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Ecosystem-based Adaptation and the successful implementation and achievement of the Sustainable Development Goals

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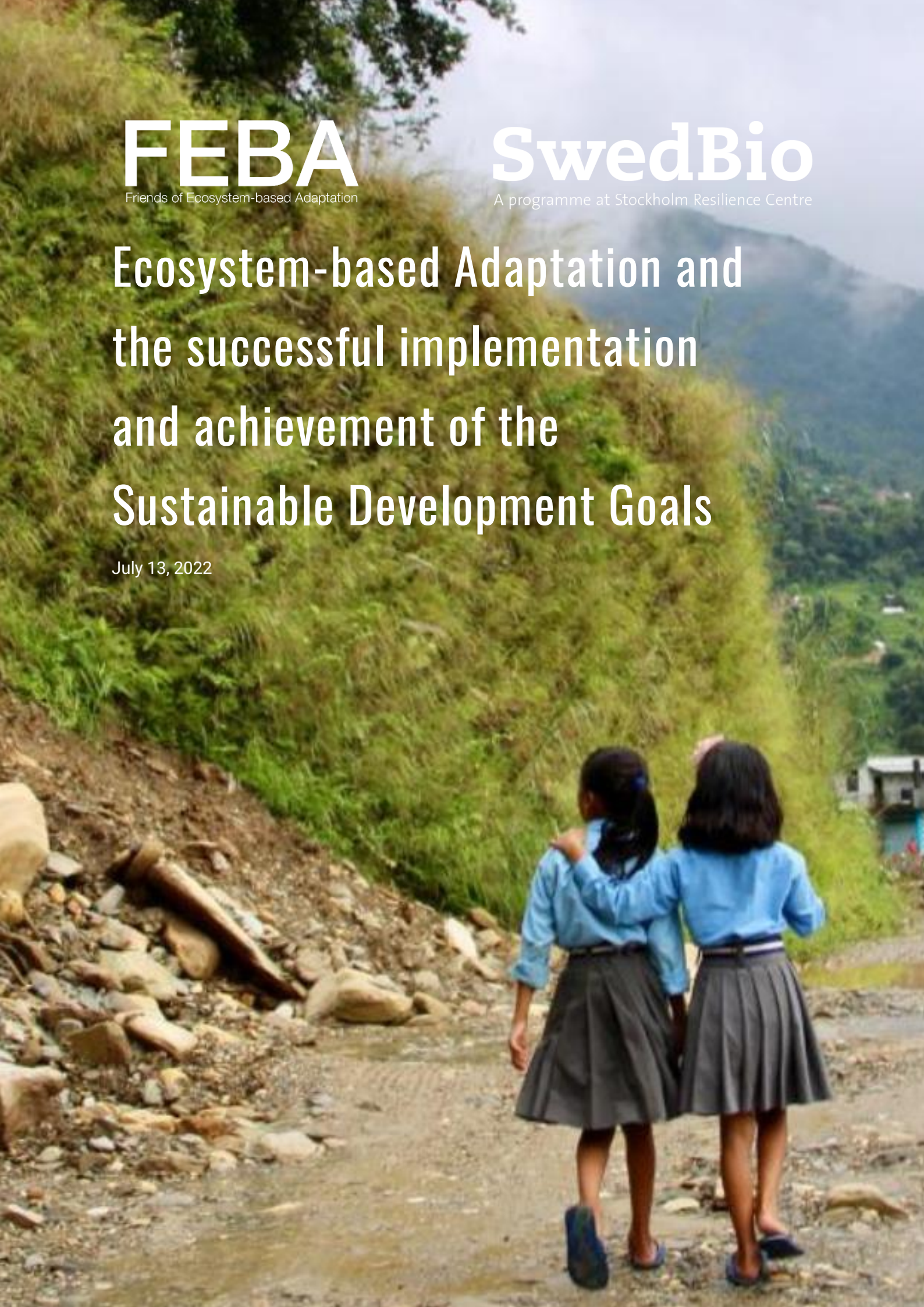

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FEBA
Friends of Ecosystem-based Adaptation

Friends of EbA (FEBA) is a global collaborative network of more than 100 agencies and organisations involved in Ecosystem-based Adaptation working jointly to share experiences and knowledge, to improve the implementation of EbA activities on the ground, and to raise awareness and understanding of nature-based solutions in adaptation planning processes and multilateral policy frameworks. FEBA convenes the global adaptation community around expert working groups, technical workshops, and high-level events. The CBD COP recognizes FEBA as a key partner "to support Parties in their efforts to promote ecosystem-based approaches to climate change adaptation" (Decision 14/5).

SwedBio
A programme at Stockholm Resilience Centre

SwedBio is a programme for biodiversity and equitable development in harmony with nature at Stockholm Resilience Centre at Stockholm University. SwedBio focuses its effort on two impact pathways for engaging with biodiversity and equitable development, namely the Dialogue for knowledge and policy pathway and the Collaborative partner implementation pathway. Through these pathways to change, SwedBio aims to advance sustainable and equitable governance of biodiversity knowledge and policy, contributing to address biodiversity loss and ecosystem degradation that undermine people´s rights to sustainable and equitable development, and those living in poverty are especially vulnerable.

This report is a collaboration of the FEBA Working Group on Ecosystem-based Adaptation and the Sustainable Development Goals.

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Acronyms

BMZ	Federal Ministry of Economic Cooperation and Development (Germany)
CBD	Convention on Biological Diversity
CI	Conservation International
EbA	Ecosystem-based Adaptation (*AbE in Spanish*)
EbM	Ecosystem-based Mitigation
Eco-DRR	Ecosystem-based Disaster Risk Reduction
EHA	EcoHealth Alliance
FAO	Food and Agriculture Organization
FEBA	Friends of EbA
GAN	Global Adaptation Network
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICIMOD	International Centre for Integrated Mountain Development
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
IPLC	Indigenous Peoples and Local Communities
IRENA	International Renewable Energy Agency
IUCN	International Union for Conservation of Nature
IUCN-CEM	IUCN – Commission on Ecosystem Management
IWRM	Integrated Water Resource Management
NAP	National Adaptation Plan
NbS	Nature-based Solutions
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
SCP	Sustainable consumption and production
SDG	Sustainable Development Goals
SEI	Stockholm Environment Institute
SIDS	Small Island Developing State
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNEP-IEMP	UNEP – International Ecosystem Management Partnership
UNEP-WCMC	UNEP – World Conservation Monitoring Centre
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNU-EHS	United Nations University – Institute for Environment and Human Security
UN-WWAP	United Nations – World Water Assessment Programme
UPEI	University of Prince Edward Island
USD	US Dollars
WHO	World Health Organization
WRI	World Resources Institute
WWF	World Wide Fund for Nature

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1. Introduction

Climate change is here, and the impacts we are already being seen around the world, from higher temperatures, rising sea levels, more frequent and intense droughts, floods, and wildfires, and increasing climate variability. The most vulnerable people and ecosystems – for example in least developed countries and small islands developing states – are the hardest hit, with recent studies demonstrating that over 3.3 billion people live in places that are highly vulnerable to climate change (International Federation of Red Cross and Red Crescent Societies (IFRC) & WWF – World Wide Fund For Nature (WWF), 2022). Climate hazards can undermine historical development progress by increasing food and water insecurity, exacerbating inequalities, and impacting livelihoods and economies around the world. Even under the most optimistic emissions scenarios, society will still need to adapt to changing climate conditions. We cannot achieve progress towards sustainable development goals, or preserve our global development gains to date, without urgent adaptation action.

Box 1: Definitions

Ecosystem-based Adaptation (EbA): the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change (Convention on Biological Diversity (CBD), 2009; CBD, 2010). EbA is a type of nature-based solution.

Nature-based Solutions (NbS): actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits (United Nations Environment Assembly of the United Nations Environment Programme (UNEP/EA.5/Res.5), 2022).

For people and society, adaptation to climate change means not only adapting our infrastructure, but adjusting our behaviour, such as how we choose to live, how we manage our food and health systems, the way we plan our cities, and how we protect, conserve and utilize our natural resources. Ecosystem-based adaptation (EbA) is a strategy that harnesses biodiversity and ecosystem services to build the resilience of human communities and societies to the impacts of climate change (Box 1). It includes the conservation, sustainable management and restoration of ecosystems – such as forests, grasslands, or wetlands – to reduce the harmful impacts of climate hazards, whether it's shifting rainfall patterns, temperature changes, or intense storms. EbA measures can be implemented on their own or in combination with engineered approaches (such as the construction of water reservoirs or seawalls), hybrid measures (such as artificial reefs) and approaches that strengthen the capacities of individuals and institutions to address climate risks (such as the introduction of early warning systems). Through integrating ecosystem-based adaptation into adaptation planning, we can work to secure productivity of agricultural systems, water resources and fisheries; promote human health and well-being; strengthen people's livelihoods and build more equitable societies; and rebuild and strengthen nature, while reducing climate risks.

