

Ecosystem-Based Disaster Risk Reduction

Implementing Nature-based Solutions for Resilience



UNDRR

UN Office for Disaster Risk Reduction

Citation

UNDRR (2020), *Ecosystem-Based Disaster Risk Reduction: Implementing Nature-based Solutions for Resilience*, United Nations Office for Disaster Risk Reduction – Regional Office for Asia and the Pacific, Bangkok, Thailand

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Acknowledgements

The policy product entitled *Ecosystem-Based Disaster Risk Reduction: Implementing Nature-based Solutions for Resilience* was drafted by Frank Thomalla of Climate and Disaster Risk Research and Consulting (CDRC) and Animesh Kumar, Deputy Chief, UNDRR Regional Office for Asia and the Pacific Office with contributions from and collaboration with members of the Partnership for Environment and Disaster Risk Reduction (PEDRR).

The authors would particularly like to thank Nathalie Louise Doswald (UNEP) for reviewing the report. The authors would like to thank experts from IUCN, ESCAP, UNEP, UNU, UN-Habitat, Stockholm Environment

Institute, Mercy Corps, University of Glasgow, Wetlands International, Indian Institute of Technology, Euro-Mediterranean Centre on Climate Change, and others who provided inputs to the report at various stages. The draft benefited from a workshop in Bangkok, Thailand, in November 2019. Iria Touzon Calle, Omar Hussein Amach, Dave Zervaas, Sarah Houghton and Priya Kanchan from UNDRR also reviewed and provided feedback on the report.

UNDRR acknowledges the generous funding made available by the Federal Republic of Germany (BMZ) as part of the project "Support the substantial reduction of disaster risk and losses for a sustainable future."

Foreword

One common thread among the disasters that most impact Asia-Pacific is that they show how delicate the balance is between human activity and nature.

The sweeping COVID-19 pandemic has demonstrated that human exploitation of nature and unchecked encroachments into wild spaces can have real consequences.

At the same time, unplanned human development in the region is stripping landscapes of natural protections against many hazards. When combined with extreme weather events, the lack of natural protections can have perilous consequences. Just one example is the extreme flooding experienced this year by Japan, China and India following unusually heavy monsoon rains.

In these examples, the balance between human activity and nature was disrupted, resulting in disasters. However, if the balance can be maintained, many hazards can be kept at bay and nature can serve as a defence against disasters.

This publication explains and highlights how this can be achieved through ecosystem-based disaster risk reduction, which centres around the harnessing of nature to build resilience and develop sustainably.

If applied strategically, nature-based solutions can help address all aspects of disaster

risk (i.e. vulnerability, hazard and exposure), while also improving people's lives and restoring ecosystems.

Many studies have found that nature-based solutions offer a high return on investments, with benefits that extend into social and economic life. This has earned them the label of 'no-regret' or "win-win" solutions.

For example, although China experienced devastating floods in 2020, overall mortality and displacement were significantly less as compared to the country's 1998 floods despite heavier rainfall in 2020. These improvements are being credited to two decades of investment in nature-based solutions to reduce disaster risks and impacts, such as China's "sponge cities" initiative.

Despite such progress and increased recognition of the value of ecosystem-based disaster risk reduction, more effort is needed to scale-up and increase adoption.

One opportunity may be the current wave of government economic stimulus funding in response to the COVID-19 pandemic. These economic recovery packages can become springboards to launch new and ambitious initiatives to strengthen green economies and integrate nature-based solutions into development.

Moreover, these approaches can help countries meet their global and national

commitments in the areas of combating climate change and sustainable development, which have lagged as a result of the pandemic.

UNDRR is pleased to present this body of work to help policymakers and planners initiate these discussions with their constituents and to consider new ways to accelerate the transition from working against nature to working with nature to reduce disaster risks and achieve a more prosperous and sustainable future.

Loretta Hieber Girardet,
Chief, UNDRR Regional Office
for Asia and the Pacific

Key messages

- **Nature-based solutions (NbS)**, including ecosystem-based disaster risk reduction (Eco-DRR) and ecosystem-based adaptation (EbA), play an important role in reducing disaster and climate risk, in particular, in addressing systemic risk arising from an increasingly complex and evolving risk landscape. Ecosystem services further catalyse disaster recovery and enhance community resilience.
 - **Eco-DRR/EbA are efficient, cost-effective, flexible, low-regret approaches to reducing disaster risk and the impacts of climate change with multiple social, economic and environmental co-benefits.** When the benefits of Eco-DRR and EbA are projected over space and time the returns increase exponentially.
 - Conversely, disasters have an impact on ecosystems causing environmental damages and losses that in turn increase risk. **Degraded environments are an important driver of risk** - if unsustainable ecosystems result in disasters or exacerbates its impact. Recognizing these interlinkages and interdependencies is important to ensure and sustain resilience.
 - **Ecosystem loss and fragmentation enhances human-ecological footprint.**
- Nature needs to be part of the solution of recovery as governments and businesses assess how to emerge from the COVID-19 crisis and rebuild the economies.
- **Eco-DRR provides a potent vehicle for disaster risk management in all its dimensions.** These include hazard reduction (e.g. mitigating flooding and enhancing soil moisture conservation), vulnerability reduction (e.g. livelihood diversification and protection), and exposure reduction (risk-sensitive land-use planning). While EbA reduces vulnerability to climate change and increases adaptive capacity.
 - **Target E of the Sendai Framework for Disaster Risk Reduction provides a unique opportunity to ensure integration of NbS in the national and local disaster risk reduction strategies.** Though Asia-Pacific national DRR strategies provide good practices on Eco-DRR most countries do not specify relevant actions to undertake this. The Words-into-Action guideline on "[Nature-based Solutions for Disaster Risk Reduction](#)", released for public review, aims to address this gap.
 - **NbS have a key role in resilient infrastructure** by providing both opportunities for design innovations and new development alternatives that go beyond the narrow focus on short-term economic gains. NbS for climate mitigation and disaster control infrastructure help reduce carbon footprint and reduce disaster impact, while achieving the national climate commitments.
 - **NbS are central to strengthening the coherent implementation of the various international frameworks under the 2030 Agenda for Sustainable Development.** This is further strengthened when cross-fertilized with the Rio Conventions and Ramsar Convention.



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About the Report

Ecosystems act as a buffer against hazards, preventing disaster and reducing disaster impact on people, critical infrastructure and basic services. Conservation, restoration and the sustainable use and management of land, wetlands, ocean, and other natural resources strengthen disaster and climate risk management. The most vulnerable people in many countries rely on ecosystems for their livelihoods and resilience. Recognizing the interdependency between human well-being, ecosystems, and changing risk patterns, ecosystems also build local socio-economic

resilience against disasters by sustaining livelihoods and providing important products to local populations in times of crises.

Conversely, degraded environments are a leading driver of disaster risk. The absence of their services exacerbates disaster impacts and affects recovery efforts and livelihood regeneration in the aftermath of a disaster.

Disaster risk reduction (DRR) and climate change adaptation (CCA) approaches should thus make optimal use of the services provided by

ecosystems. While ecosystem management has been reflected in all relevant global frameworks, the translation of such global commitments at the national and local level faces institutional and other governance barriers. Further, the integration of such measures in sectoral development plans, such as in land use and water management, both in rural and urban contexts, remains limited.

The purpose of this policy paper is to increase awareness of the important role of ecosystem-based approaches in reducing disaster risk. It emphasises the central role of ecosystem-based disaster risk reduction (Eco-DRR) in strengthening the coherent implementation of various international frameworks under the 2030 Agenda for Sustainable Development. It further provides suggestions on how to capitalise on the growing evidence-base for strengthening the integration of Eco-DRR and other nature-based solutions (NbS), such as ecosystem-based adaptation (EbA) into disaster risk reduction strategies and national development plans and highlights the usefulness of Eco-DRR in systemic risk management, using examples and good practices from the Asia-Pacific region and other parts of the world.

An inclusive, “all-of-government” and “whole-of-society” approach towards the development of ecosystem-based approaches to DRR ensure their legitimacy, ownership and buy-in by core national actors in DRR and development and their smooth adoption and sustainable implementation at the country level. The intended target audience of this document are policymakers, planners and practitioners in DRR, CCA, sustainable development, and natural resource management:

- **National-level policymakers** leading the development and coordination of the national disaster risk reduction strategy.
- **Government officials**, including those from the sectoral and line ministries, at national

and local levels, who implement DRR measures through various means and at various levels.

- **National and local disaster risk reduction practitioners** from the development sector and non-state stakeholders who contribute to the process of developing and implementing the national DRR strategy and support its alignment with local DRR strategies / action plans.
- **Disaster risk management and climate change practitioners** at regional and global level who will support the integration of DRR and climate change adaptation in support of achievement of the SDGs by 2030.
- **Technical experts** from all sectors with a wide range of thematic specializations (e.g. multi-hazard risk assessments, critical infrastructure, climate change adaptation, agriculture resilience, land-use planning, social vulnerability, insurance and financial risk transfer mechanisms, emergency preparedness, gender, national statistics and results-based management, etc.) who are contributing their expertise to ensure the development of a comprehensive DRR strategy that effectively supports risk-informed development.
- **Regional inter-governmental organizations** who support their member states in the development of a national DRR strategy aligned with a sub-regional DRR policy, normative framework and roadmap, as well as regional DRR strategies / frameworks adopted at regional platforms for DRR.

The document forms a key knowledge and evidence base for the *Words-into-Action guideline on [Nature-based Solutions for Disaster Risk Reduction](#)*. Though the geographic focus of the document is on the Asia-Pacific region the analysis is global and can be applied in other regions as well.



2

What are ecosystem-based approaches for disaster risk reduction?

Ecosystem services are defined in the Millennium Ecosystem Assessment (MEA) (WRI, 2005) as the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling.

Ecosystem-based disaster risk reduction (Eco-DRR) entails combining natural resources management approaches, or the sustainable management of

ecosystems, with disaster risk reduction (DRR) methods, such as early warning systems and emergency planning, in order to have more effective disaster prevention, reduce the impact of disasters on people and communities, and support disaster recovery (Sudmeier-Rieux et al., 2019). Eco-DRR also aims to produce societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation.

Eco-DRR is part of Natural Solutions (NS) or Nature-based Solutions (NbS), an umbrella term for all natural management approaches. NbS can be categorized in several ways. IUCN (Cohen-

Box 1: Key Terms

Nature-based Solutions (NbS)

Actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits - IUCN (Cohen-Shacham et al., 2016).

Ecosystem-based Disaster Risk Reduction (Eco-DRR)

The sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development. (Estrella and Saalismaa, 2013).

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 (CBD, 2009).

Ecosystem-based Mitigation (EbM)

The use of ecosystems for their carbon storage and sequestration service to aid climate change mitigation" (Sudmeier-Rieux et al., 2019).

Green-blue Infrastructure (GI) or Natural Infrastructure

A strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation, climate mitigation and adaptation, and management of wet weather impacts that provides many community benefits. (UNISDR, 2017).

Ecological Engineering

The design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both (Mitsch, 2012).

Shacham et al., 2019) classifies NbS as:

- a) restorative solutions (ecological restoration, forest landscape restoration, ecological engineering),
- b) issue-specific solutions EbA; ecosystem-based mitigation (EbM); Eco-DRR; climate adaptation services),
- c) infrastructure solutions (natural infrastructure; blue-green infrastructure),
- d) management solutions (integrated coastal zone management (ICZM); integrated water resources management (IWRM)),
- e) protection solutions (area-based conservation approaches, including protected area management and other effective area-based conservation measures).

Ecological engineering combines basic and applied science from engineering, ecology, economics, and natural sciences for the restoration and construction of aquatic and terrestrial ecosystems. An example of the

ecological engineering approach is 'Building with Nature' (Box 2 and p. 16), a comprehensive engineering approach that seeks to enhance the use of natural ecological processes to achieve efficient and sustainable hydraulic infrastructural designs. It purposefully intends to deliver multiple benefits including climate protection and biodiversity (EcoShape, n.d.). Building with Nature and similar ecological engineering approaches use hybrid solutions that combine engineered structures with NbS. For example, ICZM measures may consist of a marsh-levee or dune-dyke system (Pontee et al., 2016).



Photo: Anutr Yossundara / Shutterstock.com

3

Why is Eco-DRR important in reducing disaster risk?

In many places across the world, disaster risk is increasing due to poorly planned or unplanned socio-economic development in locations exposed to a range of hazards. Hydro-meteorological hazards are expected to increase in frequency and magnitude because of climate change (IPCC, 2012; IPCC, 2014). Ill-informed infrastructure projects such as dams and dykes that increase floods, droughts and other hazard risks, combined with rapid economic growth, largely unplanned urbanisation in exposed coastal and river areas, and loss of ecosystems have a significant impact on life and assets (UNISDR, 2015).

The Global Risks Report 2020 (WEF, 2020) ranks issues related to global warming, such as extreme weather and biodiversity loss, as the top five risks in terms of likelihood over the coming decade. These interacting processes pose multiple complex challenges and systemic risks to human security and ecosystem wellbeing. There is hence an urgent need for countries to better understand the impacts and associated risks of ecosystem decline and to integrate ecosystem conservation and rehabilitation, and the sustainable use and management of natural resources in national DRR policies and plans.

Box 2: Nature friendly dyke in Denmark

The European Floods Directive designates Seden Strandby in the Odense Fjord as one of 10 flood prone areas in Denmark. Odense Fjord is also a Natura 2000 area according to the Habitats Directive. The H2020 research and innovation project RECONNECT aims to demonstrate how minimizing flood risk to suburban and agricultural areas can produce co-benefits by improving habitats in the Natura 2000 area and conserving the coastal

landscape. The NbS implemented in this project includes the removal of the existing low coastal dykes and moving them to a higher location further inland to protect properties from flooding. The restoration of nature areas includes the promotion of a “self-design” rehabilitation process that enables the area outside the new dykes, which is comprised of the sea and the marine foreland to undergo a dynamic succession into salt meadows.

<http://www.reconnect.eu/network-of-cases/seden-strand-odense>

<https://www.klimatilpasning.dk/sektorer/natur/synergiprojekter/odense-kommune-seden-strandby>

Degraded environments are an important driver of disaster risk. For example, a lack of good vegetation cover on slopes can result in landslides under heavy rainfall. Furthermore, the absence of ecosystem services exacerbates disaster impacts and affect recovery efforts and livelihood recovery in the aftermath of a disaster. Rapid urbanisation negatively impacts upon urban and peri-urban local ecosystems, if city master plans do not guard these natural elements through comprehensive sustainable planning.

