adverse impacts of production (e.g. biodegradation[85]). Intact river catchment areas provide reliable water supply for agriculture, mining, production and housing, healthy reefs provide opportunities for fish stock recovery, and hedges and green belts provide habitats for pollinators.

SDG 13: Biodiversity and ecosystem conservation is critically important in responding to the call for **urgent action to combat climate change and its impacts.** The oceans and terrestrial ecosystems, such as peat bogs and diverse forests, contribute significantly to climate change mitigation.[26] They represent globally significant carbon stores, absorb around half of the anthropogenic CO_2 emissions, and are natural buffers against extreme climate and weather events.[86] Restoring 15% of converted lands in priority areas could avoid 60% of expected extinctions and sequester 300 gigatonnes of CO_2, which corresponds to 30% of the total CO_2 increase in the atmosphere since the industrial revolution.[87] In urban areas, biodiversity and functioning ecosystem services like tree shading are relevant for climate mitigation.[88, 40] Nature-based solutions are the most cost-effective and long-lasting ways to adapt to, and mitigate, climate change.[89] Avoiding deforestation, peatland burning and mangrove conversion as well as sustainable management and ecosystem restoration can contribute up to 30% of the CO_2 emission reduction needed to achieve the 1.5°C goal.[89] However, seemingly straightforward solutions such as planting trees to afforest degraded land or to regulate air quality in cities[90–92] require careful consideration of the local context and suitability to ensure the tree species benefit rather than harm biodiversity.

SDG 16: The goal – to truly **promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels** – is underpinned by the need for healthy and safe environments and via just sharing of the provisions that functioning ecosystems provide as a basis for livelihoods. Yet, many conflicts ranging from international to community-level are exacerbated by environmental degradation[93, 94] or disputes over the use of natural resources,[95, 96] which in turn can have multiple causes.[97] To achieve long-lasting peace, the conservation and restoration of biodiversity and ecosystem services should be fully integrated in international diplomacy, science diplomacy, and in governance regimes at all levels.

SDG 17: By contributing directly and indirectly to all SDGs, biodiversity **strengthens the means of implementation and revitalizes the global partnership for sustainable development**.[11] Investing official development assistance and private funds in biodiversity conservation and sustainable use strengthens the common good and human well-being.[2] Such investments are less likely to distort markets or create negative incentives compared in other investments in development cooperation objectives.[98] In Africa alone, conservation activities generate more than US$29 billion annually and employ 3.6 million people.[123] Funds to support conservation can be channeled to disadvantaged areas or segments of populations, and achieve development and conservation co-benefits. Investing in biodiversity strengthens the provision of ecosystem services on which communities depend and provides income opportunities[98]

Importance of taking measures for achieving the biodiversity-focused SDGs 14 and 15

SDG 14: The richness of biodiversity in particular in the high seas is negatively affected by overexploitation, climate change, ocean acidification, and pollution. Actions are needed to **conserve and restore marine ecosystems and resources for sustainable development**. Healthy biodiversity in terms of species numbers and abundance is an important safeguard against negative effects of environmental changes, such as ocean acidification.[99] Global fisheries are estimated to provide livelihoods for 800 million people, directly providing income to 60 million people, and are the source of 6.8% of all proteins consumed by people. Of these global catches, 87.5% are from marine sources.[70] Furthermore, the marine environment is a largely untapped reservoir of genetic resources with biotechnological and business opportunities.[100] Therefore, efforts to sustainably manage marine biodiversity and set aside marine and coastal areas for conservation are also smart investments in long-term economic prosperity and social stability.

SDG 15: This goal aims to **protect, restore and promote sustainable use of terrestrial and freshwater ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss**.[20] Systemic approaches are needed to address drivers of biodiversity loss, to integrate ecosystem and biodiversity values into national and local decision making and to mainstream biodiversity into other sectors. Targets under this goal highlight the importance of particular ecosystems, including wetlands, forests and mountains.[101] Most ecosystems are in need of protection and restoration.[4] The post-2020 global biodiversity framework is expected to aim to protect and conserve at least 30% of the planet by 2030, with the focus on areas particularly important for biodiversity.[102] The Bonn Challenge sets the target of bringing 350 million hectares of deforested and degraded land into restoration by 2030.[103] Sustainable management and nature-based solutions should be placed at the forefront of actions to address processes like desertification and land degradation. Solutions will be the most efficient, effective and long-lasting when co-benefits with other SDGs are pursued.