Nature-based solutions (NbS) for climate adaptation, such as EbA, have the potential to provide vulnerable countries with valuable protection against the economic cost of climate change (Box 1) – reducing the intensity of climate hazards by 26 percent, representing protection against the economic cost of climate change by USD 104 billion by 2030 and USD 393 billion by 2050 (IFRC & WWF, 2022). The sustainability, cost-effectiveness, and scalability of these approaches make them one of the best tools available to ensure the necessary

transformative change for climate action, while addressing other societal challenges such as biodiversity loss, ecosystem degradation and human well-being (Donatti et al., 2022). At the nexus of sustainable development, human rights, climate action, and nature conservation, EbA recognises the symbiotic connections between people and ecosystems. By creating more resilient populations, such approaches can have far-reaching benefits in improving the capacity of humans to withstand not only climate hazards, but also economic shocks and stressors. **These nature-based climate solutions have an interconnected role across sustainable development goals – from health, water and nutrition to clean energy, sustainable infrastructure, and equality - with incredible potential to drive progress across the SDGs while building more equitable and resilient societies.**

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 SDGs, which represent an urgent call for action by all countries – both developed and developing – in global partnership. The SDGs are indivisible and interdependent, with each supporting the overall vision of the 2030 Agenda to ensure that the planet continues to support the needs of the present and future generations such that their potential in dignity, equality and in a healthy environment is fulfilled. Collectively, the SDGs aim to address global challenges such as poverty, inequality, climate change, environmental degradation, peace and justice. The goals for the biosphere – including life on land, life below water, clean water and sanitation, and climate action – underpin the societal and economic markers of progress of the SDGs (Figure 1Figure 1; Rockström and Sukhdev, 2016). The biosphere is critical in upholding society and the economy at large, although societal and funding priorities may not be aligned with its fundamental importance (Science for Environment Policy, 2021).

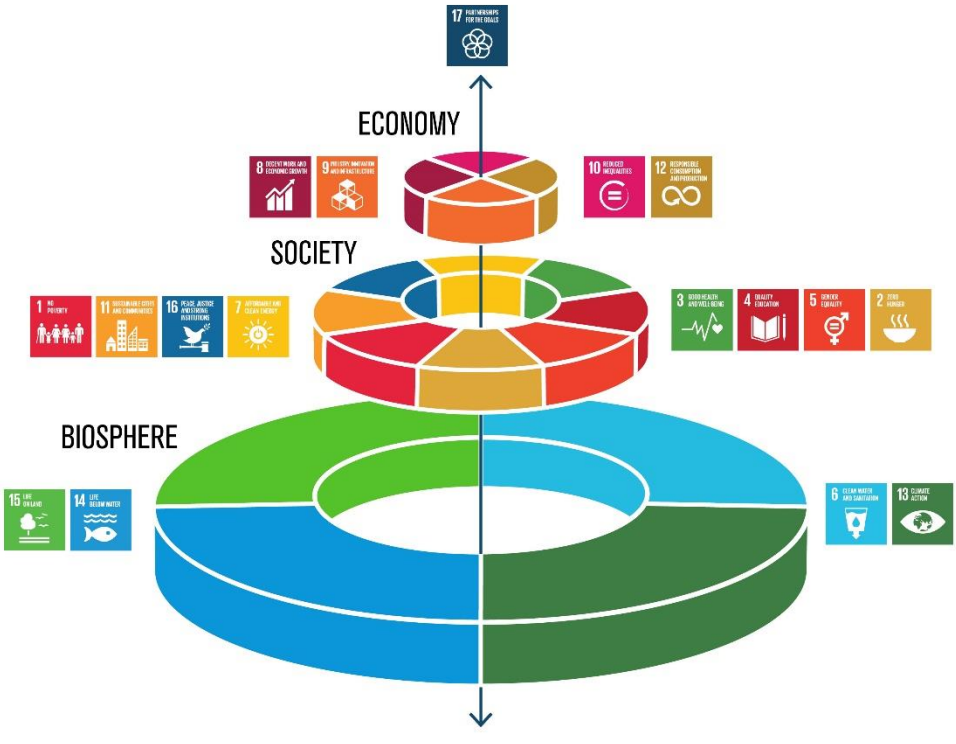

Figure 1. The SDGs of life on land (15), life below water (14), clean water and sanitation (6) and climate action (13) are the base of the "wedding cake", illustrating how nature connects and is the basis for all other SDGs (Source: Rockström and Sukhdev, 2016; Science for Environment Policy, 2021).

2. The importance of EbA to the SDGs

Biodiversity loss and ecosystem degradation, alongside the impacts felt around the globe by climate change, all have inherent connections to sustainable development. Failure to achieve the SDGs will exacerbate current negative trends, resulting in poor outcomes for global ecosystem health and human health.

EbA enables sustainable development within the context of climate change. When well designed, such approaches can achieve multiple co-benefits and contribute to sustainable development overall (IFRC & WWF, 2022). EbA is a mix of policy and action that has the potential to drive sustainability transitions while adapting to climate change (Scarano, 2017). EbA provides a clear path to showcase "coherence between climate change and development objectives" (Donatti et al. 2022). The importance of EbA for the realisation of the SDGs can be succinctly summarised in three points:

1. "EbA provides **opportunities for transformative adaptation**, e.g. changes that alter the system's properties to allow it to exist under changing climate conditions … EbA actions can be transformative when they **reshape unsustainable interactions between people and nature**, which are key if sustainable development is to be achieved in a changing climate" (Donatti et al. 2022).
2. EbA provides "economic, social, and environmental co-benefits and can contribute to climate change mitigation … Those **multiple benefits** provided by EbA are crucial for the realization of the SDGs as they help **address many challenges**," such as biodiversity loss, poverty, greenhouse emissions, natural hazards, and food insecurity under a changing climate (Donatti et al. 2022).
3. EbA represents an array of "**no- or low-regret options** for managing uncertainty in face of climate change" (Donatti et al. 2022).

Figure 2. NbS conceptual framework (Source: IUCN, 2020).

With an emphasis on inclusion and participatory process, the success of the SDGs inherently requires local communities, women and men, youth and elderly, and marginalized groups to engage and supply their knowledge to design and implement strategies. Similarly, a crucial principle of EbA is the idea of an "inclusive and participatory multi-stakeholder" approach (Vijitpan, Tan, & Ilieva, 2019; Vasseur, 2021). Inclusive participation is critical to designing and implementing EbA that contributes to climate justice and equity within and between communities.

Because EbA inherently operates in a climate risk context, integrating this approach with the various SDGs can add a climate-smart lens to supporting activities and make them more robust in the context of a changing environment. Active incorporation of the SDGs can also help ensure that EbA interventions consider broader

impacts, both intended and unintended, and sustainably and equitably manage trade-offs. Furthermore, it is essential to assess the risk of and take preventative steps to avoid maladaptation, wherein EbA might have unforeseen negative consequences for the environment and society. Meaningful participation, transparency, and consideration of equitability, as well as use of the best available science and comprehensive monitoring, evaluation and learning, can reduce the risk of maladaptation.

This cross-sectoral appeal of EbA is an important piece to consider when determining the links between EbA and some SDGs which may not typically be considered to be related to climate action. Further, EbA can provide the financial incentives to spur successful cross-sectoral collaborations, while ultimately providing the evidence base for projects to incorporate climate change and social impacts (Donatti et al. 2022).

This report dives into of the connections between EbA and each of the 17 SDGs. The following 17 sections addresses the threats posed by climate change, ecosystem degradation, and/or biodiversity loss, including how these impede the achievement of a given SDG. Each section subsequently provides an overview of how an effectively implemented EbA approach can underpin successful achievement of a given SDG. The full bibliography provides context and information for expanding this knowledge base[i].

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[i] A full case study list is in development, with plans to be launched in the latter half of 2022.

SDG 1 – No Poverty | End poverty in all its forms everywhere

Primary contributor: Biraj Adhikari (ICIMOD)

Poverty in all its forms is one of the biggest challenges faced by humanity – one that is being addressed through ambitious commitments in the form of SDG 1 (No Poverty). Evidence suggests that extreme weather events, such as heat waves, storm surges, and floods, will have disproportionate negative impacts on regions with higher levels of poverty and in countries with weak governance systems, limited access to basic services, and highly climate-sensitive livelihoods such as subsistence farmers, pastoralists and fishing communities (IPCC, 2022). Climate change will also lead to the deterioration of healthy ecosystems that are especially vital for those who directly depend on them for their livelihoods. As such, climate change is a serious risk to progress in poverty reduction and has the potential to reverse much of the progress already made by nations around the world to reduce poverty (Zhenmin & Espinosa, 2019).

EbA interventions that minimise the impacts of climate change also simultaneously increase resilience and safeguard livelihoods of vulnerable communities. Examples of EbA interventions that – by protecting, restoring and managing nature to minimise climate-related shocks – address the cyclical nature of poverty given that climate change, biodiversity and poverty alleviation are inextricably linked (Reid & Swiderska, 2008) include:

- Soil management and climate-smart agriculture practices can increase productivity of farms that not only improve food security but also help in increasing farm savings through efficient use of resources and generating income through the sale of excess crops (SDG target 1.1/1.2)
- Eco-tourism approaches generate new cash-earning opportunities that help reduce poverty by increasing household incomes (SDG target 1.1/1.2);
- Conservation and restoration of freshwater resources improve access to irrigation which helps in the production of cash crops (SDG target 1.1/1.2);
- Conservation and restoration of wetlands, springs and rivers also buffer communities against flooding and landslides, building their resilience to climate-related extreme events and disasters (SDG target 1.5);
- Community-based flood early warning systems can improve communities' response towards climate-related disasters and thereby increase their adaptive capacity (SDG target 1.5); and
- Conservation and restoration of forests and freshwater also secure access of the poor and most vulnerable to basic services such as drinking water, medicinal plants, and energy through firewood (SDG target 1.4).

EbA can further empower smallholders in affordable modern cultivation methods, quality management and marketing skills; revive traditional sustainable cultivation practices where the interests of various current and future end-users, including ecosystems, are mainstreamed; and provide equitable access and governance of natural resources, most notably water for irrigation purposes.