On the other hand, disasters also have an impact on ecosystems, causing environmental damages and losses that in turn increase risk. Recognising the interdependency between human well-being, ecosystems, and changing risk patterns, NbS such as conservation, restoration and the sustainable use and management of natural resources, are an integral part of DRR. Eco-DRR, therefore, offers multiple benefits, including DRR, and systemic opportunities for sustainable development.

Healthy and well-managed ecosystems provide important services that can address a range of risk factors. First as mentioned above they can reduce some **hazards**. Second, they act as natural or green infrastructure that reduces **physical exposure** to a range of hazards and reduces their impacts on critical infrastructure and basic services (Box 1). And third, they can reduce **vulnerability** by

providing food, water and other services. Eco-DRR harnesses ecosystems to prevent, mitigate or buffer, natural hazards and climate change impacts - either as an option to or in support of built infrastructure (Sudmeier-Rieux et al., 2019).

As Table 1 shows, different ecosystems have different hazard reduction functions and in doing so support the achievement of different Sustainable Development Goals (SDGs) (United Nations, 2015) and Aichi Biodiversity Targets (CBD, 2010). For example, forests stabilise hillslopes with their root systems and so protect against landslides and avalanches. Similarly, mangrove forests and wetlands attenuate wave energy and so help to protect the coastline from the impacts of storm surges and tropical cyclones (Box 2 and Box 3).

Table 1. Hazard reduction functions of different ecosystems

ECOSYSTEMS	HAZARD MITIGATION	
Mountain forests, vegetation on hillsides	<ul style="list-style-type: none"> • Vegetation cover and root structures protect against erosion and increase slope stability by binding soil together, preventing landslides • Forests protect against rockfall and stabilise snow, reducing the risk of avalanches. 	<ul style="list-style-type: none"> • Catchment forests, especially primary forests reduce risk of floods by increasing infiltration of rainfall, and delaying peak floodwater flows, except when soils are fully saturated. • Forests in watersheds are important for water recharge and purification, drought mitigation and safeguarding drinking water supply.
Wetlands, floodplains	<ul style="list-style-type: none"> • Mitigate water logging; Wetlands and floodplains control floods in coastal areas, inland river basins, and mountain areas subject to glacial melt. • Peatlands, wet grasslands and other wetlands store water and release it slowly, reducing the speed and volume of runoff after heavy rainfall or snowmelt in springtime. 	<ul style="list-style-type: none"> • Coastal wetlands, tidal flats, deltas and estuaries reduce the height and speed of storm surges and tidal waves. • Marshes, lakes and floodplains release wet season flows slowly during drought periods.
Coastal (Mangroves, saltmarshes, coral reefs, barrier islands, sand dunes)	<ul style="list-style-type: none"> • Coastal ecosystems protect against hurricanes, storm surges, flooding and other coastal hazards - a combined protection from coral reefs, seagrass beds, and sand dunes/coastal wetlands/coastal forests is particularly effective. • Coral reefs and coastal wetlands, such as mangroves and saltmarshes, absorb (low-magnitude) wave energy, reduce wave heights and reduce erosion from storms and high tides. 	<ul style="list-style-type: none"> • Coastal wetlands buffer against saltwater intrusion and adapt to (slow) sea-level rise by trapping sediment and organic matter. • Non-porous natural barriers, such as sand dunes (with associated plant communities) and barrier islands, dissipate wave energy and act as barriers against waves, currents, storm surges and tsunamis, depending on the magnitude.
Drylands	<ul style="list-style-type: none"> • Natural vegetation management and restoration in drylands contributes to ameliorate the effects of drought and control desertification, as trees, grasses and shrubs conserve soil and retain moisture. • Shelterbelts, greenbelts and other types of living fences act as barriers against wind erosion and sandstorms. 	<ul style="list-style-type: none"> • Maintaining vegetation cover in dryland areas, and agricultural practices, such as use of shadow crops, nutrient enriching plants and vegetation litter, increase resilience to drought. • Prescribed burning and creation of physical firebreaks in dry landscapes reduces fuel loads and the risk of unwanted large-scale fires.

Source: Sudmeier-Rieux et al., 2019, p. 54

Box 3: Building with Nature, Indonesia

Building with Nature is an innovative participative approach to hydraulic engineering challenges that makes use of and creates ecosystem services to benefit society. The essence of the Building with Nature approach is to work with nature rather than against it. This requires a change in thinking, a paradigm shift in all aspects of hydraulic engineering project development. It is a design philosophy and multi-disciplinary and multi-stakeholder process applicable to different settings (tropical and sandy shores and reefs, rivers, cities, harbours), rather than a specific solution or measure. In the case of Northern Java, which suffers from severe coastal erosion and flooding, an innovative combination of mangrove restoration and engineering measures that together bolster the coast was used.

Technical measures go alongside with socio-economic measures to avoid reconversion of the restored mangrove greenbelt and enable inclusive economic growth once the coastline is stable, such the introduction of innovative and sustainable aquaculture solutions. Through capacity building, knowledge exchange and embedding Building with Nature into policy and planning, the project supports the replication and scaling up of the Building with Nature approach to other rural and urban areas in Indonesia, and with other countries in Asia which are also ranked highly vulnerable to impacts from climate change. The project is managed by Wetlands International and EcoShape in collaboration with the Indonesian government and a range of international and local partners and local communities.

<https://www.indonesia.buildingwithnature.nl>

<http://documents.worldbank.org/curated/en/559541527663917051/pdf/CS-Indonesia-Building-with-Nature.pdf>

<https://magazine.boskalis.com/issue04/eco-shaping-the-future>

https://reliefweb.int/sites/reliefweb.int/files/resources/WI_brochure%20Building%20with%20Nature%20Indonesia_web.pdf

<http://www.genieecologique.fr/sites/default/files/documents/rex/building-with-nature-en-vf.pdf>

Box 4: Eco-DRR measures in river/flood plain in Mahanadi Delta, India

In Mahanadi Delta, Odisha, India, Wetlands International has been working with civil society partners and communities upstream, downstream and along the coast to embed wetlands in village level and district level disaster risk reduction plans. The project helps in influencing investments in greening the coastline, maintaining free flow of water to reduce waterlogging, and influencing managers of upstream dams to act more risk-informed (when releasing excessive

waters downstream). Further interventions focused on diverting risk of inundation, restoring water flows in the landscape by removal of small dams and dykes, preventing river sedimentation by strengthening embankments, and undertaking relief and rehabilitation measures, restore wetlands as natural buffers to flood, manage embankments to release water in the controlled quantity, introducing salt tolerant crops, vegetating coastline to prevent erosion

<https://www.wetlands.org/casestudy/towards-vibrant-wetlands-mahanadi-delta-kosi-gandak-floodplains-indian>

Eco-DRR and EbA are integral components of risk reduction and climate change adaptation (CCA) strategies. Both approaches emphasize the importance of biodiversity and ecosystems in reducing risk, and build on other practices such as conservation and ecosystem restoration which seek to increase the resilience of ecosystems for the benefit of people (Figure 2) (CBD, 2019). They also work well with grey infrastructure, either as a complement, a substitute, or a safeguard (IaDB, 2020). Seddon et al. (2019) argue that NbS are key to meeting global goals for climate change and sustainable development and urge the ecosystem science community to work closely with policy makers to identify meaningful adaptation targets that benefit both people and the ecosystems on which they depend.

The 2015 Global Assessment Report for Disaster Risk Reduction (GAR) (UNDRR, 2015) included ecosystem-based approaches and emphasized new approaches blending grey and green infrastructure to maximize ecosystem services. The GAR 2019 (UNDRR, 2019a) considered the pluralistic nature of risk: in multiple dimensions, at multiple scales and with multiple impacts. It highlighted environmental degradation as a

key aspect in creating risk, recognised the need to understand systemic risks to people and the ecosystems, considered ecosystems as a core concept for motivating the integration of DRR with the SDGs, included case-studies of DRR/CCA integration, and acknowledged the importance of balanced ecosystems for liveable communities in urban governance.

The Intergovernmental Panel on Climate Change (IPCC) included EbA in its 5th Assessment Report (AR5) (IPCC, 2014) and the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC, 2019) recognises ecosystem-based measures and hybrid approaches combining ecosystems and built infrastructure as actions to reduce hazards (Figure 3). Actions to reduce hazards, vulnerability and exposure, need to be weighed against systems (human, ecological, economic, etc.) and across scales (global, regional, national, sub-national, etc.).

The Asia-Pacific Disaster Report 2019 (ESCAP, 2019) demonstrated that more of today's disaster events are linked to environmental degradation and climate change. It argued that environmental degradation increases risks and that one of the

Figure 1. Integration of climate change adaptation, disaster risk management, ecosystem management and socio- economic development planning through Eco-DRR/EbA (CBD, 2019).

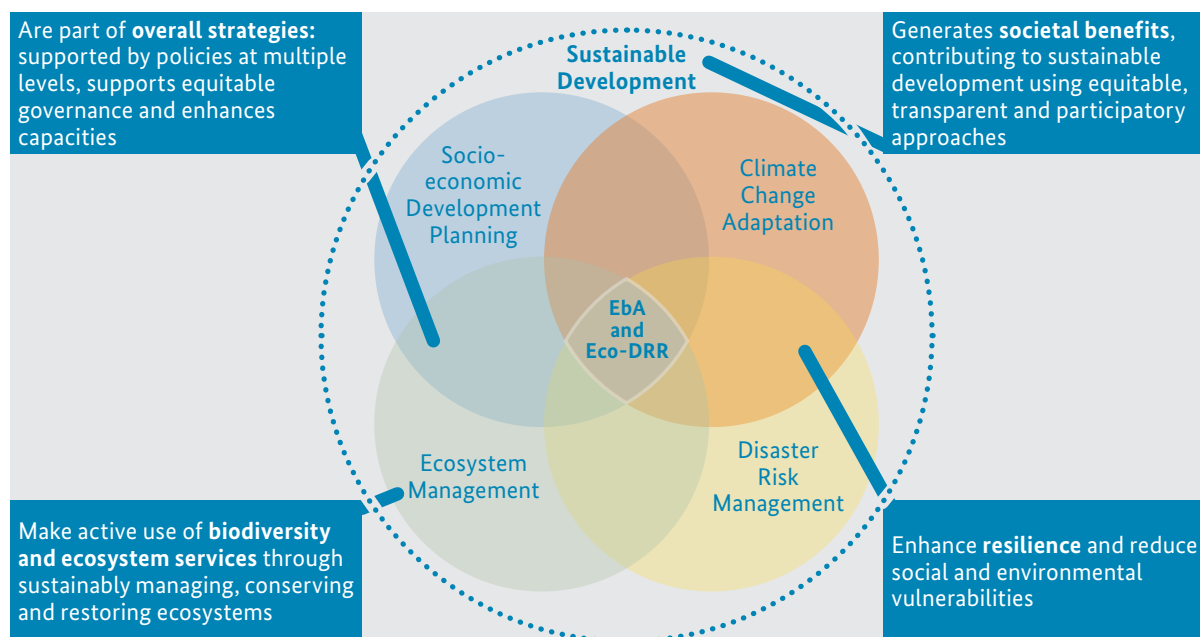
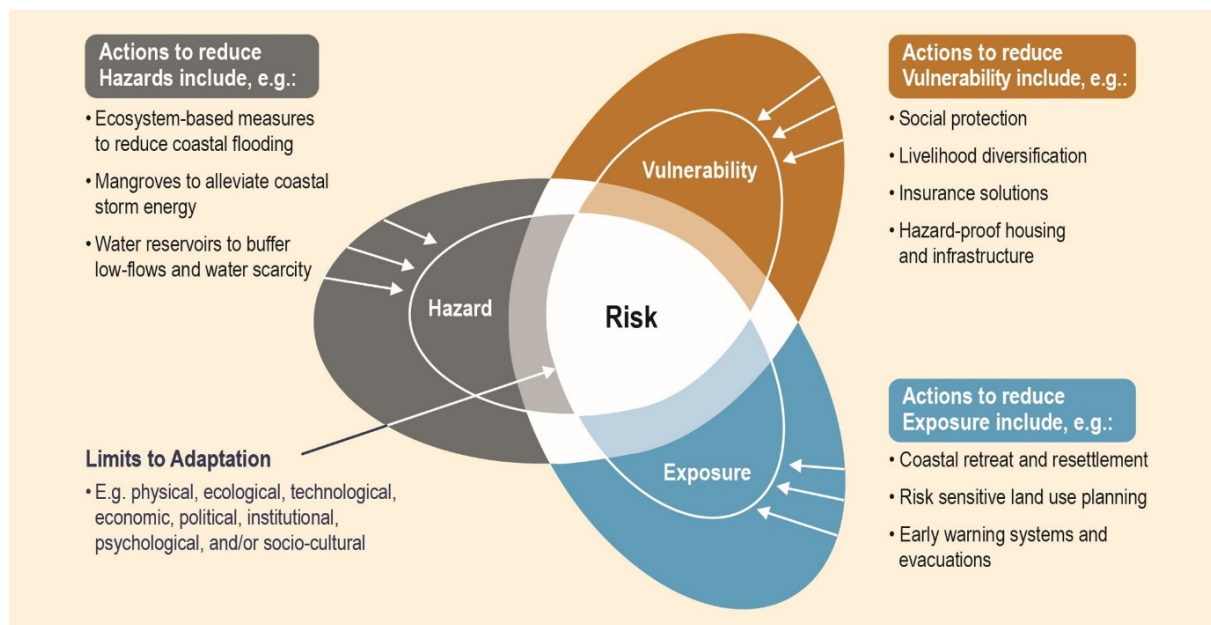


Figure 2. Interaction between environmental hazards triggered by climate change; exposure of humans, infrastructure and ecosystems to those hazards; and systems' vulnerabilities (IPCC, 2019, p. 1-19, Figure CB2.1.).



strongest defences against disasters is a healthy ecosystem. The report emphasised the need for environmental protection, ecosystem restoration and investment in NbS.

Recent advances in ecosystem-based approaches to DRR provide new and innovative solutions to reduce risk and vulnerability, some of which have been highlighted throughout the report. Ecosystems have the capacity to counter some of the spatially and temporally

distributed impacts of climate-related disasters across a wide range of geographical areas and over longer timeframes. Because similar ecosystems can be found in different parts of the world, successful solutions can be scaled up and replicated in other locations. While doing so it is important to keep the local and community context on the forefront as each ecosystem is shaped by the interaction between human and nature prevalent at a specific location.