Box: Key terms

- Biodiversity is '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' (CBD). Biodiversity is commonly addressed by researchers and policymakers as a global entity and its three key components (ecosystems, species and genes), while acknowledging that these components are characterized by attributes, such as diversity, abundance and composition.[11]
- **SDG interactions:** SDG interactions refer to interdependencies between the sustainable development goals (SDGs),[1] whereby action toward one goal (i.e., SDG or target) impacts the performance of one or more others. There can be synergistic interactions (**'co-benefits'**) or conflictual interactions (**'trade-offs'**) for each pair of SDG targets, e.g. identified in a formal network analysis based on literature review.[9, 21]

Figure 3: Interactions from one to another SDG can be synergistic *(co-benefit)* or conflictual *(trade-off)*. Some SDGs tend to systematically influence – positively or negatively – progress on other goals *(multipliers)* while some others tend to be systematically influenced – positively or negatively – by progress towards other goals *(buffers)*. The network analysis of the current state of knowledge on SDG interactions shows that implementing actions to achieve the SDGs related to natural resources (SDG 6 Clean water, SDG 12 Responsible consumption, SDG 14 Life below water, and SDG 15 Life on land) are likely to contribute to the achievement of other SDGs (in the top right box *multipliers of co-benefits*). The size of the SDG symbol (large/small) represent that SDG's influence on other SDGs. Figure adapted from Pham-Truffert et al (2020).[9]

Policy recommendations

In an increasingly globalized and hyper-connected world, chances of progress on one SDG in a specific part of the world will depend on interventions made in other world regions and in different sectors, and often in distant places.[104] Interactions frequently imply trade-offs, but also give rise to co-benefits and significant potential for transformative change towards sustainable development.[23] This knowledge should inform national strategies aiming to implement the SDGs,[10] such as the new Sustainable Development Strategy which is currently being developed in Switzerland. The following options are promising pathways to achieve the sustainable development agenda with the help of fostering biodiversity:

→ **Steer actions towards transformational change:** to enable transformational change, people need to be empowered in three ways: by enhancing equity, by pursuing innovation, and by instilling a sense of stewardship of nature[1] based on the recognition of multiple values. A shared sense of stewardship is a prerequisite for reverting trends in nature through the large-scale conservation, restoration and sustainable use of biodiversity, and for achieving a higher resilience in the face of ongoing planetary changes.

- → **Increase policy coherence:** narratives for interactions between the SDGs need to be further developed, and actors should take SDG interactions into account when devising implementation policies.[105, 13] Given that actors are often specialized in one SDG area (e.g. SDG 6), governance arrangements should aim for a fit between dependencies among SDGs (e.g. 6 and 14) and coordination among governance actors responsible for those SDGs (6 and 14, respectively).
- → **Mainstream biodiversity into all policy sectors:** by adopting multi-stakeholder participatory approaches convening representatives from all policy sectors to explore possible futures[106, 107] and formulate acceptable biodiversity-based pathways that integrate multiple values and objectives.[108].
- → **Mainstream biodiversity into the private sector:** given the right incentives, monitoring and disclosure of private sector dependency and impact on biodiversity and ecosystem services,[109] and increased business accountability[110] represent powerful mechanisms through which to streamline biodiversity into economically sustainable development.[111] The Global Reporting Initiative[112] and the IFC Performance Standard are useful guidance and performance standards. New coalitions and initiatives such as the Science Based Targets Network,[113] Business for Nature[114] and We Value Nature,[115] offer potentially powerful new platforms through which to engage the private sector in global efforts to reverse biodiversity loss.
- → **Find and apply nature-based solutions:** local communities and indigenous peoples around the world can make the achievement of the SDGs possible through nature-based actions. Existing resources such as the Nature-Based Solution Database[116] and the WOCAT database[117] offer a wealth of information and examples of such solutions for guidance and context-specific applications.
- → **Measure, track and report:** the systematic reporting on biodiversity in Voluntary National Reviews (VNRs) to the UN High Level Political Forum, as well as a better reporting on environmental dimensions in official national accounting and country reports to the UN (e.g. Environmental-Economic Accounts Experimental Ecosystem Accounting[118])[119] are essential first steps towards formulating evidence- and data-based biodiversity-centered pathways towards sustainability. Further, a unified periodic monitoring of the state and development of ecosystem services is needed to evaluate and potentially reformulate biodiversity and ecosystem services policies.[120]

1 – 123 References are included in the online version at http://bit.ly/Biodiversity_SDGs

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