SDG 2 – Zero Hunger | End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Primary contributors: Antoine Libert and Maria Nuutinen (FAO)

Biodiversity in terrestrial and aquatic systems is the foundation of food security. Degraded ecosystems, an intensifying climate crisis, and increased biodiversity loss are threatening jobs, economies, the environment and food security around the globe, all aggravated by the impacts of the COVID-19 pandemic, crises and other humanitarian emergencies (FAO, 2022).

Agriculture and food production, along with their supply chains, have historically been vulnerable to shocks – from droughts and floods to armed conflict and food price hikes – and are under growing pressure from longer-term stresses, including the climate crisis and environmental degradation (FAO 2021). Ecosystem-based Adaptation measures are cost-effective interventions that can enhance resilience in agriculture and food production, while mitigating climate change and enhancing the environment.

Biodiversity for food and agriculture contributes to food security and safety. It includes, but is not limited to, domesticated plants, animals and fungi, such as raised in crop, livestock, forest, fisheries and aquaculture systems, harvested forest and aquatic species, the wild relatives of domesticated species, other wild species harvested for food and other products and what is known as "associated biodiversity", the vast range of organisms that live in and around food and agricultural production systems, sustaining them and contributing to their output (FAO, 2019a; Bioversity International, 2017). The ongoing loss of diversity in native, domesticated plants and animals is undermining the adaptive capacity and resilience of agricultural systems to pests, pathogens and climate change (see Dury et al., 2019). Food and agricultural investments also benefit from adopting climate-sensitive approaches: this can reduce food security risks associated with climate extremes, build long-term resilience and strengthen coping mechanisms along food supply chains (FAO, 2021).

The future sustainability of the world's food system under projected climate scenarios is dependent on restoring and maintaining the health of terrestrial and aquatic ecosystems. EbA interventions on agricultural lands promote land health and climate resilient food production and can reduce deforestation. Sustainable agriculture can help buffer against climate variability and extreme events and protect the biodiversity that supports ecosystem services essential to agriculture such as healthy soil and pollination. As a concrete example, the food systems of Indigenous Peoples and their farming practices, such as diversified land use, crop rotation and crop diversification all support adaptation to climate change (FAO et al. 2021; FAO et al. 2019). Soils contain an abundance of biologically diverse organisms that perform many important functions such as nutrient cycling, soil structure maintenance, carbon transformation, and the regulation of pests and diseases (Gunstone et al., 2021). Loss of pollinators threatens annual global crop output worth between USD 235 billion and USD 577 billion (UNEP, 2021).

EbA can reduce vulnerability and risk in the agriculture and food systems. It is often applied at the landscape and community level, including livelihoods and nutrition diversification. The implementation of EbA interventions can combine disaster risk reduction and climate change adaptation to reduce food insecurity. Many EbA actions and practices (see Vignola et al., 2015) can improve or maintain agriculture productivity and ensure food security:

- Through the promotion of crop, livestock, tree and fish varieties that are more resilient to floods, droughts, saline conditions, and other hazards (Alvar-Beltrán et al., 2021) (SDG targets 2.3 and 2.4);
- Investments in underrated and under-recognised crops (e.g., "orphan crops") (SDG target 2.5);
- Improved smallholder access to pest and drought resistant crop varieties (Mbow et al., 2021; FAO, 2019b) (SDG target 2.3);
- Integration of sustainable agriculture and other practices such as climate-smart agriculture, conservation agriculture, agroforestry, fodder conservation, to improve soil and water conservation (SDG target 2.3); and
- Promotion of value chains of "new" or underutilised food sources (e.g., insects, algae, seaweed) that provide reliable nutritious sources of food amid multiple disaster risks (Tzachor et al., 2021) (SDG target 2.1).

Under the UN Decade for Ecosystem Restoration (2021-2030), restoration of farmlands, especially soil restoration for carbon sequestration, can provide not only climate mitigation options but also climate adaptation by improving food production (GIZ, 2022) and restoration of peatlands for maintenance of ecosystem services (UN Decade on Ecosystem Restoration, 2022).

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SDG 3 – Good Health and Well-being | Ensure healthy lives and promote well-being for all at all ages

Primary contributors: Megan Bobb (IUCN), Annika Min (IUCN), Catherine Machalaba (EcoHealth Alliance)

Climate resilience, human health, and natural habitats are all connected, as recognised by UN Secretary General Antonio Guterres: "Alongside the COVID-19 pandemic, we face a triple planetary emergency — a climate crisis, a nature crisis and a pollution crisis" (UN, 2020). The interlinked climate and biodiversity crises are negatively impacting human health and well-being, as well as animal and plant health – addressed collectively through the One Health approach[ii] (WHO, 2021). Extreme climate events and shifting temperature and precipitation regimes combine with the loss of ecosystem services and habitat degradation to endanger food production and water safety and security, increase the vulnerability of communities to disasters, impair local coping and response mechanisms, including access to traditional medicines, and precipitate the spread of zoonotic and vector-borne diseases, among other health-related challenges.

EbA can help address underlying drivers of unsustainable development that lead to negative health outcomes, including the impacts of climate change, deforestation, landscape fragmentation, and land use changes and degradation. Functioning ecosystems support both physical and mental health and provide food security and adequate nutrition, potable and sustainable water systems, disease regulation, and much more for communities (WHO and CBD, 2015). Through EbA interventions, ecosystems are maintained, restored, or sustainably managed in ways that help people adapt to the impacts of climate change on health. Such actions can also reduce the proximity or stress of interaction between wildlife and humans, thus reducing threats from zoonotic disease emergence and transmission. EbA strategies to address public health have the ability to be simultaneously responsive and preventative, both assisting in recovery from crises and reducing the vulnerabilities of ecosystems and communities reliant upon them for their health, livelihoods and well-being.

EbA can offer multiple benefits and co-benefits that ensure healthy lives and promote human well-being through:

- Reducing the risk and impact of wildfire or other disastrous events (SDG target 3.D);
- Regulating temperature, including mitigating urban heat island effects, heat waves, and cold snaps (SDG target 3.D);
- Reducing air, soil, and water pollution levels and associated disease burden (SDG target 3.9)
- Lowering the risk of zoonotic disease spill-over, vector-borne disease transmission, and water-borne illnesses (SDG target 3.3);
- Addressing root causes of and improving outcomes for non-communicable diseases through prevention and treatment and promotion of mental health via healthy lifestyles, healthy environments, and access to nature (SDG target 3.4); supporting active lifestyles, outdoor recreation, community relationships, psychological well-being and harmonious coexistence with nature through access to green/blue spaces (SDG target 3.4);
- Maintaining access to natural and traditional medicines (SDG target 3.8); and
- Connecting people to nature and reviving traditional practices creating harmonious coexistence between people and nature.

[ii] One Health definition developed by the One Health High-Level Expert Panel (OHHLEP) states: "One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems" (OHHLEP, 2021).

SDG 4 – Quality Education | Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 4 explicitly seeks to achieve "quality education for all" through a combination of increasing access, raising quality, equalising existing inequalities, and promoting the knowledge and skills needed for sustainable development.

Educating and building awareness about climate change has emerged as a solution to respond and adapt to climate change (Park et al., 2020). A recent study (Global Center on Adaptation, 2022) found that:

- "Education for adaptation action is key to driving climate action. Locally-contextualized educational efforts on climate adaptation generate a deeper understanding and connection with the learners, who can then take the lead in climate action, thereby addressing the local impacts."
- "A 'solutions-based approach' to climate adaptation through curriculums and extra-curricular activities at schools leads to enhanced engagement of children and youth in adaptation action, both at home and at the community-level."

SDG 4 does not explicitly emphasise education in terms of its environmental consequences and has been criticised as not being strongly tied or linked to environmental Goals such as SDGs 12-15) (Vladimirova & Le Blanc, 2015). Even while the world's education levels continue to rise (OECD, 2021), our planet is environmentally at its most vulnerable. This implies that, in order to address climate change and growing environmental crises, our assumptions around what education should look like must be adjusted and more closely aligned with environmental SDGs and EbA outcomes (Blaikie et al. 2020).

When implemented holistically, EbA can provide benefits that align with SDG 4 objectives, especially through capacity building and cross-network sharing. Expanding and supplementing knowledge through quality education ultimately promotes sustainable development. To improve climate resilience, "as a key component of adaptive capacity, education should incorporate EbA into school and university curriculum to promote a thorough understanding of the role of ecosystems and enable students to take action" (United Nations Environment Programme – International Ecosystem Management Partnership (UNEP-IEMP), 2019, pp. 3).

Addressing the drivers of biodiversity loss and climate change requires behavioural change and an equitable and participatory approach. Awareness and learning about the values of the natural environment are therefore important across all communities, ethnic groups, genders, and ages. This in turn emphasizes the need for advocating formal, informal and non-formal education strategies aimed at mainstreaming sustainable ecological practices in the lives of community members as a whole.

EbA interventions can also improve the capacity of vulnerable children to access schools through securing safe environments by developing green infrastructure that reduces the risk of being isolated due to flooding, landslides, or other hazards.

SDG 5 – Gender Equality | Achieve gender equality and empower all women and girls

Primary contributor: Liette Vasseur (Brock University/IUCN-CEM)

Women and girls are intricately connected to nature in varied and diverse ways, including through their roles linked to natural resources. Various studies throughout recent years also indicate that gender balanced decision-making groups make more prosperous, equitable, peaceful and environmentally beneficial decisions (Leisher, et al., 2016).