Photo: CravenA / Shutterstock.com

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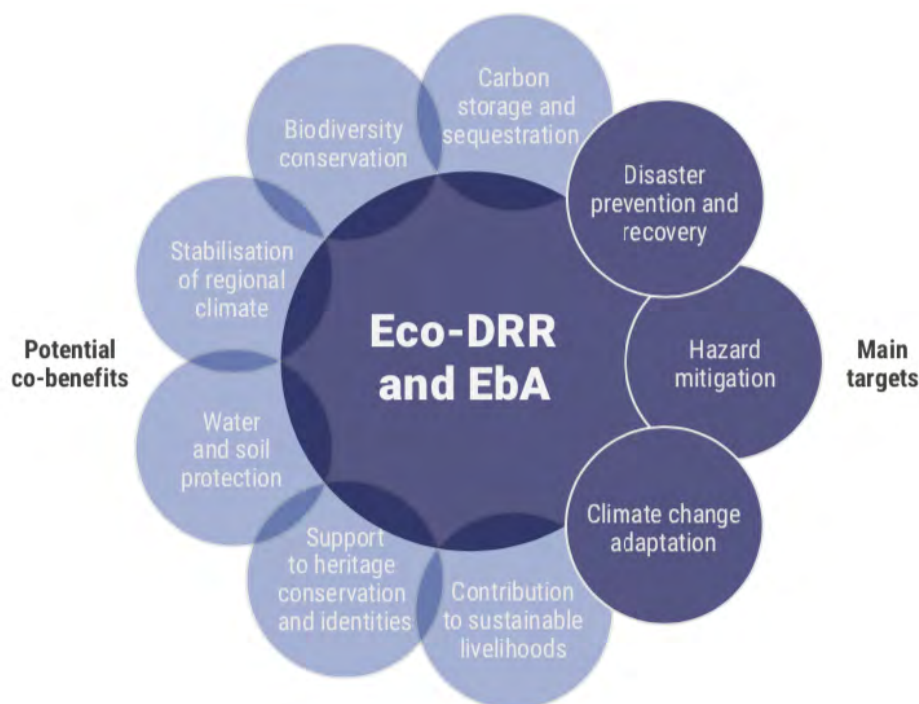
Multiple benefits from implementing Eco-DRR and EbA

Beyond their direct benefits for DRR and CCA, ecosystems also bring a range of other social, economic and environmental benefits for multiple stakeholders, which can further reduce risk (Sudmeier-Rieux et al., 2019) (Figure 4). In many countries, the most vulnerable people rely on ecosystems for their livelihoods and resilience. Eco-DRR/EbA reduces social vulnerability and enhances people's resilience by sustaining livelihoods and providing essential natural resources such as food, water and building materials (Renaud et al., 2013; Renaud et al., 2016). Carbon storage and sequestration (Box 4), biodiversity conservation, and poverty alleviation are other socio-economic benefits that

ecosystem-based approaches bring.

Because of these multiple system-wide benefits, investing in NbS is critical for reducing disaster risk, adapting to climate change, conserving natural resources, reducing poverty, and achieving sustainable development (UNEP, 2019). Eco-DRR/EbA is considered by many organisations to provide effective, cost-efficient, and "no-regret" or "low regret" solutions for reducing disaster risk and building resilience (IPCC, 2012; Sudmeier-Rieux et al., 2019). For example, in *Building with Nature* (Box 2 and p. 16). Eco-DRR/EbA is described as a no-regret approach because the adaptive management

Figure 3. Multiple benefits of Eco-DRR and EbA (Sudmeier-Rieux et al., 2019).



Box 5: Carbon sequestration in Sydney saltmarshes

This program funded by the Australian Government, focused on research, capacity-building and rehabilitation for biodiversity and carbon storage in 'salt-influenced ecosystems' across Sydney's coastal waterways. It focused on salty ecological communities, such as mangroves and saltmarshes because of their high carbon sequestration capacity. Due to their small spatial extent the carbon stored in marine ecosystems has been ignored and remains poorly understood. However, studies have shown that coastal vegetation sequesters carbon far more effectively and permanently

than terrestrial forests (Hutchinson et al. 2013; The Blue Carbon Project, 2014). This is because coastal vegetation grows much quicker than terrestrial forests, capturing large amounts of carbon dioxide, some of which is then stored in the soil (NOAA, 2015). Since these soils are submerged, they are anaerobic and therefore the carbon remains intact. The protection and restoration of coastal vegetation is therefore important in mitigating climate change and far more cost effective than efforts focused on terrestrial forests (The Blue Carbon Project, 2014).

<https://www.sydneycostalcouncils.com.au/projects/sydneys-salty-communities-turning-the-tide-on-blue-green-carbon/>

https://www.sydneycostalcouncils.com.au/sites/default/files/Sydney_sSaltyCommunitiesProjectOverview8ppA4online.pdf

<https://www.sydneycostalcouncils.com.au/wp-content/uploads/2013/12/The-Climate-ready-tool.pdf>

allows the infrastructural design to be aligned with changing environmental conditions. By creating conditions for nature to regenerate by itself, projects are often less expensive on a life-cycle basis than traditional engineering solutions.

4.1 Cost effectiveness of NbS

The long-term nature of Eco-DRR and EbA makes it difficult to estimate the economic benefits, especially in the nascent implementation stages. Further, many of the benefits are non-monetary in nature and are difficult to quantify. However, there is growing evidence on the impact, both estimated and recorded, of Eco-DRR and EbA on both biophysical and socio-economic systems. The definition, functions and benefits of ecosystem-based approaches for sustainable development, poverty reduction, livelihoods, food security, biodiversity, DRR, and climate change adaptation are now well established, and a growing community of practice is advancing this emerging field of work. The growing interest in NbS in the various policy arenas of the sustainable development agenda is evident by an increasing amount of literature, case studies and scientific research that demonstrate evidence of the effectiveness of these approaches.

A cost-benefit analysis in the Mekong Delta has shown the co-benefits of green infrastructure (GIZ, 2013). Two options were considered: a concrete dyke (the grey option) and a combination of an earth dyke and mangrove rehabilitation measures (the green option). It was found that the green option gave a higher return – five times that of the grey option – with the grey option unable to demonstrate a return to justify its investment. Further, the mangroves were found to offer a wide range of co-benefits which would not be provided by the concrete dyke. These include providing fuelwood, as well as serving as habitat and breeding grounds for

commercially and nutritionally important fish, crustaceans and snails. In addition, the protection against salinity offered by mangroves meant that land would be able to be returned to agriculture, something that would not be possible with the dyke option.

When the benefits of Eco-DRR and EbA are projected over space and time the returns increase exponentially. For instance, while the grey infrastructure options return benefits at a local scale, the benefits of ecosystem-based approaches apply to the river basin and the larger environment, besides carbon sequestration. An evaluation of the ECOSWat¹ project by GIZ in Thailand found that ecosystem-based approaches to protect against extreme weather events have lower costs, as compared to conventional grey options, with similar or more benefits (ITTrms, 2016). At the river basin level, the overall costs for water storage was estimated to have reduced by up to 65%, and in another displayed benefit: cost ratios over 25 years of between 2 to 6 as compared to 1.4 for a conventional waste water treatment plant.

Similarly, on a temporal scale, the long-term benefits of ecosystem-based approaches far outweigh the costs, especially when compared against the life span of grey infrastructure. In a cost-benefit analysis carried out for various adaptation options in Bangladesh, it was found that the longer term strategies, which aimed to increase agricultural productivity and relocate vulnerable populations, done in combination with mangrove protection, showed the highest returns. Mangrove protection also resulted in co-benefits in carbon market and tourism (Golub and Golub, 2016). A natural capital assessment conducted in Myanmar combined Eco-DRR and EbA outputs with future climate projections resulting in a series of maps showing ecosystem service provision under different future development and land use scenarios (Horton et al, 2016).

1 Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds (ECOSWat)

Box 6: China's Sponge Cities

The Sponge City initiative, launched in 2015, is piloting ecologically friendly alternatives to traditional flood defences and drainage systems in 16 cities across China. The idea of cities acting as sponges to cope with extreme weather events has been pioneered by Kongjian Yu, a landscape architect, and has been adopted by the Chinese Government as an approach to ecological urban planning. It is based on reintroducing ancient Chinese water systems to modern city planning. Sponge cities use green infrastructure, such as permeable pavements and roads, green rooftops, rain gardens, grass swales, artificial ponds and wetlands, and underground tunnels, storage tanks, and terraces to capture excess water during heavy rainfall and flood events. This water is stored and can later be extracted for irrigation, recharging aquifers, cleansing the soil, irrigate gardens and farms and other productive

uses. The motto of the sponge city is to "Retain, adapt, slow down and reuse."

A critical element in this strategy is the ability to regulate water year-round to slow down the process of drainage to help cities cope during extreme events and to make water available during other times when it is more scarce. Sponge cities must ensure that 20% of their urban land includes sponge features by 2020 and 30% by 2030, with a target of being able to retain 70% and 80% of storm water, respectively.

It has been estimated that a key reason that the Southern China floods in 2020 were not as damaging as in 1998 was the investments made in nature-based solutions like sponge cities, together with tree planting and floodplain restoration.

<https://www.theguardian.com/artanddesign/2018/mar/21/turning-cities-into-sponges-how-chinese-ancient-wisdom-is-taking-on-climate-change>

<https://www.theguardian.com/cities/2019/jan/23/inside-chinas-leading-sponge-city-wuhans-war-with-water>

<https://www.pri.org/stories/2020-07-31/how-china-s-nature-based-solutions-help-extreme-flooding>

Most of the studies have shown benefits of Eco-DRR and EbA when calculated over a longer duration.

One of the defining characteristics of ecosystem-based approaches is that it positions people at the centre of the implementation process and adopts community-based and participatory approaches. The concept of value pluralism or multiple values has hence emerged as a key issue in valuation of benefits (Emerton, 2017). Many of the benefits of Eco-DRR and EbA extend beyond goods and services that are tradeable, such as improvements in quality of life. Evaluation of ecosystem benefits hence should take into account the diverse understanding and perception of benefits and impacts.

It has also been found that stakeholder and community engagement is a key factor contributing to the success of ecosystem-based approaches. The engagement from the

conceptualization to evaluation stages instils the value of ownership and ensures the sustainability of the infrastructure.

4.2 A critical element of resilient infrastructure

Increase in infrastructure investments has been recognised as a cornerstone for development and a critical element in the achievement of the SDGs. It has been estimated that the world will spend over US\$ 30 trillion in the next ten years while US\$ 93 trillion are needed between 2016-2040 (Global Infrastructure Hub). However, such massive infrastructure investments will be ineffective in achieving the goals of the 2030 Agenda for Sustainable Development, the Sendai Framework and the Paris Agreement if they do not account for disaster and climate resilience needs.

As stated above, NbS to DRR are more cost-effective in the long-term than grey infrastructure alone. Furthermore, green options tend to be cheaper to implement as was found in a case study in Fiji (Rao N. et al, 2013). In some cases, hybrid infrastructure, such as a combination of grey and green infrastructure is the most effective approach to take (Sudmeier-Rieux et al., 2019). The Sponge City Initiative (Box 5) is an example of a hybrid infrastructure approach to regulate water flow during extreme events such as floods and droughts. Experiences in Samoa, on protection from sea surges and coastal erosion, have shown that a hybrid of grey and green infrastructure, represented by a concrete sea wall and coastal plants and riparian buffers, resulted in a high benefit-cost ratio when modelled over a 25-year period (Arena, M. 2012).

In Nepal, bio-engineering with Eco-DRR demonstrated that eco-safe roads are not only cost effective but also helped reduce landslide risk (IUCN, 2016). A hybrid “Building with Nature” approach to coastal restoration and adaptation in Indonesia resulted in multiple biophysical and socioeconomic benefits including sediment balance, reduced salt water intrusion, decreased erosion rates, re-establishment of mangroves, recovery of pond fisheries production, improvements in income and livelihoods diversification (Cronin, K., 2015).

Thus, NbS provide opportunities for design innovations and new development alternatives that go beyond the narrow focus on short-term economic gains. They also reduce dependence on resource-intensive grey infrastructure and help reduce costs, while promoting green growth. Importantly, infrastructure is not only influenced by but also shapes the future climate landscape of the country. Climate mitigation and disaster control infrastructure can go a long way in reducing the carbon footprint and reduce disaster impacts, while achieving national climate commitments. When integrated into socio-economic planning, NbS serve the dual purpose of enhancing disaster and climate resilience while providing basic services. For instance, wetlands that reduce flooding and provide urban water supplies and mangroves that protect coasts and sustain fisheries (Global Platform 2019, Session on *The Role of Green, Blue and Grey Infrastructure in Reducing Disaster Risk*).

Future-proofing new infrastructure is a unique opportunity – 75 percent of the infrastructure that needs to be in place by 2050 does not exist today (ICLEI and C40, 2018). Hence, investment in NbS and building with nature should be a key consideration for governments and other actors. Even for the existing infrastructure, NbS offers several urban greening options, for instance, urban heat island mitigation and storm-water management. Such practices should also be applied in the rehabilitation, maintenance and upgrade of ageing infrastructure.

Infrastructure investment paths compatible with nature and green solutions need not cost more than more-polluting alternatives. Nature is not at out of reach from the impacts of climate change, and efforts also need to be made to help nature to adapt, by ensuring that ecosystems are biodiverse, by reducing fragmentation and incorporating green corridors for species, and reducing degradation. Doing so will pay huge dividends to ensure a resilient future.

4.3 Ecosystems and COVID-19

The COVID-19 pandemic demonstrates how much human health and environmental health are connected (UNEP, 2020). New zoonotic diseases are emerging at an alarming rate (Vidal, 2020). The sharp increase in such diseases goes hand in hand with our negative impact on the natural world, the destruction of ecosystems, and the loss of biodiversity (de Wit et al., 2020).

UNEP and ILRI (2020) identify seven human-mediated factors that are most likely driving the emergence of zoonotic diseases: 1) increasing human demand for animal protein; 2) unsustainable agricultural intensification; 3) increased use and exploitation of wildlife; 4) unsustainable utilization of natural resources accelerated by urbanization, land use change and extractive industries; 5) increased travel and transportation; 6) changes in food supply; and 7) climate change.

According to (UNEP and ILRI, 2020), climate change is a major factor in disease emergence because the survival, reproduction, abundance and distribution of pathogens, vectors and

hosts can be influenced by climatic parameters that are affected by climate change. Infectious diseases outbreaks are often triggered by extreme climate events such as El Niño, La Niña, heatwaves, droughts, floods, increased temperature, and higher rainfall, the frequency of which might be affected by climate change. A declining ecosystem enhances human-ecological footprint causing the pathogens to emerge and spread. The resultant disruption spreads rapidly due to an increasingly globalized world, as has been seen in the past deadly viral infectious diseases like HIV, Ebola, SARS and MERS.

The emerging discipline of 'planetary health' looks at the links between human and ecosystem health. UNEP and ILRI (2020) and other organisations promote the adoption of a "One Health" approach to zoonoses – a holistic approach that brings together medical, veterinary and environmental expertise. Recognising that a multisector whole-of-society approach is the best way to improve public health, the "One Health" approach looks at environmental sustainability, livestock health, and human health (The Lancet, 2020).