Women and girls are also responsible for many natural resource collection, management and use activities – from fetching water, to managing household energy use or collecting non-timber forest products. They are also key contributors to various value chains, for example making up 90% of most fish processing roles or composing approximately 40% of the globe's agricultural roles. However, they are also often the first affected by biodiversity loss and climate change (Aguilar et al., 2015). Climate impacts make household tasks more difficult (Anderson et al., 2015) and risks for gender-based violence increase as resources deplete and activities take women and girls further from normal routes (Castañeda et al., 2020). Due to gender inequality, women's contributions to natural resource activities are often undercounted or overlooked – barring access to formal positions, finance and productive assets – as well as meaningful full participation in environmental decision making. Climate change not only severely impacts women's resulting reliance on subsistence agriculture, it also exacerbates their food insecurity due to norms that favour men's and children's nutrition – all while being unable to access supportive services designed to support climate resilience (Mbow et al., 2019).

Understanding the different roles of diverse women and men from an intersectional perspective is also essential. For example, Indigenous women safeguard traditional knowledge on sustainably using and conserving ecosystems by passing know-how throughout generations – a responsibility that makes them uniquely positioned to guide, inform and lead environmental action —while also addressing multiple layers of barriers and persistent marginalisation. As stated by SDG Target 5.A, strengthening women's rights and access to natural resources are critical for climate change adaptation, as well as communities' food security. Uniquely cross-cutting, the targets and achievement of SDG 5 have co-benefits across all SDGs that are important for EbA.

Gender-responsive EbA interventions contribute towards gender equality while achieving more inclusive governance and improved natural resource management (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2021c). Gender-responsive EbA can promote multiple benefits and co-benefits for women and girls by:

- Promoting and maintaining women and girls' rights and access to land and natural resources including for food, energy, water, and medicines (SDG target 5.A);
- Increasing their full and effective participation in decision making over natural resource management and equal opportunities for leadership in natural resource governance mechanisms (SDG target 5.5);
- Integrating gender-responsive adaptation actions that transform gender social norms, including to prevent gender-based violence (SDG targets 5.2 and 5.3); and
- Increasing access to finance and other benefits resulting from investments in adaptation (SDG target 5.A).

SDG 6 – Clean Water and Sanitation | Ensure availability and sustainable management of water and sanitation for all

Primary contributors: Miriam Seemann (GIZ), Mohammad Aminur Rahman Shah (UPEI)

Nearly all the 17 SDGs have relevance to water. SDG 6 particularly stresses clean water supply and sanitation issues, which can be addressed by increasing the availability of clean water and sanitation facilities through sustainable management practices (United Nations Water (UN-Water), 2018). Adequate availability of clean water is highly dependent upon hydrological systems and water resources and is related to healthy ecosystems and their provisioning functions and services. Shifts in global climate patterns have significant impacts on hydrological flows, leading to unpredictable water availability and extreme weather events such as droughts, floods, and tropical storms (Sadoff and Muller, 2010; Shah, 2016). Such impacts drastically affect the quantity and quality of water and human health and well-being, as well as ecosystems and biodiversity in a variety of ways. Thus, climate-resilient water management is of multi-sectoral importance (Federal Ministry for Economic Cooperation and Development (BMZ), 2017; GIZ, 2021c).

EbA is an important approach to integrated and adaptive water resources management, climate-resilient livelihoods and strengthened water security. EbA can offer multiple benefits and co-benefits that ensure water security and promote human well-being through:

(1) **Increasing water availability and enhancing water quality:** Through EbA, healthy water ecosystems can be restored, conserved and sustainably managed (SDG target 6.6) to maintain or increase the quantity of water available for communities by recharging aquifers and improving natural water storage. EbA can improve and regulate water quality by promoting adequate measures to manage forests, wetlands, peatlands, and grasslands as well as soils and crops.

(2) **Reducing water related risks:** Application of EbA can help vulnerable communities adapt to extreme weather events (storm surges, floods and hurricanes), for example, through the conservation and restoration of mangroves, coastal marshes and coral reefs (SDG target 6.6). It can also reduce flood and drought risk by regulating water flows and recharging aquifers through the management and restoration of natural floodplains (SDG target 6.6).

(3) **Establishing and/or strengthening water policies and water governances' processes:** EbA implemented in transboundary landscapes/ecosystems (river, wetlands, forests) can establish/ strengthen international, national, and local organisational structures of water governance by supporting the fair and equitable distribution of user access, rights, responsibilities and decision-making processes (SDG targets 6.5 and 6.a). Community participation in EbA projects (e.g., wetland/peatland restoration) is also linked to their involvement in water management (SDG target 6.b).

SDG 7 – Affordable and Clean Energy | Ensure access to affordable, reliable, sustainable and modern energy for all

Large-scale expansion of renewable energy is vital for a sustainable future. Long term provision of affordable, reliable, and sustainable energy must be ensured by a rapid transition to renewable energy sources including wind, solar, hydropower, and biomass. However, efforts to implement and scale renewable energy production can have unintended negative consequences on the environment (Bennun et al., 2021b) and be at odds with adaptation outcomes. All renewable energy sources can contribute to biodiversity loss and disruption of ecosystem services, raising the risk of degrading and polluting landscapes and habitats and thus undermining resilience at a local and global level. Bennun et al. (2021b) argues that "a truly sustainable green energy transition must therefore be carefully planned and managed so that it does not come at an unacceptable cost to nature" and people (as relevant also to other SDGs, such as 9, 13, 14, 15).

Climate mitigation and adaptation efforts must work more synergistically to optimise sustainable development outcomes, including between renewable energy and EbA. Bringing an ecosystem-focused climate risk lens to the development of renewable energy projects could highlight their potential impacts on nature and on the communities dependent on natural resources for their livelihoods. Holistic planning (see e.g. Bennun et al. 2021b) could help identify opportunities to generate multiple benefits for poverty reduction, health and well-being alongside energy production, as well as avoid biodiversity loss and reduce the risk of maladaptation.

EbA can also directly support renewable energy generation through its regulation or provision of natural resources. For example, forest restoration can provide measurable ecosystem services – such as reduced sedimentation and increased volume and regularity of water flow – that increase the efficiency of hydropower generation while improving water security and quality, sequestering carbon, and creating jobs and investment opportunities. Such improvements in efficiency could make renewable energy projects more economically viable and scalable, which would increase the share of renewable energy in the global energy mix and expand clean energy access globally.

In addition to contributing to the sustainability of renewable energy generation, EbA provides powerful opportunities to reduce energy consumption needs, which is also vital to ensure sustained access to energy. EbA interventions can conserve natural resource use; urban ecosystems and tree planting can act as insulation against urban heat or cold island effects and thus reduce heating and cooling demand; green-gray stormwater catchment systems can reduce flooding and the associated loss and damage and pumping needs; and protect local energy-related infrastructure from climate-related disasters, such as by reducing local wind speed during storms through the conservation of nearby forest.

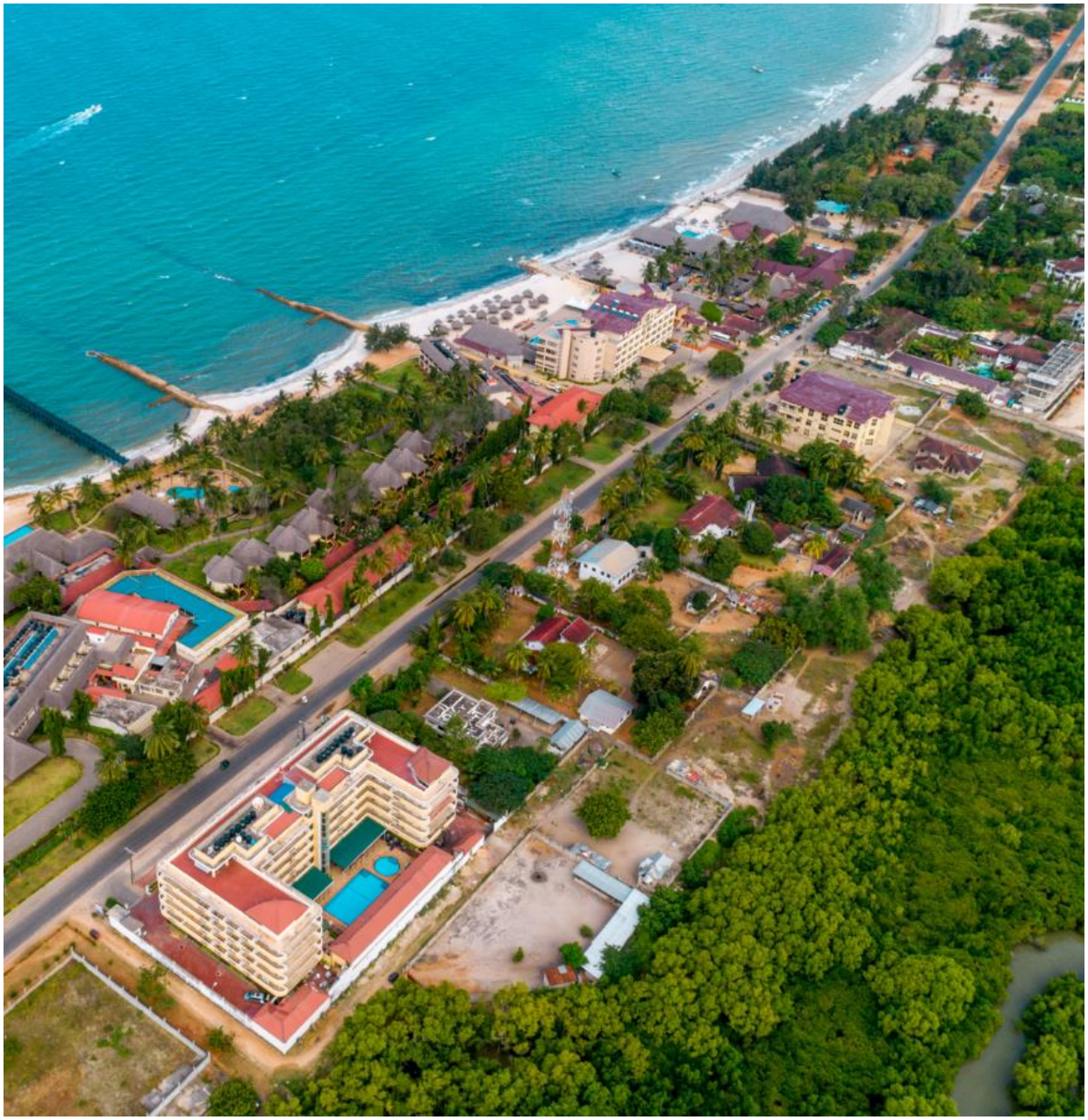
The versatility of a portfolio of renewable energy sources allows for such technologies and approaches to boost resilience to climate change for communities amid uncertainties regarding wind, water and other natural sources, such that both renewables and EbA can both be part of a comprehensive adaptation strategy.