The World Economic Forum (WEF 2020a) argues that nature needs to be part of the recovery solutions as governments and businesses assess how to emerge from the COVID-19 crisis and rebuild the economies. According to the WEF (2020b), nature provides businesses and governments with vast opportunities as over half of the world's GDP is highly or moderately dependent on nature.

Recovering from COVID-19 provides governments across the world with a unique opportunity to achieve long-term global goals on decarbonisation, climate change and sustainable consumption by promoting green growth (UNDRR, 2020). NbS are a critical component in building climate-sensitive, inclusive, equitable and resilient systems that are better able to prepare for and respond to such crises in the future. A green strategy for building back better can support sustainable development on many accounts, not only for mental and physical well-being, but also to ensure that multiple global goals, such as combating climate change and reducing natural hazard risks, can be achieved (Sebesvari, 2020).



5

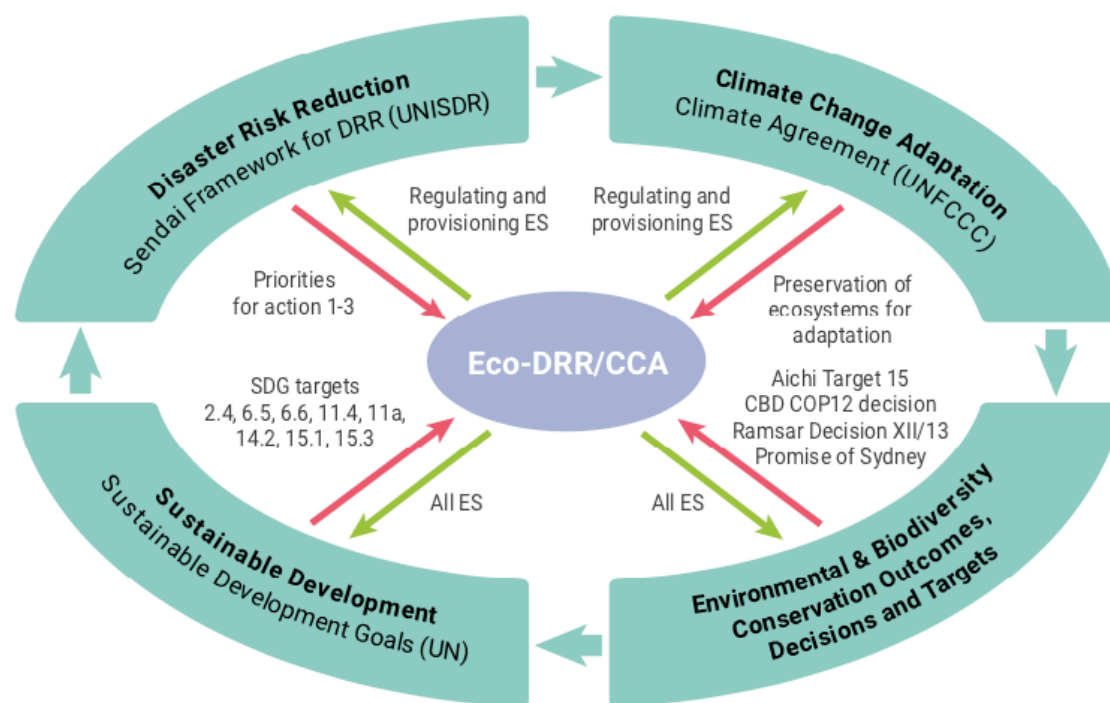
Coherence across global frameworks and agreements

Ecosystem management for resilience through NbS is embedded in many of the global frameworks and agreements relating to sustainable development. All the Rio Conventions (CBD, UNCCD and UNFCCC) promote Eco-DRR and EbA in national conservation and environmental management strategies as well as in risk management plans and programs. EbA and Eco-DRR are recognized as instruments for promoting the synergistic implementation of the Rio Conventions, including through the Aichi Biodiversity Targets, the UNCCD

Land Degradation Neutrality targets and the Cancun Adaptation Framework (CBD, 2019). The joint focus on resilience and ecosystem-based approaches provides a common entry point for the coherent implementation of these international agendas, in particular those on biodiversity, climate change, DRR, and sustainable development.

As Figure 5 shows, the various ecosystem services and priorities, goals and targets of the global frameworks are closely linked.

Figure 5. Eco-DRR/EbA major priorities and decisions with regards to major international framework agreements. Green arrows illustrate various levels of ecosystem services, red arrows highlight the main provisions of each agreement related to Eco-DRR/ EbA. Source: Renaud et al. (2016); Sudmeier-Rieux et al. (2019).



5.1 Global Framework, Agreements and Conventions

The Strategic Plan for Biodiversity 2011-2020 under the **Convention on Biological Diversity** (CBD) (UN, 1992) aimed to halt the loss of biodiversity to ensure ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life and contributing to human wellbeing and poverty eradication. In Decision X/2, the tenth meeting of the Conference of the Parties (COP) of the Convention on Biological Diversity, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, adopted a revised and updated Strategic Plan for Biodiversity, including the **Aichi Biodiversity Targets** for 2011-2020 (CBD, 2010). The Aichi Biodiversity Targets include 20 time-bound measurable targets under five strategic goals: address the causes of biodiversity loss; reduce the direct pressure on biodiversity and

promote sustainable use; safeguard ecosystems; species and genetic diversity; biodiversity benefits to all; and participatory planning, capacity building. EbA and Eco-DRR are encouraged in decisions X/33, XII/20, XIII/4 and 14/5 of the Conference of the Parties to the Convention on Biological Diversity. National Biodiversity Strategies and Action Plans (NBSAPs) are important entry points for prioritizing EbA and Eco-DRR.

In 2021, the Convention on Biological Diversity will adopt a post-2020 global biodiversity framework at the 15th meeting of the Parties to the Convention (COP-15) to be held in China.² The language of this new framework, including its corresponding targets and indicators, will shape the ambition of Member States to promote and implement NbS across policies and sectors, marking a stepping stone towards the 2050 Vision of "Living in harmony with nature". NbS and ecosystem-based approaches are likely to be

² <https://www.cbd.int/doc/press/2020/pr-2020-07-16-sbstta-sbi-en.pdf>

part of some of the new targets post-2020.

The Ramsar Convention on Wetlands (UNESCO, 1971) is an intergovernmental treaty that entered into force in 1976. It provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Two resolutions relevant to EbA/Eco-DRR: X.24 and XII.13, which recognise importance of wetlands for DRR.

The United Nations Convention to Combat Desertification (UNCCD) (UN, 1994) seeks to reverse and prevent land degradation and desertification, and specifically recognizes the important services provided by ecosystems, especially in dryland ecosystems, for drought mitigation and the prevention of desertification. By adopting the Land Degradation Neutrality (LDN) target, Parties agreed that the amount of healthy and productive land should stay stable starting in 2030, enhancing land resilience to climate change and halting biodiversity loss linked to ecosystem degradation. At UNCCD COP 14 in 2019 Decision 4 requests the secretariat to work in coordination with other Rio conventions and relevant partners to ensure coherence and alignment in the way EbA, Eco-DRR, NbS and sustainable land management are categorised through the UNCCD science-policy instruments and the UNCCD Knowledge Hub (UNCCD, 2019).

The Cancun Adaptation Framework under the UN Framework Convention on Climate Change (UNFCCC), aims to enhance action on adaptation, reducing vulnerability and building resilience in developing country Parties. National Adaptation Plans (NAPs) aim to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience; and integrate climate change adaptation into policies, programmes and activities within all relevant sectors and at different levels. (Intended) Nationally Determined Contributions ((I)NDCs) set out high-level objectives and a vision for addressing adaptation goals. The NAP process is a key tool for coherent implementation of an (I) NDC adaptation component.

The Paris Agreement (UN, 2015) recognises the protection of the integrity of ecosystems and biodiversity for both climate change mitigation and adaptation actions. It specifically lays out principles of adaptation that takes ecosystems into consideration. It also calls for integrating adaptation into relevant environmental

policies and actions, where appropriate, as well as for building resilience of ecosystems through sustainable management of natural resources, taking into account the imperatives of a just transition of the workforce. The Paris Agreement requires all Parties to put forward their best efforts through nationally determined contributions (NDCs) and to strengthen these efforts in the years ahead. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. Further, Article 8 of the Paris Agreement asks parties to “recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage” and appoints the **Warsaw International Mechanism** to promote implementation of approaches to address loss and damage, including giving guidance on early warning, preparedness and risk assessment and management (UN, 2015).

The 2030 Agenda for Sustainable Development (UNGA, 2015a) call for protecting the planet from degradation. The Sustainable Development Goals (SDG) global indicator framework (UNGA, 2019) refers to the importance of maintaining and restoring ecosystems so as to achieve Goal 2 (end hunger), Goal 6 (water and sanitation), Goal 14 (oceans), and Goal 15 (terrestrial ecosystems).

The Sendai Framework for Disaster Risk Reduction 2015-2030 (UNGA, 2015b), that succeeds the Hyogo Framework for Action 2005-2015, outlines seven global targets. The role of ecosystems will need to be taken into account in disaster risk assessments (Priority Action 1), strengthening risk governance (Priority Action 2) and investments in disaster resilience (Priority Action 3). Highlighting poor land management, unsustainable use of natural resources and degrading ecosystems as underlying drivers of disaster risk, the Sendai Framework urges countries to strengthen the sustainable use and management of ecosystems for building resilience to disasters. The Sendai Framework also calls for greater collaboration between institutions and stakeholders from other sectors and calls for ecosystem-based approaches to be implemented in transboundary cooperation for shared resources, such as within river basins and shared coastlines.

The Sendai Framework hence presents a new opportunity to raise global actions and scale

up investments in Eco-DRR/EbA. The Sendai Framework Monitor (UNDRR, 2017) includes the reporting of losses to green infrastructure under direct economic losses (Target C) and under damages to infrastructure and disruptions to basic services (Target D). Addressing the challenge of translating the environmental components under its four priorities into tangible actions, The Partnership for Environment and Disaster Risk Reduction (PEDRR) (2016) outlined a Roadmap for advancing implementation of the Sendai Framework through Eco-DRR/EbA and reflected on the scope for promoting Eco-DRR/EbA as an integrated strategy that delivers across the 2030 Sustainable Development Agenda. Sebesvari et al., (2019) identified opportunities for considering green infrastructure and ecosystems in the Sendai Framework Monitor.

The **New Urban Agenda (UNGA, 2017)**, adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016, envisages cities and human settlements that 'protect, conserve, restore and promote their ecosystems, water, natural habitats and biodiversity, minimize their environmental impact and change to sustainable consumption and production patterns' (p. 7). Its members also commit themselves to 'preserving and promoting the ecological and social function of land, including coastal areas that support cities and human settlements, and to fostering ecosystem-based solutions to ensure sustainable consumption and production patterns, so that the ecosystem's regenerative capacity is not exceeded' (p. 22).

The **Bonn Challenge**, launched in 2011 by the Government of Germany and the International Union for Conservation of Nature (IUCN), is a global effort to bring 150 million hectares of deforested and degraded land into restoration by 2020 and 350 million hectares by 2030 (IUCN and Government of Germany, 2019). The **New York Declaration on Forests** (NYDF) is a voluntary and non-binding international declaration to take action to halt global deforestation. It was first endorsed at the United Nations Climate Summit in September 2014 (NYDF Assessment Partners, 2019).

As a key contribution to the achievement of the relevant targets and objectives of several these frameworks and instruments, the UN General

Assembly (Resolution A/RES/73/284) adopted 2021-2030 as the **United Nations Decade on Ecosystem Restoration** (UNEP and FAO, 2020). The resolution calls for supporting and scaling up efforts to prevent, halt and reverse the degradation of ecosystems worldwide and raise awareness of the importance of successful ecosystem restoration. The UN Decade on Ecosystem Restoration also aligns with the Decade of Action for the Sustainable Development Goals.

There are many more opportunities to optimise the interconnectedness among the global frameworks, which would help to further promote the implementation of ecosystem-based approaches at the national and sub-national levels, and across sectors. According to the GAR 2019 (UNDRR, 2019a) greater coherence can be achieved through systemic risk management, as cascading and interconnected risks relate strongly to ecosystem services.

5.2 Global Momentum and Advocacy for NbS

Within the United Nations Framework Convention on Climate Change (UNFCCC), NbS, including ecosystem-based climate change mitigation (EbM) have been advocated since 2007 by Wetlands International (WI), the University of Greifswald, and partners. An example is the rewetting of (tropical) peatlands to address the substantial greenhouse gas emissions occurring as a consequence of tropical peatland drainage (e.g., for oil palm plantations in Southeast Asia). After being overlooked for long time, these emissions are now included in the calculation of national greenhouse gas (GHG) emissions. Rewetting also prevents subsidence of peatland soils and subsequent flooding and hence contributes to both, mitigation and DRR (WI, 2009a; WI, 2009b). The promotion and uptake of NbS for DRR and CCA has further grown since the UNFCCC 14th Conference of the Parties (COP) in 2008 (Sudmeier-Rieux et al., 2019). Conservation organisations, such as the International Union for Nature Conservation (IUCN), The Nature Conservancy (TNC) and WI, supported by some Member States, brought forth in their submissions to the COP the concept of EbA as

an important element of the future adaptation framework under the UNFCCC (Vignola et al., 2009).

The [2017 Global Platform on Disaster Risk Reduction](#) featured a session on *Ecosystems protection, management and resilient agriculture*. In its outcome document Integrated Water Resources Management was highlighted as an effective way to strengthen resilience for disaster risk reduction and adaptation to climate change, inviting leaders and all stakeholders to join in this approach and to include water considerations in all of the development discussions at the global arena. It promotes considerable investments in resilient infrastructure, including green

infrastructure and calls for the development of standards for green infrastructure in order to stimulate investments in nature-based solutions. At the Global Platform Wetlands International and CARE also launched the 'Landscape approach for disaster risk reduction in 7 steps' (Care Nederland and Wetlands International, 2017) to help increase community resilience.

The [2018 Asian Ministerial Conference on Disaster Risk Reduction](#) (AMCDRR) in Ulaanbaatar, Mongolia, hosted a session on *ecosystem-based disaster risk reduction* that discussed a range of ecosystem-based approaches from Nepal (Box 6), Indonesia (Box 1), Vietnam (Box 7), and the Pacific

Box 7: Ecosystem Protecting Infrastructure and Communities (EPIC): Eco-safe Roads for Enhancing Resilience of Communities in Nepal

This case study was presented at the 2018 AMCDRR by IUCN.

In Nepal, EPIC is contributing to research on bio-engineering techniques establishing demonstration sites for reducing landslide instabilities along roadsides using ecosystem-based, locally adapted bio-engineering methods

creating "eco-safe" roads. Communities are involved in the establishment and maintenance of bio-engineering sites which contributes to community awareness. Efforts are also in place to mainstream ecosystem-based approaches in policies related to road construction, land management (Integrated Watershed Management) and disaster risk reduction.

<https://www.iucn.org/theme/ecosystem-management/our-work/environment-and-disasters/ecosystems-protecting-infrastructure-and-communities-epic>

Box 8: Using flood-based livelihoods to restore the flood retention ecosystem function of the Mekong Delta, Viet Nam

One of the major causes of the loss of biodiversity and resilience to climate change in the Vietnamese Mekong Delta is intensive rice production. Traditionally, a system of low dykes has supported the harvest of two rice crops per year, while allowing water to flood the land during the monsoon season. But increasingly high dykes have been constructed in the upper delta flood zone to prevent this

seasonal flooding in order to be able to grow a third rice crop. With the aim to conserve the flood area in the rice growing landscape of the delta, IUCN piloted alternative livelihood options that are both flood and drought resistant. They demonstrated that integrated lotus farming was up to twice as profitable than growing three rice crops and was therefore strongly supported by farmers.

<https://www.iucn.org/news/viet-nam/201610/conserving-floods-mekong-delta-story-vietnam-component-integrated-planning-implement-cbd-strategic-plan-and-increase-ecosystem-resilience-climate-change-project>

Islands. Calling on the governments and stakeholders to “Commit to the integration of climate change adaptation and disaster risk reduction”, the Ulaanbaatar Declaration adopted at the AMCDRR highlighted the importance of enhancing the resilience of natural ecosystems. The associated Action Plan 2018-2020 (UNDRR, 2018) also recommends coherent ecosystem-based approaches to prevent and reduce the impact of water-related disasters.

The [2019 Global Platform for Disaster Risk Reduction](#) focused on the “Resilience Dividend”, wherein nature- and ecosystem-based approaches were highlighted as key means to attain this dividend. The Platform included a session on *The Role of Green, Blue and Grey infrastructure in Reducing Disaster Risk* (Box 8), which further underscored the need to ‘capitalize on the co-benefits of ecosystem-based approaches and leverage the complementarity across blue, green and grey infrastructure’ (Co-Chairs’ Summary).

Another session focused on *Integrated Risk management, Ecosystems and Water-related risks*, which showed how poor water resource and ecosystem management makes disaster risk more pronounced. It showed that a paradigm shift in the water sector is urgently needed considering its complex task of securing and balancing water needs for people, industry, food production, urban and rural development, biodiversity and climate change adaptation. However, climate change and DRR policies, practices and investments that integrate IWRM and NbS are still lagging behind, whereas grey (built) infrastructure schemes still dominate the thinking and spending for climate proofing globally which can lead to increasing risks (PEDRR, 2019). The 2019 Global Platform generated a strong interest in ecosystem-based approaches and resulted in a discussion on how such approaches can be better integrated into national planning frameworks where coherence is still weak.

Box 9: National Greening Programme, the Philippines

This case study was presented at the 2019 Global Platform by the Philippines Department of Environment and Natural Resources.

Established in 2011 through Presidential Executive Order (EO) 26, the Philippines National Greening Program (NGP) aimed to reduce poverty, promote food security, create alternative livelihoods, and enhance climate change mitigation and adaptation. Between 2011-2018, the NGP reforested over 1.91 million hectares of area, planted over 1.5 billion seedlings, generated over 4,736,195 jobs, and employed over 670, 489 personnel (Republic of the Philippines, 2016). Because of the success of the NGP and in order to accelerate rehabilitation and reforestation efforts, President Benigno S. Aquino III, passed EO 193 in 2015, entitled “Expanding the Coverage of the National Greening Program”, to increase the coverage of the NGP to cover all the

remaining unproductive, denuded and degraded forestlands from 2016 to 2028.

According to Ahmed (2018), the NGP has contributed to improved water quality in rivers and irrigation for farmlands, reduced the threat of flooding, increased carbon sequestration, and has created a foundation for a timber products economy. It mobilised stakeholders, including the youth and local communities, to contribute by planting seedlings, and maintaining tree plantations. The NGP has also promoted coordination among national government agencies, civil society, private sector and local communities. Alternative livelihoods and benefit sharing with local communities motivates them to protect the reforested lands. Engaging local communities’ in reforestation programs produces substantially better ecological and social outcomes.

<https://www.govserv.org/PH/Los-Ba%C3%B1os/195690263782286/National-Greening-Program>
<https://reliefweb.int/report/philippines/denr-mangrove-beach-forest-plan-gets-p400-m-seed-fund>
<https://nbsapforum.net/knowledge-base/best-practice/pockets-success-philippines%E2%80%99-national-greening-program>

As a stepping stone to the 2019 Climate Action Summit, [the 2019 Asia-Pacific Climate Week](#) (APCW) in Bangkok, Thailand, was designed to advance regional climate action. It aimed to support implementation of Asia-Pacific countries' Nationally Determined Contributions (NDCs) under the Paris Agreement and action to deliver on the SDGs. The APCW outcomes, recognising the need for "a fundamental shift in mindset" to achieve long-term resilience, called for mainstreaming NbS into policies and frameworks at all levels, including through collating empirical data and evidence base and developing appropriate indicators to assess the contribution of NbS.

NbS were a central focus of the [2019 UN Climate Action Summit](#), where world leaders were called upon to present concrete, realistic plans to enhance their NDCs by 2020, in line with reducing greenhouse gas emissions by 45 per cent over the next decade, and to net zero emissions by 2050 (United Nations, 2019). More than 40 countries, 50 international organizations and institutions, 100 civil society organizations, 50 private sector organizations and companies, and 12 foundations prepared a Nature-Based Solutions call for action, highlighting the importance of valuing nature in

governance, decision-making and finance. The Summit also considered limits to adaptation and no-regret climate actions in urban contexts. The Global Commission on Adaptation (GCA) launched its landmark "Adapt Now" report (Global Commission on Adaptation, 2019) which aims to raise understanding of the value of nature for climate adaptation, argues that NbS should be embedded into adaptation planning and policy, and urges to increase investment in NbS. The [Global Resilience Partnership](#) convened the Building a Resilient Future Day at the Climate Action Summit which highlighted that nature based solutions (NbS) are the foundation of resilience to climate change and that NbS that conserve, sustainably manage and restore natural ecosystems offer cost-effective solutions to build resilience to climate change and mitigate GHG emissions.

PEDDR (Box 10) plays an important role in engaging with international and national stakeholders. It has facilitated implementation, knowledge-sharing and collective actions related to Eco-DRR and EbA since 2008 and continues to help advance the implementation of the Sendai Framework through ecosystem solutions (PEDRR, 2016).

Box 10: What is PEDRR?

"Formally established in 2008, the Partnership for Environment and Disaster Risk Reduction (PEDRR) is a global alliance of UN agencies, NGOs and specialist institutes. As a global thematic platform of the International Strategy for Disaster Risk Reduction (ISDR), PEDRR seeks to promote and scale-up implementation of ecosystem-based disaster risk reduction and ensure it is mainstreamed in development planning at global, national and local levels in line with the Sendai Framework for Disaster Risk Reduction 2015-2030. It provides

technical and science-based expertise and applies best practices in ecosystems-based DRR approaches. PEDRR is guided by its vision of "Resilient communities as a result of improved ecosystem management for disaster risk reduction and climate change adaptation". Its objective is to pool expertise and advocate for policy change and best practice in ecosystem management for DRR and CCA, based on science and practitioners' experiences." See: www.pedrr.org



6

Integrating NbS into policies, plans and programs

All of the international frameworks and agreements stipulate actions to advance NbS at the national level. Country governments hold the primary accountability for providing the policy space and resources for implementation at the national and sub-national levels. Integrating Eco-DRR into national plans requires collaborative planning processes to bring together relevant actors, encourage coherence of actions, and make efficient use of available capacities. Taking a people-centred approach, governments will need to collaborate closely with vulnerable people

and communities and support local-level and community-based initiatives.

6.1 National climate and biodiversity strategies

UNDP (2019) provides a framework for governments to identify potential NbS with the aim of enhancing their climate mitigation and

adaptation action in a cost-effective manner and with multiple co-benefits. In order to support the increased uptake of NbS in future NDCs, Seddon et al. (2019b) present an overview of the current level of ambition for nature within NDCs, and highlight what can be done further to fully harness the potential of NbS in global climate action going forward. WWF (2019) review 151 currently available NDCs to determine how Parties intend to utilise protected areas to contribute to their adaptation and mitigation commitments. WWF (2020) provide a list of eight recommendations to help Parties demonstrate strong commitments to NbS.

Countries are also developing or updating their NAPs and updating their national development plans to integrate the SDGs. The (Intended) Nationally Determined Contributions ((I)NDCs) and NAPs offer further opportunities for national governments to ensure the integration of Eco-DRR and EbA and to optimise the interconnectedness among the global frameworks to facilitate implementation at the national level. For instance, the National Adaptation Plan 2018 of Fiji stipulates flood risk management and strengthening of coastal boundaries through hybrid or nature-based solutions.

The National Biodiversity Strategic Action Plans (NBSAPs) also provide opportunities to integrate action on DRR and climate change. CBD signatory Member States can advocate for a stronger role for biodiversity conservation and ecosystem-based approaches in local and national DRR strategies as well as in NAPs. The NBSAP of Samoa aims to enhance ecosystem resilience and restore degraded ecosystems to combat desertification. The CBD has guidance (see - Technical Series 93 on the “Voluntary Guidelines for the Design and Effective Implementation of Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction”) on how to incorporate EbA and Eco-DRR into projects, which was adopted by the Conference of the Parties to the CBD at its fourteenth meeting (Sharm El-Sheikh, Egypt, 17 – 29 November 2018).

The Ramsar Convention strongly encourages countries to mainstream DRR measures in wetland management plans, and to mainstream wetlands management in national DRR plans. Wetlands and their services should be integrated within disaster risk assessments and their impact should be considered across the river basins or coastal zones. The inclusion of wetland-related indicators can link implementation of the Ramsar Convention and its Strategic Plan for 2016–2024 to track progress on these mechanisms (Kumar, et al, 2017). With the adoption of the land degradation neutrality target, UNCCD signatory countries can promote the sustainable use, conservation, and restoration of ecosystems and biodiversity in the context of reducing the risk of desertification and drought.

6.2 Regional and sub-regional DRR strategies

In addition to guiding and supporting the national implementation of the Sendai Framework, several existing strategies and plans could be used to facilitate the integration of Eco-DRR at the regional level. For example, the Asia Regional Plan for Implementation of the Sendai Framework (UNDRR, 2016) seeks to identify priorities and regional activities to support national and local actions, enhance the exchange of good practices, knowledge and information among governments and stakeholders, and strengthen regional cooperation. Regional strategies are crucial in addressing transboundary climate and disaster risks and developing transboundary eco-management approaches.

Within the Association of Southeast Asian Nations (ASEAN), the Declaration on Institutionalising the Resilience of ASEAN and its Communities and Peoples to Disasters and Climate Change (ASEAN, 2015a) signifies renewed commitment amongst ASEAN Member States to ‘...forge a more resilient future by reducing existing disaster and climate-related risks, preventing the generation of new risks

and adapting to a changing climate through the implementation of economic, social, cultural, physical, and environmental measures which address exposure and vulnerability, and thus strengthen resilience' (p. 2). The ASEAN Community Vision 2025 (ASEAN, 2015b) emphasises the need for environmental protection in realising a resilient community. The ASEAN Vision 2025 on Disaster Management (ASEAN, 2018) 'aims to build resilient nations, safe communities, and ensure environmental sustainability' (p. 7).

Also important in promoting NbS including Eco-DRR approaches are the ASEAN Peatland Management Strategy (APMS) 2006-2020 (ASEAN, 2013; Ramirez, 2013) and the ASEAN Strategic Plan of Action on Water Resources Management (ASEAN, 2005). The APMS aims to address transboundary haze pollution and environmental degradation, promote the sustainable management of peatlands, and promote regional cooperation. Focus Area 11 'Peatlands and Climate Change' has the operational objectives to 'Protect and improve function of peatlands as carbon sequestration and storage' (11.1) and to 'Support peatland adaptation process to global climate change' (11.2). The ASEAN Strategic Plan of Action on Water Resources Management recommends 'to establish and apply the ecosystem approach to WRM' (p.2) and to 'foster proper economic, social and cultural valuation of natural and environmental resources to restore degraded and depleted resources and establish environmental fund (p.3).

In 2019, the ASEAN Secretariat (ASEC) and the ASEAN Centre for Biodiversity (ACB) held a workshop on "Natural capital in ASEAN" in Bangkok, Thailand. Supported by the Enhanced Regional EU ASEAN Dialogue Instrument (E READI), the workshop facilitated a dialogue between EU and ASEAN on tools and narratives for the integration of natural capital in related decision-making (ASEAN, 2019). The expected outcome will be an ASEAN Natural Capital Road Map, which aims to clarify how international organisations could contribute to the establishment of a regional Natural Capital Platform.

The Framework for Resilient Development in the Pacific (SPC et al., 2016), a unique regional framework that addresses multiple aspects of DRR and CCA, acknowledges the progressive degradation of the natural environment and critical ecosystems, and emphasises the need for conservation of terrestrial and marine ecosystems for carbon storage and resilience. The Framework also adopts incorporation of ecosystem-based services and functions in resilience building as a key guiding principle.

The Regional Framework for Disaster Risk Reduction of the Economic Cooperation Organization (ECORFDRR) (ECO, 2017) could be an important vehicle for promoting Eco-DRR in the ECO Member States, but does not currently have Regional Priorities for Action to address the Sendai Framework National Level Priority for Action to 'Strengthen the sustainable use and management of ecosystems.

Box 11: Ecosystem Focus in India

The [National Disaster Management Plan of India \(2019\)](#) provides a comprehensive mechanism to implement ecosystem-based disaster risk reduction. Implementation of ecosystem-based approaches in river basins, mountainous regions and coastlines has been defined as one of the objectives of the Plan.

The Plan also promotes Eco-DRR as a key means to integrate disaster risk management

and addressing environmental change. Asserting the role of ecosystems in serving as natural barriers that can moderate the effects of a hazard and protect communities the plan highlights the role of ecosystems and appropriate land-use in DRR as a key responsibility of both central and state governments towards strengthening DRR governance.

6.3 National disaster risk reduction strategies

Target E of the Sendai Framework, which calls to “substantially increase the number of countries with national and local disaster risk reduction strategies”, aligned with the targets of SDGs 1 (No poverty), 11 (Sustainable cities and communities) and 13 (Climate action), call upon countries to develop national and local DRR strategies by 2020.