When implementing EbA, it is important to consider long-term maladaptation that may occur without taking proper considerations for local context- and case-specific needs. This is especially important in the context of renewable energy technologies and renewables-based

adaptation, which may not be best suited for certain adaptation measures, given that "adaptation is usually quite local context- and case-specific" (IRENA, 2021).

EbA can offer multiple benefits and co-benefits to ensure renewable and sustainable energy is available to all by:

- Contributing to the scaling and expansion of clean, affordable energy by improving efficiency of energy generation through ecosystem service provision and by making projects that integrate EbA and renewables more economically viable and attractive (SDG targets 7.1 and 7.2);
- Increasing energy efficiency and reducing consumption needs by providing green infrastructure that reduces temperature extremes and disaster impacts (SDG target 7.3); and
- Ensuring that local communities have access to diverse energy sources which can be protected from or re-established rapidly after an extreme climate event (SDG target 7.B).



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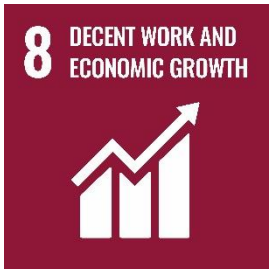

SDG 8 – Decent Work and Economic Growth | Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 8 establishes a human-centred approach to the future of work. To achieve the goals associated with SDG 8 an emphasis must be placed on the integrated nature of the needs of society within a sustainable environment. Appreciating this integrated nature then allows for the establishment of a transformative path towards economic growth and development.

SDG 8 straddles the economic, social, and environmental dimensions of sustainable development. There is a strong case for arguing that SDG 8 is central to the entire 2030 Agenda (International Labour Organization (ILO), 2019). SDG 8 recognises that countries continue to strive for economic growth but that to achieve this, economic goals must decouple growth from environmental degradation, to mitigate impacts on climate change. Importantly, as with all SDGs, gender equality and equitable activities must be a founding principle of all action.

The urgency of striking a balance between the economic, social and environmental dimensions calls for new policy choices to be made at the national and global level (ILO, 2019). EbA provides benefits to achieve just that – especially related to livelihood maintenance and human safety and resource security.

Many livelihoods and economic value chains are directly dependent on natural resources that can be maintained or enhanced by EbA interventions in the face of climate change and other threats. EbA can also improve the safety of work by reducing the risk of hazards such as disease vectors, flooding, and heat or cold waves. EbA can further support the dignity of work by supporting traditional livelihoods that are tied to local biodiversity and landscapes and providing employment opportunities for youth to continue engaging with local ecosystems.

Biodiversity and ecosystem services are crucial for long-term sustainable economic growth. Simultaneously, the current and projected economic impacts of climate change are widely recognised, from production systems to investments and insurance. EbA can offer solutions that help to address these challenges by supporting sustainable economic development and decent employment opportunities. Integrating EbA as an approach can secure short-term economic recovery for communities, while simultaneously investing in measures to address climate change in the long term.

Further, implementing EbA approaches in tandem with existing mechanisms, such as in agriculture or livelihood generation, can enhance the resiliency of communities by facilitating exchanges to share knowledge on success of EbA implementation, while learning from each other (Harvey, et al. 2017). EbA can contribute to this SDG by:

- Ensuring equitable and inclusive participation and governance, as well as benefit-sharing from EbA actions; and
- Providing alternative livelihoods and economic opportunities based on the sustainable use of natural resources.
- Through innovative solutions, youth can integrate a new diversified workforce that provide work for the future (SDG target 8.6).
- EbA can also lead to new and more diverse work by creating new small and medium sized enterprises (SDG target 8.3).

SDG 9 – Industry, Innovation and Infrastructure | Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Primary contributors: Emmie Oliver (WRI), Emily Corwin (CI)

With much of the world living in cities and other developed areas, where billions of dollars are spent each year on growth and infrastructure, there is an urgent need to finance and implement sustainable infrastructure and industrial practices. Such practices must be innovative in nature, to ensure that they remain economically viable in the short- and long-term, while reducing our carbon footprint and prioritizing sustainability (Bath, 2018).

Nature-based innovations could increasingly support infrastructure needs. Biodiversity and healthy ecosystems provide cost-effective natural infrastructure, such as wetlands providing quality water, along with serving as buffers against catastrophic effects of extreme weather by storing water in times of flooding and preserving surface water in times of drought. Further, maintaining and restoring wetlands also lead to cost savings when compared to manmade infrastructure solutions, in many cases (Ramsar Convention on Wetlands, 2021).

As climate change impacts increase, the availability of natural infrastructure to address such impacts is essential. EbA alone or combined with grey infrastructure can lead to innovative and resilient ways to address the impacts of climate change (Figure 3). Many networks exist to expand innovation, such as the Global Green-Gray Community of Practice and the Building with Nature Consortium, which foster inclusion of diverse professional disciplines and lived experiences to further innovation, adoption, and adaptation.

Literature has been growing which showcase that green-grey designs[iii] can out-deliver grey infrastructure investments, not only in economic terms, but also in social and environmental outcomes (Green-Gray Community of Practice 2020; Browder et al. 2019). This is because of the variety of co-benefits that green components generate, such as improved sustainability, durability, cost-effectiveness, and acceptance by local communities. Green-grey designs for infrastructure are unique in their ability to work with natural systems to economically deliver resilience outcomes (Oliver, 2021).

EbA can offer multiple benefits and co-benefits to infrastructure by:

- Developing green infrastructure that is more resilient to extreme climate events (SDG target 9.1); and
- Through inclusive governance in local communities, improving clean, resilient, and sustainable industrialization of developing countries (SDG targets 9.2 and 9.3).

[iii] A hybrid green-gray approach to infrastructure — one that combines "green" ecosystem conservation and restoration with "gray" conventional engineering — can generate more benefits and climate resilience for people and nature than either strategy applied alone. The Practical Guide to Implementing Green-Gray Infrastructure is a tool for identifying, funding, planning, designing, constructing, and monitoring green-grey infrastructure projects, to increase the resilience of vulnerable cities, communities, and assets around the world. *Learn more about the Global Green-Gray Community of Practice, coordinated by Conservation International.*

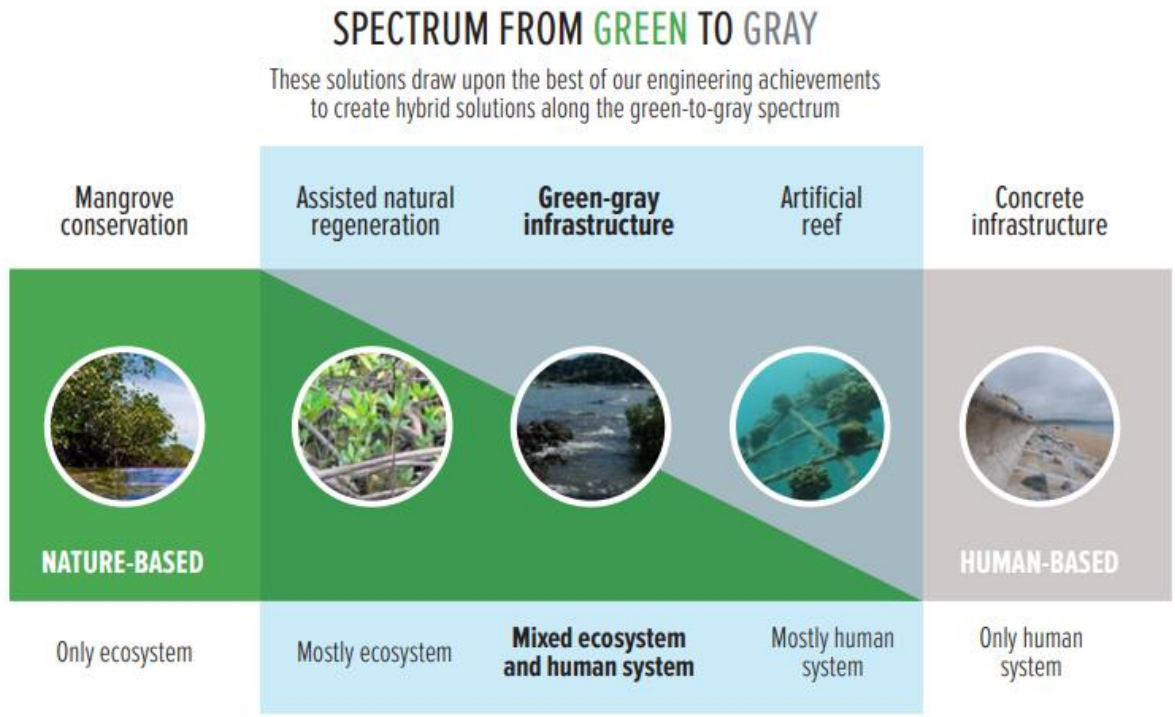

Figure 3. Spectrum from green to gray infrastructure (Green-Gray Community of Practice, 2020).