As of August 2020, 91 countries globally and 17 countries in Asia-Pacific have officially reported (on Sendai Framework Monitor) on the development of DRR strategies. In Asia-Pacific, almost all the countries have some form of a guiding document (strategy, plan or framework) many of which are in the process of developing or updating their strategies in line with the Sendai Framework.

However, translation of the global commitments at these levels face institutional and other governance barriers. A review of DRR guidance documents in Asia-Pacific countries reveals most countries do not explicitly refer to actions on Eco-DRR/EbA in their national DRR strategies. Some countries have goals or current or planned activities, but these vary greatly in specificity and scope – from protecting the environment to ecosystem-based approaches and promoting green growth.

Nonetheless, some good examples of NbS

integration in DRR strategies exist (See adjoining box). The Australian National DRR Framework (2018) seeks to be holistically applied across and between the built, social, natural and economic environments, wherein ecosystems and natural assets like wetlands have been outlined under the natural environment. Several countries indirectly refer to NbS as part of environmental conservation (e.g. Bangladesh, Indonesia), including integration of DRR concerns in Environmental Impact Assessment to prevent creation of new risk (e.g. Bhutan, Sri Lanka). The Papua New Guinea National DRR Framework (2017-2030) identifies the sustainable use and management of ecosystems and integrated environmental and natural resource management approaches that incorporate DRR as a priority action.

Some DRR strategies and plans also refer to other relevant sectoral plans, in particular the national environmental plans (e.g. Cambodia, Vanuatu) and climate action plans (e.g. Philippines), and call for integration of DRR into the ecosystem management programmes.

It is hence important to provide more guidance on how to integrate NbS approaches into national DRR guidance documents, and associated implementation/action plans, similarly to what has been done to promote the uptake of NbS in NDCs. This should include raising awareness and knowledge of ecosystem-based approaches; sharing case studies, good practices and lessons learnt; reporting on recent positive developments in

Box 12: Implementing Nature-Based Solutions

The [Words into Action \(WiA\) guidelines series](#) aims to ensure worldwide access to expertise, communities of practice and networks of DRR practitioners. Led by the PEDRR network, UNDRR has released a WiA guide on “Nature-Based Solutions for Disaster Risk Reduction” for public review.

This guide aims to give practical, how-to-do information on setting up and implementing NbS, both for DRR and CCA. It is designed

to help implement the Sendai Framework, with a focus on its environmental components. The guide provides the current global state of play on NbS, elaborates on its implementation in context of the Sendai Framework, and offers means to mainstream and upscale NbS to address disaster and climate risk through a multi-stakeholder and rights-based approach.

www.preventionweb.net/go/74082

science, policy and practice; identifying and supporting enabling factors; demonstrating the success and effectiveness of existing projects; and enhancing access to financial and technical support.

This is an opportunity for governments to take a holistic approach to risk-informed development and to integrate Eco-DRR/EbA as a key element of reducing disaster risks and enhancing resilience into all of these plans. To facilitate this process, UNDRR has released a [Words-into-Action \(WiA\) guideline on Developing National DRR Strategies](#) (UNDRR, 2019c) that establishes coherence as one of the key guiding principles of alignment. In order to achieve coherence and to be able to make best use of efficiencies in planning, implementation, and monitoring, the WiA recommends that national DRR strategies 1) build coherence between DRR, CCA and sustainable development, 2) mainstream DRR into all sectors, 3) promote alignment and linkages between national and local DRR strategies and, 4) promote coherence and alignment with regional DRR strategies.

To aid the integration of Eco-DRR and EbA in disaster risk reduction strategies a Words-into-Action guideline on “Nature-based Solutions for Disaster Risk Reduction” has been released for public review (See Box 12).

6.4 Local disaster risk reduction strategies

At the local level, the Making Cities Resilient (MCR) Campaign (2010-2020) builds on the Sendai Framework and addresses issues of local governance and urban risk. The MCR Campaign, led by UNDRR, is self-motivating, partnership and city-driven and aims to raise the profile of resilience and DRR among local governments and urban communities worldwide.

The MCR Campaign is based on “Ten Essentials for Making Cities Resilient” that form a set of critical and independent steps to build and maintain resilience.

In particular, the Essential 5: ‘Safeguard Natural Buffers to Enhance the Protective Functions Offered by Natural Ecosystems’ aims to ‘Identify, protect and monitor natural ecosystems within and outside the city geography to sustain and safeguard their protective functions as natural buffers and enhance their use for risk reduction’ (UNISDR, 2017b, p. 54). Local governments are invited to identify local ecosystems and understand their role in reducing disaster impacts (e.g. slope stabilization, reduction of heat island effect, etc.) and their contribution to climate change mitigation and adaptation (within the city and the surrounding region) as well as to compile updated information on natural areas and their current and potential uses.

Box 13: Local-level Eco-DRR in Myanmar

The national disaster risk reduction policy and planning framework of Myanmar is a good example of decentralized implementation of ecosystem-based disaster risk reduction. The [Myanmar National Framework for Community Disaster Resilience](#) adopts a vision where the communities follow structural, nonstructural and ecosystem-based measures, at the household and community level, to reduce disaster risk.

To achieve this vision, the [Myanmar Action Plan on Disaster Risk Reduction](#) (2017) identifies

‘mainstreaming disaster and climate risk considerations into village development planning and implementation including, infrastructure, livelihoods, agriculture and environment’ as a key area of priority action that aims at undertaking Eco-DRR measures to ensure that village development plans and community infrastructure are informed by disaster and climate risk. The Plan also suggests a few indicative activities focusing on EbA on soil moisture conservation and natural resource management.

This Essential can be achieved by 1) developing solutions to address current and future environmental risks such as maintenance of green and blue infrastructure through NbS or protection of the ecosystems; and 2) protecting and restoring ecosystems to the extent that they offer sufficient adaptation and mitigation benefits to current and future risks (UNISDR, 2017b). This has been further elaborated through the [“WiA guidelines: An Implementation Guide for Local Disaster Risk Reduction and Resilience Strategies”](#). The alignment of local and national DRR strategies provides an entry point for advocating the integration of NbS approaches at all scales.

An analysis of local government progress on resilience and DRR in Asia-Pacific (UNDRR, 2019b) shows that over two-third the surveyed MCR cities and key stakeholders are aware of the term ecosystem and understand most of the functions provided by key local natural assets, including water attenuation, food growing, fuel, carbon sequestration, air filtration, and aesthetic value. Ninety percent of the MCR cities in Asia-Pacific promote green infrastructure (e.g. greening streets, roadsides, and roofs, restoring embankments, creating urban corridors, etc.)

and blue infrastructure (e.g. river corridors, wetlands, waterways, etc.), and majority of the city administrations are aware of the functions provided by natural capital beyond their administrative borders.

Building on the high momentum on local resilience through the ten-year implementation of the MCR Campaign, UNDRR has launched the Making Cities Resilient 2030 (MCR2030) initiative that will run during 2021-2030. MCR2030 aims to ensure cities become inclusive, safe, resilient and sustainable by 2030, following a three-stage ‘resilience roadmap’³.

6.5 NbS as the basis for coherent planning

DRR processes have multiple connections with climate change adaptation and mitigation, yet few DRR plans take these connections into account. Investing in DRR should be considered a precondition for developing sustainably in a changing climate (GAR 2015, GAR 2019). In the last five years, governments have increasingly

Box 14: Ecosystem as the common basis for DRR and climate action in the Philippines

The [Philippine National Development Plan 2017-2022](#) outlines increase of adaptive capacity and resilience ecosystems as one of the sub-sector outcomes. This objective will be measured through the climate change and disaster risk reduction and management plans which in turn will be implemented through the sectoral plans, particularly at the local level. To provide an enabling environment, an agreement has been formalized between the Climate Change Commission and National Disaster Risk Reduction and Management Council that provides the standards and to integrate local

DRRM and CC plans.

The ecosystem-related objectives of the development plan are further elaborated in the national climate and disaster risk reduction plans. The [National Climate Change Action Plan \(NCCAP\) 2011-2028](#) adopts “Ecosystem and environmental stability” as one of the strategic priorities, while the [National Disaster Risk Reduction and Management Plan \(NDRRMP\) 2011-2028](#) reflects it as a key priority under disaster prevention and mitigation pillar.

3 <https://mcr2030.undrr.org/>

Box 15: Ecosystem-based approaches in Vanuatu

The [Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030](#) adopts ecosystem-based approaches as a key means to coherently implement climate change adaptation and disaster risk reduction. Activities include both integrating ecosystem services into adaptation and risk reduction planning and budgeting, and minimizing negative impacts on the environment from proposed adaptation and risk reduction activities, including through planning and legal frameworks.

Importantly, the policy highlights the importance of a hybrid approach to disaster control infrastructure, prioritising “soft” ecosystem based adaptation over “hard” engineered infrastructure (e.g. coastal revegetation over sea walls). Land-use planning approaches and ecosystem-related development policy documents are highlighted and advocacy and educational programmes on the value of EbA have been promoted.

recognized the need for coherence among the global frameworks in policy and practice (Ulaanbaatar Declaration 2018).

Failure to identify and harness the mutual co-benefits of DRR and CCA is a missed development opportunity. Healthy ecosystems and their management play a key role in supporting post-disaster recovery, but importantly also reducing future risks and supporting adaptation.

Considering that all the global frameworks, as outlined in Chapter 5, highlight Eco-DRR and EbA as implementation approaches, they provide a valid basis for coherent planning and implementation of DRR and CCA. Countries should integrate Eco-DRR/EbA in their national DRR strategies and plans, and in national climate and development plans (See a good practice example in the adjoining box).

It should be noted that development, climate action and disaster risk management are not linear processes – different processes unfold concurrently interacting with each other. The

Joint National Action Plans in the Pacific Island Countries provide a good example of coherent DRR and CCA planning and in all the cases highlight the importance of achieving resilient ecosystems as a key means to achieve disaster resilience (See box below).

Hence, when planned coherently, Eco-DRR/ EbA become an integral element of sectoral development plans that implement adaptation, mitigation and risk management actions of the country and help meet the national development vision and (I)NDCs. Eco-DRR/ EbA are commonly used as adaptation and risk management tools on their own or as a compliment to structural measures. This can take several forms, e.g. spatially, Eco-DRR/ EbA at watershed or river basin level provides an efficient means to preserve and promote biodiversity; structurally, land-use planning works well when implemented with Eco-DRR/ EbA, especially in the urban context. Such spatial and structural measures help both in creating incentives to protect ecosystems as well as in ensuring the provision of ecosystem services such as flood control.



7

Tools to support NbS Implementation

A variety of existing ecosystem management approaches can be readily adopted and applied as part of DRR strategies (Sudmeier-Rieux et al., 2019). These include IWRM, Sustainable Land Management (SLM), Community-based Natural Resource and Risk Management (CBNRRM), Integrated Fire Management (IFM), Protected Area Management (PAM), and Integrated coastal zone management (ICZM).

To meet the challenge of sustaining ecological systems, an ecological perspective should be incorporated into land-use and land-management decisions. Specifying ecological principles and understanding their implications for land-use

and land management decisions are essential for SLM. Harari et al. (2017) showcase linkages between SLM and DRR for reducing present and future disasters by preserving and restoring natural resources that ensure livelihoods. For instance, green infrastructure provides approaches to strengthen land-use planning to cope with water-related disasters, including both floods and droughts.

As many hazard risks are water-related, a focus on water-related ecosystems and landscape level approaches such as IWRM as a systematic solution for preventing and reducing the impact of or the recovery from water-related hazards

Box 16: Global Standard for Nature-based Solutions

To benefit from the full potential of Nature-based Solutions, a standard is required in order to create a common language and understanding, engage relevant stakeholders, safeguard nature from overexploitation, increase demand and supply of interventions and incentivize positive sustainable change.

To address these needs and mainstream NbS, IUCN has launched the first-ever [Global Standard](#) for the design and verification of this concept. This Standard, composed by 8 Criteria and 28 Indicators, aims to equip users with a robust framework for designing and verifying NbS that yield the outcomes desired, in solving one or several societal challenge(s). Based on the feedback of actual and potential NbS users, it has been developed as a facilitative Standard,

purposefully avoiding a rigid normative framing with fixed, definitive thresholds of what NbS ought to achieve. Rather the Standard is designed to support users to apply, learn and continuously strengthen and improve the effectiveness, sustainability and adaptability of their NbS interventions.

NbS and its potential contribute towards creating innovative and non-regret pathways to strengthening resilience, establishing disaster risk reduction coping strategies and building back better without leaving no one. Similarly, NbS and the IUCN Global Standard offer a platform to support countries achieving Target E of the Sendai Framework – *substantially increase the number of countries with national and local disaster risk reduction strategies by 2020*.

is critical. If implemented with an awareness of potential climate impacts, cross-sectoral coherence methods such as IWRM can ensure that DRR processes coordinate efforts for energy, water supply and sanitation, agriculture, and cities before, during, and after disasters. One example is Vietnam's IWRM approach that spans many sectors and administrative boundaries (MacClune and Nguyen, 2018). DRR efforts that encompass eco-hydrological systems - surface water, snowpack, and groundwater - can ensure a broader vision of economic and ecological sustainability (WWF, 2016).

Spatial, land-use, and urban planning are important tools into which risk reduction measures can be incorporated. Risk information (e.g., types of hazards over time and space, socio-economic vulnerability profiles of communities,

elements at risk, etc.) needs to feed into the design of integrated ecosystem management interventions to enhance their added value for DRR (Sudmeier-Rieux et al., 2019).

Formal processes for planning and management include Environmental Impact Analysis (EIA) and Strategic Environmental Assessment (SEA). UNEP has developed an Integrated Strategic Environmental Assessment (ISEA) tool to support decision-making and development planning, while assuring environmental sustainability and DRR (IUCN and UNEP, 2017; UNEP, 2017). CBD (2009) stress the importance of applying risk assessment, scenario planning and adaptive management approaches in decisions to implement EbA so as to recognise and incorporate potential trade-offs.



8

Conclusions and recommendations

There is a growing interest in NbS as effective, cost-effective, flexible and low regret approaches for reducing climate and disaster risks that also have multiple social, economic and environmental co-benefits. Eco-DRR and EbA are increasingly being promoted by donors and funders, international organisations and NGOs in the implementation of the various global commitments aimed at achieving equitable, resilient, and ecologically sustainable development outcomes for all.

Eco-DRR and other NbS are crucial in reducing and managing the increasingly complex and systemic

risks arising from unsustainable development practices and environmental changes, such as environmental degradation, biodiversity loss and climate change, that create and perpetuate patterns of vulnerability, exposure and risk. The multiple benefits offered by NbS make them a necessary integral component of DRR strategies.