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SDG 10 – Reduced Inequalities | Reduce inequality within and among countries

Primary contributors: Ashanapuri Hertz and Tristan Tyrrell (SwedBio)

Ecosystem degradation has uneven impacts across different groups within societies, and among countries. Likewise, climate change often more intensively affects those already vulnerable. Recognising who benefits most from healthy ecosystems, who bears the burden of negative impacts, and what can be done to address them, helps reduce inequality within and among countries. Properly implemented EbA interventions are conducted in a way that is, by definition, human-centric and thereby includes social justice, cohesion and equity at its core, ultimately leading to reduced inequality locally and globally. However, it is critical to mention that EbA is only able to contribute to reduced inequalities when conducted and carried out correctly – this does not happen by default, but rather with deliberate planning, monitoring and adaptive management (GIZ, 2021c).

EbA aims to combine outcomes of societal adaptation, including reducing poverty, protecting and restoring biodiversity and ecosystem services, and reducing (ideally removing) atmospheric greenhouse gases (Scarano, 2017). EbA often overlaps with many socio-economic goals, such as poverty alleviation (Munang et al., 2014).

As laid out in a set of proposed EbA social principles, "EbA should promote equitable access to benefits and safeguard the attention to specific needs across groups, particularly with respect to marginalised or vulnerable groups and women, while not exacerbating existing inequalities" (FEBA, 2021).

By better harnessing natural resources to build resilience to climate variation and thereby improve livelihoods, EbA has the potential to improve community resilience – especially in rural areas – that is threatened by adverse impacts from climate change. Unfortunately, EbA can also unintentionally undermine the overall goals of reducing inequalities, including undermining poverty alleviation, by not considering local, regional, and country-wide situations, alongside broader adaptation and development plans (Duan, 2017). In general, EbA can provide benefits and co-benefits to the reduction of inequality by:

- Increasing the inclusion of people in governance of EbA interventions (SDG target 10.2);
- Ensuring equal opportunity to everyone to participate in EbA interventions (SDG target 10.3), including equity for local and Indigenous communities and their knowledge; and
- Modification of discriminatory laws and policies by the inclusion of all stakeholders, including women, people with disabilities, etc., to fair contribution to their community development (SDG target 10.4).

Scaling up NbS, including EbA, now provides a path forward to protect society from the most severe consequences of climate change, including "the economic cost of losses and damages, and the number of people in need of international humanitarian assistance due to climate- and weather-related disasters" (IFRC & WWF, 2022). Thus, scaling up and successfully implementing EbA and NbS approaches globally can play a key role in achieving SDG 10 by addressing both slow and fast onset impacts which disproportionately affect the poor and vulnerable.

SDG 11 – Sustainable Cities and Communities | Make cities and human settlements inclusive, safe, resilient and sustainable

Primary contributors: Liette Vasseur (Brock University/IUCN-CEM, Rachel Nisbet (University of Leeds), Heidi Tuhkanen (SEI)

In many rapidly growing cities, especially in the Global South, ecosystems are under pressure from the development of the built environment (Gwedla and Shackleton, 2015; Guenat et al., 2019; Muhamad Nor et al., 2021). According to the recent IPCC AR6 report, urban areas are especially exposed to climate extremes, such as extreme temperatures, heatwaves and flooding. Due to the increasing density of people in urban areas, buildings and infrastructure are concentrated in such a way that they increase vulnerability of populations, especially when located near the coast, in a floodplain, or on a former wetland, and also due to extreme heat. Climate impacts also include cascading impacts related to infrastructure and environmental pollution, such as the urban heat island effect. By 2050, an additional 1 billion people may be living in urban areas living in low elevation coastal zones and thus highly exposed to climate impacts (Intergovernmental Panel on Climate Change (IPCC), 2022).

Biodiversity and ecosystem services are essential in urban and rural planning, underpinning functions such as supplying water, regulating temperature, and reducing flooding and other disaster risks, much of which is exacerbated by climate change. The protection, restoration and sustainable management of ecosystems and services in urban settings will become increasingly important as the world's urban population rapidly grows. EbA actions implemented in urban areas, especially those that minimize water scarcity, regulate temperature and reduce the risks of disasters can make urban populations safer and more resilient to climate impacts and other shocks. EbA can help to mitigate the urban heat island effect which is exacerbating extreme temperatures and heatwaves in cities (Tan et al., 2021).

EbA can support community well-being through providing cultural ecosystem service benefits, including recreation, aesthetic and cultural value (Sandler, 2007). These values plausibly lead urban residents to recognise ecosystem services' relational value; thus, enabling interactions between their instrumental *and* intrinsic value to be recognised (Mollie and Chapman, 2020). If planned together with local residents, ensuring that diverse communities can experience the relational value of EbA plays an important role in promoting equitable outcomes or equitably distributed benefits; the process of collaborative planning can also support the social aspects of community resilience. A human rights-based approach is key to ensure diverse communities can experience such benefits from EbA and related measures, particularly important in low- and middle-income developing countries, where it is unlikely that environmental taxes for, say, stormwater runoff can be levied to cover the long-term costs of maintaining green infrastructure (FEBA, 2021).

EbA can provide benefits and co-benefits to increase the inclusivity, safety, resiliency, and sustainability of cities by:

- Helping address vulnerability to climate hazards and disaster losses for poor and vulnerable communities by reducing local hazard risk (SDG target 11.5);
- Increasing green spaces that can include water retention ponds and absorptive structures to reduce impact from hazards such as flooding due to heavy rainfall (SDG target 11.7); and
- Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning (SDG target 11.A).

SDG 12 – Responsible Consumption and Production | Ensure sustainable consumption and production patterns

Primary contributor: Maria Nuutinen (FAO)

SDG 12 "links worldwide consumption and production — a driving force of the global economy — to the use of the natural environment and resources in a way that has destructive impacts on the planet. … Implementation of SDG 12 is linked to the achievement of overall development plans, the reduction of future economic, environmental, and social costs, strengthening economic competitiveness, and the reduction of poverty" (Doran, 2021).

Healthy ecosystems provide us with ecosystem services that are the basis for sustainable consumption and production, which underpins the responses to both climate change and ecosystem degradation. NbS, including EbA, have a "vital role to play in mitigating climate change, while simultaneously providing adaptation and other benefits" (UNEP and IUCN, 2022). EbA initiatives such as those implemented in agricultural systems can promote sustainable production and help raising awareness about the importance of improved land and water management; and avoidance of deforestation and peatland drainage (and the limited availability of our natural resources), and directing consumption to more sustainable products and services, thereby contributing also to sustainable consumption.

Sustainable consumption and production (SCP) is a holistic approach that focuses on systemic change, which can contribute to poverty alleviation and the transition to low-carbon and green economies. SCP refers to "*the use of services and related products, which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of future generations*" (UNEP, 2010).

There are "complex linkages between human well-being, economic prosperity, and environmental resilience and the need for policy makers to act across all three domains to bring about transformative outcomes" (Doran, 2021). EbA approaches implemented with a keen eye toward responsible consumption and production can do just that – creating systems that improve the "well-being of people while minimizing resource use and environmental impacts, in particular through enhanced resource efficiency" (Doran, 2021).

EbA can also provide benefits and co-benefits, especially as related to circular economy, by:

- using and re-using natural infrastructure which can evolve over time (SDG target 12.8); and
- promoting the sustainable use and management of natural resources (SDG target 12.2).

Critically, however, we need to first accomplish a "wholesale shift in how society approaches the core question of what it values and whether we are prepared to continue to allow market exchange and pricing mechanisms a privileged status in determining what is to be valued, produced, and consumed." Until such a "debate on value is resolved in favour of equality and socio-ecological regeneration it will be difficult to see how market and pricing mechanisms applied to biodiversity, forests, and land can produce long-term shifts in consumption practices" (Doran, 2021). Further, if NbS, including EbA, are to deliver on contributions to sustainable production and consumption, "then the necessary safeguards, carbon accounting frameworks and governance schemes … need to be in place and strictly enforced" (UNEP and IUCN, 2022).

SDG 13 – Climate Action | Take urgent action to combat climate change and its impacts

Primary contributors: Nakul Chettri (ICIMOD), Miriam Seemann (GIZ), Liette Vasseur (Brock University/IUCN-CEM), Biraj Adhikari and colleagues (ICIMOD), Amy Duchelle (FAO), Yvonne Walz (UNU-EHS), Lisa Schindler Murray (Rare), Antoine Libert (FAO), Anna Kilponen, Oscar Ivanova and Suyeon Yang (UNEP GAN)

Climate change is affecting all lives and ecosystems on earth (IPCC, 2022). The economy, livelihood and well-being of societies are threatened by climate change impacts, especially extreme weather events and slow onset events (such as biodiversity loss, habitat degradation, sea level rise, and salinisation). Biodiversity and ecosystem services play key roles in mitigating and adapting to climate change. EbA is central to implementing such benefits. EbA, supports the ability of healthy ecosystems to, strengthen community resilience and adaptive capacity.

EbA initiatives can help reduce the impacts of climate change and improve the wellbeing of communities by restoring or protecting ecosystem services and diversifying livelihoods away from highly climate-vulnerable activities, allowing stressed ecosystems to recover and continue providing their services. EbA initiatives can be tailored to specific ecosystems and situations (such as coastal communities, arid areas, and Small Island Developing States) which may be facing existential climate risks. Adaptation measures benefit from early identification and safeguarding of vulnerable ecosystems and threats to biodiversity on which human wellbeing is dependent. Early identification and safeguarding could directly help to minimise the lost potential of ecosystems to provide multiple services to society, including for reducing loss and damage.[iv]

Greater global awareness of its benefits has allowed EbA to be integrated within both international and national climate change policies and actions. The UNFCCC has supported the development, dissemination, and use of effective adaptation policies and practices around the world, including EbA, through mandated processes such as the Adaptation Committee and National Adaptation Plans (NAP).[v] A recent examination of the Nationally Determined Contributions (NDCs) shows that nearly two-thirds of Parties include NbS to help achieve their climate change mitigation and/or adaptation goals (Seddon et al., 2019).

The recent IPCC AR6 WGII report highlights the contributions of ecosystem-based approaches and, specifically, forest-based adaptation, as highly feasible measures that have synergies with the SDGs. Many examples demonstrate the importance of EbA as a major action to reduce the impacts of climate change. These include the use of coastal wetland conservation and restoration to buffer against salinization, hurricane and storm surges; planting of green spaces, green roofs and trees in cities to reduce heat islands; and moving from tree monoculture to biodiverse plantation systems to reduce risk.

[iv] Tools and networks, such as the IUCN Red List of Ecosystems and Friends of Ecosystem-based Adaptation (FEBA), are available to support countries both in identifying and prioritizing critical ecosystems and in incorporating EbA and disaster risk reduction practices and policies across different levels.

[v] The NAP Global Network, hosted by IISD, has a platform to analyse the latest information and trends in NAPs, including trends related to NbS and EbA.

EbA can provide benefits and co-benefits by:

- strengthening resilience and adaptive capacity to climate-related hazards and natural hazards in all countries using green or grey-green infrastructure;
- investing efforts in sound climate governance through policies, norms, and the capacity of institutions to make informed decisions (based on improved capacities, evidence, and funding) at community, local and national levels; and
- supporting the changes of national and local policies, mainstreaming EbA, and strengthening local governance structures to enable urgent action to combat climate change and its impacts.

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SDG 14 – Life Below Water | Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Primary contributors: Emily Goodwin (IUCN), Lisa Schindler Murray (Rare), Jack O'Connor (UNU-EHS)

The ocean – and therefore life below water – is inextricably linked to the health of the entire planet. The success of SDG 14 underpins success for all other SDGs, as does SDG 15.

More than 600 million people reside in coastal zones that are less than 10 meters above sea level (United Nations Framework Convention on Climate Change Technology Executive Committee (TEC) and Executive Committee of the Warsaw International Mechanism (WIM), 2020), leaving many coastal communities and Small Island Developing States (SIDS) particularly vulnerable to climate hazards including sea level rise, coastal erosion, warming ocean temperatures and ocean acidification, and extreme weather events such as storm surges and tropical cyclones. These climate impacts are further exacerbated by anthropogenic pressures such as pollution, coastal development, and overexploitation of natural resources, which reduce the capacity of coastal ecosystems to serve as a buffer against climate impacts (such as storm surges and tropical cyclones) and to support livelihoods (such as fisheries, aquaculture and coastal tourism).

Coastal ecosystems play a critical role in supporting and protecting communities and infrastructure, including through mitigation of storm surge and wave energy, erosion reduction, sediment capture, food provision, and carbon sequestration. For example, conservation or restoration of coastal and marine habitats, particularly mangroves, salt marshes, seagrasses, and coral reefs, can substantially reduce exposure and vulnerability to climate change, providing natural protection from risks. Green-grey and climate-resilient infrastructure – such as mangrove restoration in synergy with a floodwall – can also proactively protect ecosystems and habitats in a way that addresses the ocean-climate-biodiversity nexus holistically, making infrastructure more resilient to climate change effects in the longer-term (Thiele, et al., 2020). Protecting and sustainably managing the world's oceans and coastal areas are vital to reduce biodiversity loss. Mangrove ecosystems alone provide flood protection benefits exceeding USD 65 billion per year and protecting more than 15 million people (Menéndez et al 2020). Adopting coastal and marine EbA, centred on the sustainable use of coastal resources and protection and restoration of coastal and marine ecosystems, is critical to provide and enhance climate adaptation and resilience benefits to local coastal communities. The benefits that EbA can provide include:

- Implement a ridge-to-reef project that addresses marine pollution and nutrient runoff from land-based activities by implementing EbA in terrestrial forests and mountains as well as in coastal areas (SDG target 14.1) to reduce non-climate stressors on coastal and marine ecosystems;
- Enhance scientific cooperation across ocean and/or climate agencies that are researching how EbA in coastal areas could reduce the impacts of ocean acidification (SDG target 14.3);
- Promote conservation of fish population, reduces illegal fishing, and ensures that local livelihoods of small-scale fishers and their local communities are secured (SDG target 14.4);
- Advocate for local communities in governance and climate policy and EbA processes to be integrated into local planning and processes (SDG target 14.5);
- Sustainable management, restoration, and protection of marine and coastal ecosystems (SDG target 14.2);

- Improve resilience of small-scale fishers through promoting and applying the principles of EbA as an important driver to support the health of coastal ecosystems and of national or local fisheries (SDG target 14.2); and
- Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources (SDG target 14.c).

In addition to SDG target 14.2, target 14.b refers to access for small-scale artisanal fishers to marine resources and markets. Improving the resilience of small-scale fishers through promoting and applying the principles of EbA can be an important driver to support the health of coastal ecosystems and of national or local fisheries. Small-scale fishers and local communities play an important role in protecting and sustainably managing their coastal resources given the ecosystem services they provide like improving food security, enhancing biodiversity, supporting eco-tourism, and ensuring economic diversification.

Protecting and sustainably managing the world's ocean and coastal areas is vital to reduce biodiversity loss and addressing climate change, as the recent IPCC Working Group II (WGII) Sixth Assessment Report (AR6) on climate adaptation and impacts clearly indicates. Marine Protected Areas (MPA) and locally led protected area networks together with sustainable fisheries have a joint role in achieving SDG 14 and climate goals, as stated in the IPCC AR6.

Lastly, engaging local communities in governance and climate policy processes, including engagement in processes like to integrate EbA into fisheries management plans and marine spatial plans, builds resilience and enables societal transformation towards systemic change.[vi]

While highlighting the importance of maintaining the integrity of the ocean and coastal and marine systems, as well as the contribution that coastal and marine NbS can make towards addressing climate change adaptation and mitigation, it is equally important to ensure that broader global efforts to mitigate GHGs do not have negative consequences on the ocean and coastal and marine biodiversity. For example, while the expansion of off-shore and on-shore renewable energy systems clearly plays an important role in global climate change mitigation efforts, the infrastructure set up for these can also have negative impacts on marine and coastal biodiversity through disturbance, loss of habitat, noise pollution, collision, and other indirect pressures. It is therefore important to consider, assess, and minimise these adverse impacts throughout the entire life cycle of such projects, from the design to the operational and decommissioning phases.[vii]

Equally, there is need for appropriate governance mechanisms that can critically identify, evaluate, and address the potential negative impacts of other new and emerging mitigation measures and technologies on ocean and marine systems, such as geoengineering and carbon capture and storage in the deep sea.

[vi] Relatedly, the ecosystem approach to aquaculture (EAA) has emerged as a way to move aquaculture development towards greater sustainability, such that mainstreaming "EAA in planning processes has raised awareness of the usefulness of holistic and participatory approaches in aquaculture and helped to steer the sector towards greater sustainability" (Brugère et al. 2019).

[vii] The understanding of effects of offshore wind farms on marine wildlife – among other important areas of consideration – is constantly evolving, but is "potentially applicable to marine planning situations in various aquatic ecosystems" (Bergström et al. 2014).

SDG 15 – Life on Land | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Primary contributors: Yvonne Walz (UNU-EHS) and Nakul Chettri (ICIMOD), Nakul Chettri and Biraj Adhikari (ICIMOD), Liette Vasseur (Brock University/IUCN-CEM), Amitha Bachan K Hyder (MES Asmabi College), Antoine Libert (FAO)

Climate change is a recognised threat to terrestrial ecosystems and the services they provide. EbA can support the achievement of SDG 15, which underpins success for all other SDGs, as does SDG 14. EbA projects restore and protect ecosystems - including expanding green space, habitats and biodiversity – and improve environmental conditions, such as air quality and waste management, restoration of wetlands for provision of a wide range of ecosystem services, and others. EbA also incorporates regeneration, land-use and urban development to better protect and restore ecosystems (Science for Environment Policy, 2021). However, as ecosystem degradation is exacerbated by a variety of factors especially unsustainable management of natural resources, coupled with climate change, there is an urgent need to prioritise ecosystem health and incorporate a climate risk context while developing and implementing sustainable land management policies.

Adaptation and mitigation measures in the land sector have the potential to be highly synergistic, and could clearly benefit from early identification and safeguarding of vulnerable ecosystems and threats to biodiversity on which human wellbeing is dependent. Distribution and training of EbA resources and guidance will support integrating ecosystem and biodiversity values into national and local planning and development processes.