The growing awareness and interest in ecosystem-based approaches has been accompanied by an increasing knowledge base and practical experience in designing, implementing and assessing the effectiveness of such measures. A considerable amount of local knowledge, scientific evidence,

guidelines, decision-support tools and resources for policy-makers, decision-makers and practitioners exist and can be shared among a diverse set of stakeholders (see Annex 2 and Annex 3).

The importance of NbS for achieving resilience has been recognised and is to various degrees integrated into and promoted by the various global frameworks related to sustainable development. However, despite these recent advances in science, policy and practice and the opportunities presented in this brief, there is an urgent need to further strengthen coherence amongst key international frameworks and agreements and to mainstream NbS, both conceptually and in their implementation.

Some key recommendations include:

- Mainstream NbS (e.g. Eco-DRR and EbA) in national and local DRR strategies as a key means to enhance coherence across international frameworks and agendas and, in particular, ensure an integrated implementation of disaster risk reduction and climate change adaptation.
- Using relevant national and local coordination mechanisms, countries should include Eco-DRR approaches in the NAPs, NAPAs, NDCs, (I)NDCs, NBSAPs, Ramsar, UNCCD, national urban strategies and land-use policies and other sectoral policies and programmes.
- NbS should be made a core element of resilient infrastructure, bringing together different dimensions of sustainable development. Green, blue and grey infrastructure should be effectively integrated to create the right mix of hybrid infrastructure as appropriate to the context. This would provide sustained biophysical and socio-economic benefits, while reducing carbon footprint and costs.
- NbS should be integrated into land-use and urban planning that not only reduces disaster risk but also enhances green spaces while providing ecosystem services. When combined with a watershed-based approach Eco-DRR becomes a very cost-effective approach to adaptation and risk reduction.
- Specific indicators related to ecosystem-based measures could be added to the Sendai Framework Monitor (in particular, targets c and d). Countries should be encouraged to inform about their level of coherence as a key element of target e.
- Knowledge and awareness building on NbS should be promoted to ensure their application, including through 1) creating an inventory and plan of action for NbS for a range of specific contexts and hazards; 2) establishing a collaborative platform for replicating and scaling best practices; 3) conducting baseline studies to assess ecosystem health and condition and to identify the risks posed by environmental degradation; 4) identifying, promoting and providing a scientific basis of replication to the indigenous NbS, and 5) emphasizing the importance of community participation and all-stakeholder engagement in the design, implementation and monitoring of development policies and plans.
- Considering the upcoming post-2020 global biodiversity framework, Member States should be encouraged to ensure that NbS are a cornerstone of the post-2020 global biodiversity framework and explicitly featured in the corresponding targets, goals and indicators. This is critically important in scaling up implementation of NbS and EbA across policies and sectors.

Annex 1 – Abbreviations

ACB	ASEAN Centre for Biodiversity	GPI	Global Peatlands Initiative
AILA	Australian Institute of Landscape Architects	GPS	World Bank Global Program for Sustainability
AMCDRR	Asian Ministerial Conference on Disaster Risk Reduction	GWP	Global Water Partnership
APCW	Asia Pacific Climate Week	ICZM	Integrated Coastal Zone Management
APMS	ASEAN Peatland Management Strategy	IFM	Integrated Fire Management
ASEC	ASEAN Secretariat	IIED	International Institute for Environment and Development
BMU	Federal Environment Ministry of Germany	IKI	International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)
BMUB	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety		(Intended) Nationally determined contributions
CBD	Convention on Biological Diversity	(I)NDC	
CCA	Climate Change Adaptation	IOC-UNESCO	Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization
CI	Conservation International		
COP	Conference of the Parties	IPBES	Intergovernmental Panel on Biodiversity and Ecosystem Services
DRM	Disaster Risk Management	IPCC	Intergovernmental Panel on Climate Change
DRR	Disaster Risk Reduction	ISDR	International Strategy for Disaster Reduction
EbA	Ecosystem-based Adaptation	IUCN	International Union for the Conservation of Nature
EbM	Ecosystem-based Mitigation	IWRM	Integrated Water Resource Management
EC	European Commission	MAB	Man and Biosphere Programme
ECO	Economic Cooperation Organization	MCRC	Making Cities Resilient Campaign
Eco-DRR	Ecosystem-based Disaster Risk Reduction	MDGs	Millennium Development Goals
ECORFDRR	ECO Regional Framework for Disaster Risk Reduction	MEA	Millennium Ecosystem Assessment
EPIC	Ecosystems Protecting Infrastructure and Community	NAPA	National Adaptation Programme of Action
E-READI	EU ASEAN Dialogue Instrument	NAP	National Adaptation Plan
ES	Ecosystem Services	NbS	Nature-based Solutions
ESCAP	Economic and Social Commission for Asia and the Pacific	NBSAP	National Biodiversity Strategic Action Plan
FAO	Food and Agriculture Organization of the United Nations	NDCs	Nationally Determined Contributions
FEBA	Friends of EbA	NGO	Non-Governmental Organization
GAR	Global Assessment Report on Disaster Risk Reduction	NI	Natural Infrastructure
GCA	Global Commission on Adaptation	NOAA	National Oceanic and Atmospheric Administration (U.S. Department of Commerce)
GCRN	Global Resilient Cities Network		
GI	Green or green-blue Infrastructure		
GIZ	Gesellschaft für Internationale Zusammenarbeit		
GMA	Global Mangrove Alliance		

NYDF	New York Declaration on Forests
PAM	Protected Area Management
NGP	National Greening Program (Philippines)
NS	Natural Solutions
PEDRR	Partnership for Environment and Disaster Risk Reduction
PfR	Partners for Resilience
SCCG	Sydney Coastal Councils Group
SDGs	Sustainable Development Goals
SEA	Strategic environmental assessment
SLM	Sustainable Land Management
SREX	IPCC Special Report on Extreme Events (IPCC 2012)
TNC	The Nature Conservancy
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNDRR	United Nations Office for Disaster Risk Reduction (formerly UNISDR)
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WCMC	World Conservation Monitoring Centre
WIA	Words into Action
WI	Wetlands International
WMO	World Meteorological Organization
WWF	World Wildlife Fund for Nature

Annex 2 – Definition of terms

Climate change adaptation (CCA) is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (UNFCCC, 2020).

Convention on Migratory Species (CMS), also known as the Bonn Convention, was signed in 1979 and aims to conserve terrestrial, aquatic and avian migratory species throughout their range.

Convention on Wetlands (Ramsar) is an intergovernmental treaty that entered into force in 1976. It provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

Convention on Biological Diversity (CBD). Signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity is dedicated to promoting sustainable development.

Convention on Climate Change (UNFCCC). Signed in 1992, the ultimate aim of the UNFCCC is to prevent “dangerous” human interference with the climate system.

Convention to Combat Desertification (UNCCD). Established in 1994, the UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found.

Critical infrastructure: The physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society (UNDRR, 2017).

Disaster risk management (DRM) is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses (UNDRR, 2017).

Disaster risk reduction (DRR) is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development. Disaster risk reduction is the policy objective of disaster risk management (UNDRR, 2017).

Ecosystem-based adaptation (EbA) is 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 (CBD, 2009).

Ecosystem-based disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalismaa, 2013).

Ecosystem-based mitigation (EbM) is the use of ecosystems for their carbon storage and sequestration service to aid climate change mitigation (Sudmeier-Rieux et al., 2019).

Ecological engineering is defined as the design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both Mitsch (2012).

Green-blue (or natural) infrastructure (GI or NI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for

recreation, climate mitigation and adaptation, and management of wet weather impacts that provides many community benefits (UNISDR, 2017).

Grey infrastructure involves engineered assets that provide one or multiple services required by society, such as transportation or wastewater treatment (IISD, 2020).

Natural infrastructure refers to land networks or ecosystems that provide services inherent to those geographical areas, while also perpetuating active conservation efforts and the enhancement of those environments (IISD, 2020).

Nature-based solutions (NbS) are actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits” (Cohen-Shacham et al., 2016).

Underlying disaster risk drivers are the processes or conditions, often development-related, that influence the level of disaster risk by increasing levels of exposure and vulnerability or reducing capacity (UNDRR, 2017).

World Heritage Convention (WHC). Signed in 1972 the WHC provides protection of cultural and natural heritage of such universal value that its conservation is important for current and future generations.

Annex 3 – Guidelines and decision-support tools

The following list is a compilation of recently published guidelines on different aspects of Eco-DRR and EbA. It is organised by date and not meant to be comprehensive or exhaustive.

- The *Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions* (GIZ et al., 2020) provides an overview of the process needed for designing and implementing effective monitoring and evaluation (M&E) for EbA.
- The *IUCN Global Standard for Nature-based Solutions* (IUCN, 2020) is a self-assessment that consists of eight criteria and associated indicators, which address the pillars of sustainable development (biodiversity, economy and society) and resilient project management.
- Partners for Resilience (PfR) produced the *Integrated Risk Management Law and Policy Checklist* (Partners for Resilience, 2019) to identify areas for improvement within current legislation, policies and implementation in relation to PfR's IRM approach.
- The *Voluntary Guidelines for the Design and Effective Implementation of Ecosystem-based Approaches to CCA and DRR* developed by CBD (2019) provide information on principles, safeguards, tools, and a flexible framework for planning and implementing ecosystem-based approaches, to support countries in integrating ecosystem-based approaches into their national biodiversity strategies and action plans, and into other sectoral policies.
- The *Source Book on Disasters and Ecosystems* (Sudmeier-Rieux et al., 2019) highlights the advantages of Eco-DRR and EbA, including how they promote multiple benefits, and

demonstrates how they can be integrated into DRR and CCA strategies and development frameworks. This information can be used to encourage decision-makers to implement Eco-DRR and EbA across different sectors and in policies and strategies addressing DRR, climate change and sustainable development

- Beck et al. (2019) explore opportunities for the integration of EbA and insurance for risk reduction. The authors observe a strong interest for Climate Risk Finance & Insurance (CRFI) and EbA solutions for risk transfer and ecosystem-based conservation and rehabilitation in the donor and finance community. However, they also find that only very limited insurance incentives for conservation and restoration currently exist and that environmental and EbA solutions are not well understood by the insurance industry. They recommend that the adaptation and resilience benefits of EbA need to be better quantified in general and more specifically within the tools and approaches of the risk industry.
- The *Technical Handbook of Nature-based Solutions* (UNALAB, 2019) provides information on the full range of potentially applicable NbS to support urban climate and water resilience, their anticipated or demonstrated performance, and their limitations.
- Kennedy et al. (2019) present case studies on integrating ecosystem services and climate resilience in infrastructure development and identify lessons for advocacy. The report reviews promising practices in which developments at a significant scale have attempted to integrate ecosystem services and climate change implications. It also reviews existing frameworks from international financial institutions and development partners,

which are involved in financing sustainable infrastructure, to assess the level of awareness and interest that exist in the industry landscape.

- The World Bank, though its NbS Program, has produced several publications aimed at exchanging knowledge, experiences, and lessons learned to enhance the planning and implementation of NbS. A joint World Bank and World Resources Institute report (Browder et al., 2019) seeks to advance the integration of green and gray infrastructure solutions by guiding developing country service providers and their partners on how to integrate natural systems into their infrastructure programs.
- The relationship between natural capital, or ecosystem services and hazards can be modelled using various existing open source models (**Sudmeier-Rieux et al., 2019**). For example, InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs), developed for the Natural Capital Project, is a suite of models used to map and value the goods and services from nature that sustain and fulfil human life. It helps to explore how changes in ecosystems can lead to changes in the flows of many different benefits to people (**Stanford University, 2019b**).
- Assessing the effectiveness of EbA in supporting local peoples' adaptive capacity or resilience or reduce vulnerability; in helping ecosystems produce services for local people and allow them to withstand climate change impacts and other stressors; and in being financially and economically viable, **Reid et al. (2019)** show that EbA can provide important, wide-reaching and long-term benefits relating to adaptation, the environment and social issues (**IIED, 2019**).
- Comparing conventional engineering and ecological solutions, **Wanger et al. (2019)** evaluate the effectiveness, cost, and the capacity to sustain biodiversity and ecosystems. The authors argue that ecosystem-based protection should form the basis of planning a coastal protection strategy in the future. Adding man-made and engineered solutions may be more cost-efficient and may enhance the protection of valuable coastal biodiversity and related ecosystem services. The study concludes that such a hybrid 'ecosystem-based and engineered' approach could become a model for other high-risk coastal hazard sites in tropical biodiversity hotspots.
- **Frantzeskaki (2019)** identify seven overarching lessons related to all stages of proof-of-concept and implementation of NbS in cities: (a) NbS need to be aesthetically appealing to citizens, (b) NbS create new green urban commons, (c) experimenting with NbS requires trust in the local government and in experimentation process itself, (d) co-creation of NbS requires diversity and learning from social innovation, (e) NbS require collaborative governance, (f) an inclusive narrative of mission for NbS can enable integration to many urban agendas and (g) design NbS so as to learn and replicate them on the long-term.
- **ESCAP (2018)** provide a toolkit on policy coherence for DRR and resilience relevant for all countries with special needs. The document presents evidence on where synergies between sectors exist and could help to identify where the trade-offs for ecological management and the implementation of Eco-DRR measures may occur.
- **FEBA (2017)** have produced a framework for defining qualification criteria and quality standards for EbA. Its objectives are to sharpen understanding among policy makers and practitioners about what qualifies as EbA, and to provide guidance on the quality of EbA measures.
- Based on the experience of CARE and WI in the Partners for Resilience alliance, and on best practices developed by other experts, *A Landscape Approach for Disaster Risk Reduction in 7 steps* (**Care Nederland and Wetlands International, 2017**) synthesises the main characteristics of the landscape approach and suggests seven steps when adopting a landscape approach.
- **The World Bank (2017)** present principles and implementation guidance for the planning, design, implementation and evaluation of NbS for flood risk management as an alternative to or complementary to conventional engineering measures. **Soz et al. (2016)** introduce GI solutions for urban flood risk management, review implementation issues, and provide recommendations on overcoming

impediments, identify gaps, and provide suggestions for further work for practitioners and institutions.

- **The World Bank (2016)** reviews and provides recommendations for how the protective services of mangroves and coral reefs can be measured and valued in a manner consistent with national economic accounts and included in other decision-making processes to support planning for development, disaster risk, and coastal zone management. The guidelines review the tools and approaches commonly used by ecologists, economists and engineers for estimating the coastal protection services of coastal habitats and examine how the valuations of these services can be considered in the System of Environmental Economic Accounts (SEEA).
- *The Ecosystem-Based Adaptation Handbook* (**Jiménez Hernández, 2016**) is a step-by-step guide for setting up an EbA intervention. It promotes an integrated approach to EbA with the ultimate goal of building resilience of socio-ecological systems.
- UN-Habitat has produced a *Handbook of Sustainable Housing Practices* (**Hannula, 2012; UN Habitat, 2016**). It also promotes the use of green building materials within the context of slum upgrading, large scale affordable housing, social housing, and reconstruction in developing countries and emerging economies.
- *The System of Environmental-Economic Accounts—Experimental Ecosystem Accounting* (SEEA EEA) (**United Nations, 2014**) examines how the contributions of ecosystems to people can be understood in terms of both services provided and in terms of ecosystems being an asset, i.e., systems that can regenerate and provide a flow of services over time depending upon their health or condition.
- *Integrating ecosystems in resilience practice: Criteria for Ecosystem-smart Disaster Risk Reduction and Climate Change Adaptation* (**van Leeuwen et al., 2014**). WI produced a set of criteria, which can be used by policy makers and practitioners to better integrate the management of ecosystems and natural resources in their DRR work.
- Frameworks assisting the assessment of services ecosystems provide to society include the Millennium Ecosystem Assessment (MA) (**WRI, 2005**), The Economics of Ecosystems and Biodiversity (TEEB) (**TEEB, 2010**) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (**Díaz et al., 2015**).
- *Part 6 of the FAO Voluntary Guidelines for the Responsible Governance of Tenure* (**FAO, 2012**) addresses the governance of tenure of land, fisheries and forests in the context of climate change, natural disasters and conflicts. The guidelines aim to ensure that the legitimate tenure rights to land, fisheries and forests of all individuals, communities or peoples likely to be affected, are respected and protected by laws, policies, strategies and actions with the aim to prevent and respond to the effects of climate change and in preventing and preparing for natural disasters (**FAO, 2012**).
- **Andrate et al. (2011)** propose a series of draft principles and guidelines aimed at supporting best practices for the design and implementation of EbA. The principles are intended to be used by decision makers in national policy in national, territorial and sector planning initiatives, in financial planning, and in project and research design.
- The IUCN *Relief Kit project* (**IUCN, Undated**) documents linkages between biodiversity and disasters and establishes capacity development knowledge products for policy makers, researchers and other relevant stakeholders.

Annex 4: Increasing experience of Eco-DRR and EbA in practice

There is now a wealth of examples of implemented ecosystem-based approaches to DRR and CCA from across the Asia Pacific Region and the world. These examples provide opportunities to share insights and lessons learnt and to replicate and upscale good practice. The following is a selection of projects conducted at international, regional, national and sub-national levels and by a variety of organisations engaged in Eco-DRR and EbA:

The Natural Capital Project

The Natural Capital Project, a partnership between WWF, The Nature Conservancy, Stanford University, the Chinese Academy of Sciences, the University of Minnesota, and the Stockholm Resilience Centre, aims to improve the well-being of people and our planet by motivating targeted investments in nature (Stanford University, 2019a). Natural capital is defined as the world's stocks of natural assets which include geology, soil, air, water and all living things (World Forum on Natural Capital, 2017). Ecosystem services derived from natural capital include food, water, plant materials for fuel, building materials and medicines, climate regulation and natural flood defences, carbon storage, crop pollination, and cultural services.

The International Blue Carbon Initiative

The International Blue Carbon Initiative is a coordinated, global program focused on mitigating climate change through the conservation and restoration of coastal and marine ecosystems. The Initiative brings together governments, research institutions, non-governmental organizations and communities from around the world. It is coordinated by Conservation International (CI), the International Union for Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and

Cultural Organization (IOC-UNESCO) ("The Blue Carbon Initiative," n.d.; Herr and Landis, 2016).

Nature-based Solutions Program

The World Bank invests in NbS through its Nature-based Solutions Program and other World Bank projects (Browder et al., 2019; World Bank, 2017). Illustrating NbS through 14 examples focusing on coastal flooding and erosion, urban stormwater flooding, and river flooding, Ozmet et al. (2019) aim to facilitate the uptake of NbS in water management and disaster risk management (DRM) projects by providing guidance to support the implementation of NbS in DRM, including a high-level review of emerging policies and financing approaches that encourage the use of NbS.

Wealth Accounting and the Valuation of Ecosystem Services (WAVES)

WAVES is a World Bank-led global partnership that aims to promote sustainable development by ensuring that natural resources are mainstreamed in development planning and national economic accounts. WAVES is part of the World Bank Global Program for Sustainability (GPS) (World Bank, 2019).

Urban Nature Labs (UnaLab)

The European Commission has spent €100s of millions on NbS related research across its 7th Framework Programme for Research and Technological Development (FP7) and Horizon 2020 programs. The Horizon 2020 project Urban Nature Labs (UnaLab) aims to foster the development of a European NbS Reference Framework on the benefits, cost-effectiveness, economic viability and replicability of NbS, which will guide cities in developing and implementing their own co-creative NbS (UNALAB, 2020). The UnaLab partner cities Eindhoven, Tampere, Genova, Stavanger, Prague, Castellón, Cannes,

Başakşehir, Hong Kong and Buenos Aires are committed to addressing climate and water related urban challenges within an innovative and citizen-driven paradigm. Horizon 2020 also implements the EU Research and Innovation policy agenda on Nature-Based Solutions and Re-Naturing Cities, which aims to position the EU as leader in 'Innovating with nature' for more sustainable and resilient societies (European Commission, 2020).

Building with Nature

Ecoshape is a consortium of in total 20 government agencies, dredging companies, engineering firms, research institutes, and NGO's, that develops and shares *Building with Nature* knowledge and experience. Members share the vision that multi-sectoral and public private collaboration is key to drive innovation needed for coastal managers that face the challenge to align the interests of economic development and care for the environment in their hydraulic engineering designs, while coping with challenges such as sea level rise, land subsidence and extreme natural events. Knowledge is developed via pilot projects, in which *Building with Nature* Solutions are realised and monitored. Based on the monitoring results, guidelines for replication and scaling up are developed and disseminated. Since 2008, large and successful pilots have been implemented, through a wide variety of partnerships between Ecoshape members and local stakeholders. *Building with Nature* is now widely supported within the Dutch water sector and embraced by a growing number of government institutions in the field of infrastructure and ecosystem development. Rijkswaterstaat, the Netherlands National Water Management Authority is using *Building with Nature* in its coastal flood defences (Rijkswaterstaat, n.d.). One of the large-scale pilot projects outside the Netherlands is being implemented in Indonesia (Box 2). *Room for the River* is an example of how the *Building with Nature* approach is used on a large scale for managing extensive river works in the Netherlands. At more than 30 locations, measures are taken to give the river space to flood safely and to improve the quality of the immediate surroundings.

Partners for Resilience (PfR)

PfR is an alliance of the Netherlands Red Cross (lead agency), CARE Netherlands, Cordaid, the Red Cross/Red Crescent Climate Centre, and Wetlands International. PfR, supported by the

Dutch Ministry of Foreign Affairs, contributes to the resilience of communities by integrating climate change adaptation (CCA) and ecosystem management and restoration (EMR) into Disaster Risk Reduction (DRR). With this Integrated Risk Management (IRM) approach, communities strengthen their capacities to reduce the impact of disasters. Ecosystems and landscapes are seen as buffers against hazards like droughts or floods, and as a source of livelihoods. While PfR started with on the ground projects, the second phase of PfR centres on supporting effective dialogue with stakeholders at all levels with focus on the institutional environment – ensuring policy, investment and practice are all moulded to the risk-reduction agenda assisting vulnerable communities.

The Global Mangrove Alliance (GMA)

GMA, coordinated by members Conservation International, The International Union for the Conservation of Nature, The Nature Conservancy, Wetlands International and World Wildlife Fund, aims to increase the global area of mangrove habitat 20% over current extent by the year 2030. This target underpins and helps deliver objectives, including climate adaptation, climate mitigation, sustaining biodiversity and improving human well-being.

Partners of the Global Peatlands Initiative (GPI)

GPI are working together within their respective areas of expertise to improve the conservation, restoration and sustainable management of peatlands. In this way the Initiative is contributing to several Sustainable Development Goals, including by reducing greenhouse gas emissions, maintaining ecosystem services and securing lives and livelihoods through improved adaptive capacity.

Resilience Evaluation, Analysis and Learning (REAL)

REAL aims to build the intellectual capital around resilience concepts, analysis, measurement, learning, and knowledge management related to resilience-related program design and implementation for USAID. Henly-Shepard et al. (2018) examine what is required to integrate a resilience approach to Climate and Ecosystems-Inclusive Disaster Risk Reduction (CEDRR). Adopting this approach supports adaptive program design, implementation, monitoring and evaluation amidst shocks and stresses impacting communities. This framework and accompanying

case studies demonstrate how a focus on resilience can promote “win-win nexus strategies”, address risk, support healthy eco-systems and sustainable livelihoods.

Ecosystems Protecting Infrastructure and Community” (EPIC)

Through its International Climate Initiative (IKI) the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) has spent €10s of millions on EbA projects. The IKI-funded IUCN EPIC project (2012-2017), aims to promote the use of ecosystem-based approaches and to protect communities from disasters and the negative impacts of climate change (Monty et al., 2017). It includes 18 case studies in Burkina Faso, Chile, China, Nepal, Senegal, and Thailand, covering different types of ecosystems, hazards, countries, regions and ecosystem-based approaches. EPIC demonstrates that effective implementation requires working on science, policy and practice, and proposes a step-by-step guidance to implement integrated Eco-DRR and EbA initiatives.

Thai German Climate Programme – Water (TGCP-Water)

An example of an EbA project at the national level is the Thai German Climate Programme – Water (TGCP-Water) (GIZ, 2018). This programme, funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) International Climate Initiative (IKI) from 2018-2021, promotes IWRM as a key adaptation effort to achieve water security, reduce flood and drought risks, and manage extreme weather events. TGCP-Water is guided by Thailand’s Water Resources Act (2018), the 20-year National Water Resources Management Master Plan (2018–2037), Thailand’s National Adaptation Plan (NAP) and the Thai NDC under the Paris Agreement, and aligns with the Sendai Framework and the SDGs.

Resilient South City project

There is also growing experience in applying ecosystem-based approaches in the private sector. The Hassell and partners Resilient South City project in South San Francisco (Box 10) was a collaborative design challenge to develop

inventive, community-based solutions to sea level rise, severe storms, flooding and earthquakes (Hassell Studio, 2019). The project received the top Award of Excellence in the International category of the Australian Institute of Landscape Architects (AILA) National Landscape Architecture Awards and is an example from the private sector.

Box 17: Resilient South City, South San Francisco, CA, USA

The Resilient South City project was a holistic master plan for increased resilience to many disaster risks. The City suffers from floods, significant seismic activity and inundation due to sea-level rise impacting shoreline areas. Hassell has re-imagined a series of San Francisco waterfront communities as vibrant, fundamentally public places for everyday use – but also vital for environmental and emergency needs. The proposal envisions a network of green spaces, creeks and revived high streets serving as points of collection, connection and water management – from the ridgeline to the shoreline and across the bay via an enhanced ferry network.

<https://www.hassellstudio.com/project/resilient-south-city#0>

A review and synthesis of global experiences on nature-based approaches to EbA and Eco-DRR by Lo (2016) demonstrates the variety of ecosystem-based measures conducted across the world, identifies key lessons and challenges in implementation, documents existing tools and resources, and provides insights for the mainstreaming of Eco-DRR and EbA into policy and practice. A number of institutions have produced principles, criteria, guidelines and resources for various aspects of NbS and Eco-DRR to make them more operational (see Annex 3 and Annex 5).

Annex 5 – Online resources

The following is a selection of useful online resources for those interested in Eco-DRR and EbA. This list is not comprehensive or exhaustive.

- **AdaptationCommunity.net** was developed for the interested public and adaptation experts to provide information on applying approaches, methods and tools that facilitate the planning and implementation of adaptation action.
- **weADAPT.org** is an online 'open space' on climate adaptation issues (including the synergies between adaptation and mitigation) which allows practitioners, researchers and policy makers to access credible, high quality information and to share experiences and lessons learnt. It is designed to facilitate learning, exchange, collaboration and knowledge integration to build a professional community of research and practice on adaptation issues while developing policy-relevant tools and guidance for adaptation planning and decision-making.
- The aim of the **Global Adaptation Network** (GAN) is to help build resilience to climate change by sharing adaptation knowledge. It acts as an umbrella system across the world, linking various organisations, many of which focus on the regions most vulnerable to the impacts of global warming.
- The **EbA Tools Navigator** developed by IIED, IUCN, UNEP-WCMC and GIZ catalogues tools for EbA planners and practitioners. It has been developed through a collaboration between two International Climate Initiative (IKI) funded projects: Ecosystem-based adaptation (EbA): strengthening the evidence and informing policy, implemented by IIED, IUCN and UNEP-WCMC; and Mainstreaming ecosystem-based adaptation (EbA): strengthening EbA in planning and decision-making processes, implemented by GIZ.
- **PANORAMA – Solutions for a Healthy Planet** is a partnership initiative to document and promote examples of inspiring, replicable solutions across a range of conservation and sustainable development topics, enabling cross-sectoral learning and inspiration. PANORAMA allows practitioners to share and reflect on their experiences, increase recognition for successful work, and to learn with their peers how similar challenges have been addressed around the globe.
- The ESCAP **Sustainable Development Goals Help Desk** is a one-stop online service providing access to SDG-related tools, knowledge products, data portals, expertise, advice and opportunities for peer-learning and regional South-South cooperation through thematic areas, covering a multitude of topics.
- **WOCAT** (World Overview of Conservation Approaches and Technologies) is a global network on Sustainable Land Management (SLM) that promotes the documentation, sharing and use of knowledge to support adaptation, innovation and decision-making in SLM.
- **Lo–TEK** is a design movement building on indigenous philosophy and vernacular infrastructure to generate sustainable, resilient, nature-based technology. Spanning 20 countries from Peru to the Philippines, Tanzania to Iran, the book **Lo–TEK - Design by Radical Indigenism** by Julia Watson explores millennia-old human ingenuity on how to live in symbiosis with nature.
- UN Environment and the Cologne University of Applied Sciences developed a Massive Open Online Course (MOOC) on **Disasters and Ecosystems: Resilience in a Changing Climate**, which was launched in January 2015 through the iVersity MOOC platform and again in 2017-2018 through the Asian Disaster Preparedness Center (ADPC) e-learning platform.

- A new ***Building with Nature Masters Online Open Course*** (MOOC) will be run by TU Delft 11 February to 17 March 2020. A new MOOC called Beyond Engineering: Building with Nature will start on 31 March
- Source about the Building with Nature approach: www.ecoshape.org.

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