EbA can provide benefits and co-benefits to all terrestrial ecosystems by:

- Supporting conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements (SDG target 15.1);
- Reducing the impact of desertification and soil degradation through the use of sustainable practices such as conservation agriculture (SDG target 15.3);
- Reducing the loss of biodiversity in all ecosystems, especially those more at risk due to their exploitation or their vulnerability (SDG target 15.5);
- Promoting and ensuring that native species are used, and their genetic makeup protected for future generations, while preventing invasion of exotic species (SDG targets 15.6 and 15.8); and
- Demonstrating the capacity of EbA to protect biodiversity, improve investment and promote integrate of natural ecosystems into planning, development process, and poverty reduction action in developing countries (SDG targets 15.9, 15.A, and 15.B).

SDG 16 – Peace, Justice and Strong Institutions | Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

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The impacts of climate change adversely affected people's livelihoods, especially those directly dependent on access to natural resources. There is a correlation between climate vulnerability and fragility (Boyer et al., 2020), and evidence for how the impacts add burden on communities that are already struggling with the effects of poverty, violation of human rights, deep-rooted gender inequality (including gender-based violence), conflict, and displacement.

EbA, as an approach to address the impacts of climate change and ecosystem degradation, must also consider the differences among people -- factors such as gender, indigeneity, ethnicity, disability, and the protection and advancement of human rights. For example, Indigenous Peoples are not only effective stewards of nature, but are also often at the forefront of environmental defence against industries that contribute to the climate crisis and environmental degradation and can experience layered levels of discrimination that infringe their human rights and hamper their work to conserve the environment (Global Witness, 2021). Apart from rights-based and inclusive approaches, it is thus essential to ensure respect for the rule of law, including customary law, and provide access to justice through formal and informal grievance and dispute resolution mechanisms. The legal and justice dimension of SDG 16 is key to make EbA work and ensure climate justice and the enforcement of rights.

The IUCN Global Standard for NbS™ underlines the imperative of upholding human rights in designing and implementing NbS approaches, particularly, relating to effective and meaningful participation, adherence to rights-based approaches, as well as respect and upholding of the legal and customary rights to access, use and control management over land and natural resources, particularly of vulnerable and marginalised groups, including the right of Indigenous Peoples to Free, Prior and Informed Consent (FPIC) (IUCN, 2020). The latter is particularly noteworthy in the context of climate change where Indigenous Peoples manage nearly 25 percent of the total carbon stored aboveground in the world's tropical forests (Rights and Resources Initiative (RRI), 2016). Further, Indigenous Peoples and local communities manage at least 17 percent of the total carbon stored in forestlands — a global estimate that is 5 times greater than shown in previous analysis (RRI, 2018).

When done appropriately and supported by an enabling legal and policy framework, EbA can help reduce conflicts arising from unequal or discriminatory access to natural resources, as well as the adversity of climate change impacts, by addressing the rights and interests of rights holders and ensuring inclusive governance. These serve as key considerations in implementation of improved land management for the promotion of peaceful and egalitarian societies through effective, accountable and inclusive institutions. EbA can provide a way to:

- Ensure responsive, inclusive, participatory and full and effective decision-making at all levels, by securing participatory natural resource governance (target 16.7); and
- Promote and enforce non-discriminatory laws and policies for sustainable development by recognizing, protecting and upholding the rights of Indigenous Peoples, including the right to free, prior and informed consent (FPIC), and gender-responsive and socially-inclusive natural resource and climate change policies and laws (target 16.B).

SDG 17 – Partnerships for the Goals | Strengthen the means of implementation and revitalize the global partnership for sustainable development

SDG 17 is, by design, cross-sectoral and essential to the realization of all SDGs. The SDGs can only be realized with strong global partnerships and cooperation. Successful development, overall, requires inclusive partnerships at global, regional, national, and local levels. Such an agenda must be built upon principles and values and a shared vision placing people and planet at the centre (UN, 2022).

Transformed economic and financial systems can power the shift to sustainability (UNEP, 2021). SDG 17 focuses on finance, information and communications technology, capacity-building, trade, and data, monitoring and accountability. SDG 17 uses the SDGs as a shared framework to define a collaborative future for cooperation between nation-states. EbA can provide a mechanism for adding value to healthy ecosystems and, as a cross-cutting and potentially unifying approach, strengthen such a framework for understanding and using the natural environment to address climate change and the other barriers to sustainable development. While providing common principles and thus advancing policy coherence at multiple levels (SDG target 17.14), EbA also allows for the necessary flexibility to adopt solutions that are appropriate and tailored to a specific context, thereby ensuring ownership and respect for the policy space and leadership of each country (SDG target 17.15).

SDG 17 directly relates to the definition of EbA as being part of an overall adaptation strategy: EbA can:

- contribute directly to enhancing regional and international cooperation on and access to science, technology and innovation, while also enhancing knowledge sharing (SDG target 17.6);
- scale up international support for implementing effective and targeted capacity-building to support national plans to implement SDGs more broadly, including through North-South, South-South and triangular cooperation (SDG target 17.9);
- enhance policy coherence for sustainable development (SDG target 17.14); and
- enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the SDGs in all countries, in particular developing countries (SDG target 17.16).[viii]

EbA can only create ripple effects if carried out in many different countries, territories, ecosystems, etc., and at many different scales. For this, global cooperation, shared learning and exchange are key. Strong international cooperation is needed now more than ever to ensure that countries have the means to recover from the pandemic, build back better and achieve the SDGs.

[viii] The SDG Partnership Guidebook: A practical guide to building high impact multi-stakeholder partnerships for the Sustainable Development Goals sets out the key Building Blocks of successful partnerships and the underlying processes – from initial stakeholder engagement to partnership review – necessary to develop and keep those Building Blocks in place and to maximise partnership impact.

3. Conclusion

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Climate change is here, and we are already feeling its impacts around the world, from higher temperatures, rising sea levels, and increasing incidences of extreme events. The most vulnerable people and ecosystems – for example in Least Developed Countries and Small Islands Developing States – are the hardest hit, with recent studies demonstrating that over 3.3 billion people live in places that are highly vulnerable to climate change impacts (IFRC & WWF, 2022). Climate hazards can undermine historical development progress by increasing food and water insecurity, exacerbating inequalities, and impacting livelihoods and economies – to name a few. Even under the most optimistic emissions scenarios (IPCC, 2022), society will still need to adapt to these climate impacts. We cannot achieve progress towards sustainable development goals, or preserve our global development gains to date, without urgent adaptation action.

Nature-based Solutions for Sustainable Development

Recent estimates share that adaptation of wetlands, rivers, agricultural lands, construction, infrastructure, water, electricity, and housing in the most vulnerable countries is required to safeguard achievement of 68% of SDG targets from near-term climate risk by 2030 (Fuldauer et al., 2022). Aligning adaptation and development approaches offers huge potential to accelerate resilient development gains. As demonstrated throughout this report, the health and preservation of ecosystems underpin human well-being in incredible ways. Investing in adaptation efforts for both ecosystems and humanity can enable transformative progress toward sustainable development. Nature-based solutions for climate adaptation, such as EbA, have the potential to provide vulnerable countries with valuable protection against the economic cost of climate change – reducing the intensity of climate hazards by 26 percent, representing protection against the economic cost of climate change by USD 104 billion by 2030 and USD 393 billion by 2050 (IFRC & WWF, 2022)**. These nature-based climate solutions have an interconnected role across sustainable development goals – from health, water and nutrition to clean energy, sustainable infrastructure, and equality - with incredible potential to drive progress across the SDGs while building more equitable and resilient societies.**

Scaling Up Adaptation Ambition and Finance

However, it is important to note that estimated adaptation costs in developing countries are five to ten times greater than current public adaptation finance flows, and the adaptation finance gap is widening. (UNEP, 2022). Accelerated ambition across finance and implementation is critical to drive progress on managing climate risks, particularly in developing countries. Despite the cost-effectiveness of ecosystem-based adaptation as a strategy to tackle climate change, so far only 5% of global climate finance flows are spent on adaptation (UNEP, 2021) and only 1.4% of this on nature-based solutions for adaptation (Swann et al., 2021). **The world needs to scale up adaptation commitments and public adaptation finance, and more broadly integrate climate resilience across other windows of public finance, such as for development, infrastructure, clean energy and beyond.**

Global Ambition for Local Action: EbA and the SDGs

As the world collectively faces the impacts of a changing climate, the incorporation of EbA strategies across sectors presents an important, cost-effective, and multi-solution approach for development, humanitarian, and climate practitioners to build climate-resilient societies and promote sustainable development. EbA approaches can be applied across numerous contexts, geographical areas, and ecosystems. While these approaches utilize healthy ecosystems, it's important to understand that the use of these nature-based solutions is not limited to climate change and biodiversity strategies, but spans across sectoral priorities. **EbA approaches are not meant to stand in isolation, but be integrated into broader adaptation planning, with far-reaching impact across SDGs. The integration of such approaches into wider development goals can play a key role in promoting sustainable development and sustaining progress to date – but in order to do so, countries and practitioners must urgently push for transformative action in a rapidly changing world.**

Finally, it is critical to note that while adaptation is essential to reduce harm and spur development and human well-being: if it is to be effective, it must go hand-in-hand with ambitious reductions in greenhouse gas emissions because with increased warming, the effectiveness of many adaptation options declines. Together with adaptation action, collective global progress towards climate mitigation is critical to safeguard the world. **This work is urgent, but it's not too late. We have an opportunity to re-orient the world towards a more climate-resilient and nature-positive future, for progress towards sustainable development and ensuring the well-being of all.**

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